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THE SELF-DETERMINATION THEORY OF MOTIVATION IN DENTAL EDUCATION: TESTING A MODEL OF SOCIAL FACTORS, PSYCHOLOGICAL MEDIATORS, ACADEMIC MOTIVATION AND OUTCOMES.

Submitted for the Degree of Doctor in Health Professions Education

University of Glasgow- School of Medicine, Dentistry & Nursing

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Abbreviations

AEQ	Assessment Experience Questionnaire
AMEE	Association for Medical Education in Europe
AMOS	Analysis of Moment Structures
AMS	Academic Motivation Scale
ANOVA	Univariate Analysis of Variance
BEME	Best Evidence Medical and Health Professional Education reviews
CAPS	Current state of knowledge, Area of interest, Potential impact for education and Suggestions from experts in the field
CINAHL	Cumulative Index for Nursing and Allied Health Literature
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
Embase	Excerpta Medica database
ERIC	Education Resources Information Centre
EPAs	Entrustable Professional Activities
GFI	Goodness of Fit Index
GPA	Grade Point Average
HPE	Health Professions Education
IMRAD	Introduction, Methods, Results and Discussion
LCQ	Learning Climate Questionnaire
MANOVA	Multivariate Analysis of Variance
Medline	Medical Literature Analysis and Retrieval System Online
PAL	Peer Assisted Learning
PASW	Predictive Analytics SoftWare
PICO	Population, Intervention, Comparison, Outcome
PRISMA	Preferred reporting items for systematic reviews and meta-analyses statement
PsycINFO	Psychological Information Database
RAM	Relative Autonomous Motivation
RMSEA	Root mean square error of approximation
RSES	Rosenberg Self-esteem Scale
R-SPQ-2F	Revised Study Process Questionnaire
SDT	Self-determination theory
STORIES	Structured approach to the Reporting In healthcare education of Evidence Synthesis statement
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
VIF	Variable Inflation Factor
X²	Chi-square test

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Cesar A. Orsini

Declaration

I hereby confirm that this work is my own, and that any legitimate collaboration, or reference has been properly indicated and acknowledged. This work has not been submitted for any other course or qualification on a previous occasion.

Cesar A. Orsini

ABSTRACT

Background: Motivation plays a vital role in dental students' learning experience and wellbeing. Self-determination theory differentiates between autonomous and controlled motivation and amotivation, where autonomous motivation corresponds to the most self-determined form of regulation. Previous research has found that several social educational factors, mediated by students' satisfaction of their basic psychological needs of feeling autonomous, competent and related to important others, predicts autonomous motivation. In turn, autonomous motivation leads to more positive educational outcomes compared to controlled motivation or amotivation. So far, however, few studies have investigated the process of motivation in health professions education from the perspective of the Self-determination Theory. A systematic review was conducted within this thesis, identifying determinants, such as an autonomy supportive learning climate and feedback, that predicted students' autonomous motivation. No studies were found that tested mediation effects between determinants and motivation. In turn, students' self-determined motivation was found to predict different affective, behavioural and cognitive outcomes. These studies, however, came mainly from medical education. Despite its relevance for students' development, very little is known about the process of motivation in dental students. This indicates a need to understand its various aspects, which may lead to evidence-based interventions to foster students optimal functioning.

Purpose: To test a model of academic motivation in dental education by analysing the associations between autonomy-support and quantity and quality of feedback, as determinants, and self-determined motivation, mediated by students' basic psychological needs satisfaction. This, followed by testing the associations between self-determined motivation and the behavioural outcomes of deep and surface study strategies and academic performance, and the affective outcomes of vitality and self-esteem. Finally, we aimed to test whether the model worked different for female and male students, and by year of curriculum.

Methods: We conducted a correlational cross-sectional survey study at the dental school of the University San Sebastian in Chile. All dental students from year 1 to 6 were invited to participate and to answer a questionnaire package containing demographic data and previously validated self-reported instruments. Data on academic performance were obtained from the administrative department. Data analysis involved five phases. First, internal consistency of all measures was assessed by means of Cronbach alpha. Second,

descriptive and group comparisons were computed by means of independent t-test to assess gender differences and MANOVA to assess year-of-curriculum differences. Third, bivariate correlations were assessed amongst all measures. Fourth, mediation was tested through a series of regression analyses. Finally, the entire model was assessed by means of structured equation modelling, for the overall student sample as well as for the subgroups of females and males and different years of study. Data were analysed with the PASW and AMOS software.

Results: A total of 924 students (90.2% response rate) agreed to participate and completed the questionnaires. Cronbach's alpha values of all instruments ranged from .641 to .912. Students' autonomous motivation for attending university was higher than controlled motivation and amotivation, showing an overall self-determined profile. Females endorsed higher than men both autonomous and controlled motivation, while men endorsed amotivation higher. The overall motivation profile, however, did not show significant gender differences. Across the six years, students showed an overall self-determined profile, in which autonomous motivation decreased when transitioning to clinical years, to rise again in the final year. The contrary was found for students' amotivation scores, while controlled motivation declined as they entered clinical-based years. Bivariate correlations showed that both determinants were positively correlated with students' basic psychological needs satisfaction and with autonomous motivation. In turn, the latter was positively associated with behavioural and affective outcomes. All these associations showed a decreasingly positive correlation from autonomous motivation to amotivation. Mediation regression analyses showed both determinants predicting dental students' autonomous motivation, however, this influence was not direct, it was mediated by students' perceptions of the satisfaction of their basic psychological needs. Finally, structured equation modelling indicated that the data fitted the model well, and showed both determinants positively predicting students' satisfaction of their basic psychological needs, which positively influenced autonomous motivation over controlled motivation. In turn, the gradual shift from controlled to autonomous motivation positively predicted affective and behavioural outcomes. Moreover, the associations followed a similar pattern, with minor deviations, when tested by gender and by year of study.

Discussion and conclusion: In the context of this research, dental students' autonomous motivation was indirectly predicted by the social educational factors of teachers' autonomy-support and quantity and quality of feedback, being mediated by students' satisfaction of their basic psychological needs. Students' acting out of autonomous motivation showed enhanced deep study strategies and better academic performance, experienced higher

vitality and self-esteem, and showed lower surface study strategies. This suggests that autonomous motivation leads to important outcomes, decreasing from controlled motivation to amotivation. Whilst students in different years of study showed an autonomous motivation profile, there were important differences that showed that students' transition from basic/preclinical to clinical years influenced their motivation and should therefore be taken into account when planning interventions to enhance students' motivation. Results are discussed in light of self-determination theory and considering its implications on curriculum development, teaching and learning, clinical training, assessment, faculty development, peer-assisted-learning and dentist-patient relationship.

Significance: This is the first study, in health professions education, to test a Self-determination theory-based model including determinants, mediators, motivation and outcomes. This research also expands to dental education the study of motivation based on an empirically verified psychological theory. The results provide strong support for the Self-determination theory of motivation in dental education and provide acceptable evidence that the quality of motivation and satisfying students' psychological needs are important in determining positive educational outcomes amongst dental students. Therefore, many successes and failures in a number of elements of dental and health professions education may be understood through the lens of this theory. As such, efforts should be made in various aspects of dental education to support learners' sense of autonomy, competence and relatedness, which may have an extensive influence on dental education and on students' wellbeing. Future research should confirm or refute our results in other dental education settings.

1. INTRODUCTION

The purpose of this thesis is to test a complex model of academic motivation in dental education based on the Self-determination theory of human motivation (SDT). In this model we aim to integrate different quality types of motivation with different determinants, mediators and outcomes, all of which have been considered key variables in other health professions and general higher education areas. Limited research has been conducted in dental education concerning self-determined types of motivation; therefore, this research intends to inform and understand better the process of motivation in dental education and to justify its relevance and contribution to the field of health professions education (HPE).

This thesis has been divided in seven chapters as follows:

1. **Introduction:** Overview, background, and context. This chapter sets the field, scope, and rationale for conducting the research. It begins with an overview of the project providing a broad perspective and outlining the general purpose of the study. Subsequently, the background outlines the principles of academic motivation from the SDT perspective, and finally the context section provides a detailed critical analysis of the field of study, so that readers may understand the reasons why this topic has been chosen and what is the expected outcome.
2. **Systematic Literature Review:** This chapter outlines what is already known in the HPE literature regarding determinants, mediators and outcomes of self-determined motivation. The systematic review includes the technique or protocol (i.e., initial questions, synonyms, keywords, and search strategy), and a narrative synthesis including both, a critical appraisal of methods and results of selected key papers, in a way to support and inform the next phases and objectives of the research.
3. **Research Aims and Questions:** Following from the main findings of chapter 2, this section presents the thesis' research questions and general and specific objectives.
4. **Methodology and Methods:** In this chapter the theoretical perspective along with its ontology, epistemology and methods adopted to answer the research questions and to achieve the planned objectives are explained and justified. The chapter also covers the principles of the research, outlining study design, sample and access, data collection and analysis, and ethical considerations.

5. **Results:** The results are organised and presented in such a way as to supply information that allows the reader to judge whether the research questions have been answered.
6. **Discussion:** From the results presented, this chapter focuses on what the research adds to what is already known and its relation to the broad literature guided by the research questions. The limitations are outlined together with recommendations for future research.
7. **Conclusion:** The final chapter brings together the main areas covered, summarises key results and learning points risen from the study, and provides a final judgment on the significance of the research.

1.1 Overview

Imagine the following students (based loosely on personal experience); Mark, Karen, and Allan are all third year undergraduate dental students enrolled in the course of basic oral surgery; this, being the first time they are treating real patients. By the end of the course, Mark achieved one of the highest academic performances. He claimed he was very motivated by the course and every activity within it. He was happy learning the content, interacting with his tutors and patients, and he enjoyed spending time extending his knowledge in his areas of interest. Karen achieved a good academic performance, not as strong as Mark, but she passed the course with an acceptable score. Even though she claimed to be motivated by the course, her experience and reasons to study oral surgery were quite different to those of Mark. She said that the course content did not interest her greatly, but she knew that it was going to be useful for her future. In addition, she also reported experiencing anxiety when studying and also when working with patients; as she knew that if her performance was not as good as in other courses, she would feel guilty and did not want to disappoint her parents. On the other hand, Allan failed the course; he claimed that he really did not know why he was attending and that his experience with tutors and patients had not been as good as he expected. He found the course very difficult and at the same time very boring, and could not understand how it was going to help him become a good dentist. The few times he spent studying were either at home, when his parents were watching him, or in class, when the teachers could see him...

Would not every teacher want a class full of highly motivated students like Mark? The reality, however, is different. A typical class is likely to include several students like Mark, Karen, and Allan. As illustrated in the example above, the three students had their own reasons and motivation to attend and study the course, ranging from internal and intrinsic reasons to external pressures and feelings of guilt. The way they approached the course, what they found stimulating, and the consequences of their degree of self-determination towards the different academic activities, indicates the importance of studying motivation in HPE, particularly in dental education, where students begin the direct treatment of patients during their early years as undergraduates.

Motivation has been defined as the energy for every action we make, it constitutes the perceived reasons and the force that drives a person to engage in a determined activity or exhibit certain behaviour (Deci, 1971). Moreover, it is transversal and important to all disciplines, such as health, sports, interpersonal relationships, and education amongst others.

Academic motivation is the type of motivation that drives an individual towards educational achievements. Traditionally, it has been thought as a unitary concept differing only in amount, and being explained as if 'the amount' increases, the associated behaviour will increase as well. If we think about the example above and if we had measured the students' motivation, it is reasonable to think that this would have positively correlated with the expected behaviour. This would be a quite simple and straightforward way of understanding motivation, but the qualitative differences in the three students' learning process is something that cannot be explained by only thinking about the amount of motivation and the expected behaviour. What made the three students' degree of determination so different? While Mark and Karen appeared to be highly motivated and passed the course, their reasons to engage in activities were different, therefore, would the amount of motivation and the expected behaviour be the association that mattered the most? Where does the type of motivation that enables students' actions come from? Are there other educational outcomes, such as behavioural, cognitive, or affective ones, that are influenced by different quality types of motivation?

Several theories of motivation have been proposed. Of them, the SDT of Human Motivation (Ryan and Deci, 2000b), which investigates the roles of self-determined and controlled behaviours in different environments, highlights the importance of studying motivation as a multidimensional construct based on three different quality types; ranging from the least to

the most self-determined forms there is amotivation, controlled motivation (comprising forms of extrinsic motivation), and autonomous motivation (comprising intrinsic motivation and the most self-determined forms of extrinsic motivation). According to Hagger and Chatzisarantis (2015) SDT arose from how rewards affect motivation in educational contexts and it is said to be really a meta-theory consisting of five sub-theories: Cognitive evaluation theory, causality orientations theory, basic psychological needs theory, organismic integration theory and goal content theory. Each theory contributes a set of testable hypotheses as part of the over-arching meta-theory. SDT is said to originate from the organismic and humanistic theories of motivation, intention and free will as well as personal causation, competence and control.

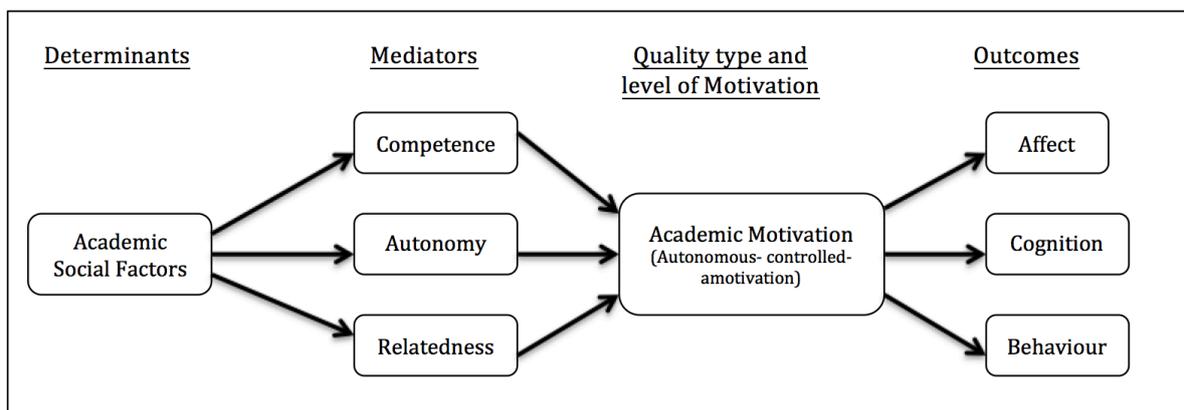
Several studies have found that internalisation of students motivation towards an autonomous form is associated with positive educational outcomes, such as deep level study strategies (Ames and Archer, 1988), enhanced conceptual learning (Grolnick and Ryan, 1987), creativity (Koestner, et al., 1984), cognitive flexibility (McGraw and McCullers, 1979), greater recall of learned material (Ryan, et al., 1984), better academic performance (Reeve, Deci and Ryan, 2002), enhanced self-esteem (Deci and Ryan, 1995), and better psychological wellbeing (Ryan, 1995a; Grolnick and Ryan, 1989; Miserandino, 1996; Ryan and Deci, 2000b; Sheldon and Kasser, 1998). In contrast, least self-determined forms of motivation, such as controlled motivation and amotivation have been associated with more negative outcomes, such as low competence, poor wellbeing, and inadequate psychological adjustment to university life (Baker, 2004; Miserandino, 1996; Ryan and Deci, 2000a; Vallerand and Bissonnette, 1992).

Previous research has found that academic motivation results from social factors that act as determinants of motivation (i.e., both human and nonhuman factors found in social and academic environments) (Deci and Ryan, 1987; Vallerand, 1997). The impact of these determinants on motivation is, however, mediated by how they influence students' perception of three basic psychological needs. These are the needs of autonomy, competence, and relatedness (Deci, 1975; Deci, et al., 1991) Therefore, educational social factors that facilitate perceptions of these needs will increase self-determined forms of motivation and make it more likely to be sustainable. Conversely, those that impair such perceptions will have a negative effect and will facilitate least self-determined forms of motivation and amotivation. A consequence of the above is that different types of motivation lead students to different types of outcomes, mainly at the cognitive, affective, and behavioural level (Vallerand, 1997). Thus, a student can be motivated in high amount but it

does not guarantee all positive outcomes, it depends on which quality types of motivation are driving students towards academic activities.

Vallerand (1997) proposed a motivational model that outlines the above (Fig. 1), highlighting that research built on it may provide a solid base from which adaptation-promoting interventions can be designed. More specifically, by intervening on specific social factors (e.g., teachers autonomy support), one can encourage or re-establish self-determined forms of motivation that are postulated to lead to positive academic outcomes.

Figure 1. SDT's model of academic motivation, depicting determinants, mediators, quality-type and level of motivation, and outcomes. Source: Adapted from Vallerand, 1997.



In HPE, the areas of psychology education (Vallerand and Others, 1993; Nunez, Martin-Albo and Navarro, 2004) and medical education (Kusurkar et al., 2013a) have studied academic motivation from the SDT perspective. They have identified several social factors (e.g., adaptation to university, attachment style, educational background, autonomy support) that may enhance self-determined forms of motivation, which in turn may lead to positive outcomes, such as academic success, deep learning and study motives, and wellbeing (Bailey and Phillips, 2016; Kusurkar, et al., 2010; Williams and Deci, 1996a) Nevertheless, to our knowledge, there are no studies conducted so far in dental education.

The exceptions to the latter are two articles that correspond to the first attempts in dental education, made by our research group. The first focusing on the conditions by which teachers can enhance students' perceptions of autonomy, competence, and relatedness in the clinical learning environment (Orsini, et al., 2015b), and the second by validating and testing the psychometric properties of a scale intended to measure quality types of academic motivation in dental education (Orsini, et al., 2015a). These research projects were

conducted as assignments within this doctoral programme, and corresponded to a case study from course 1 and to the dissertation from course 3, respectively. The results from our previous projects will be used and expanded in this thesis as a continuation of the same area of research in dental education.

Though it may sound paradoxical that 'others' can guide self-determination, the vast amount of research based on this theory makes it important, practical, and relevant for HPE and particularly in this thesis, for dental education. Therefore, the overall purpose of the present research is to test a model derived from the one described in Figure 1, relying on social factors that have been deemed of key importance by previous literature, which mediated by perceptions of the three basic psychological needs may promote self-determined forms of motivation and lead to positive educational outcomes, contributing to a better understanding of students motivation in dental education.

1.2 Background

Many definitions of motivation have been proposed through the years, but to date there is no standard accepted one (Kusurkar, 2012). Most of the proposed definitions understand motivation as the force that determines thought and action, influencing why behaviour is initiated, persisted, and stopped, as well as the reasons underlying the choices that are made (Kusurkar et al., 2012). In education, as well as in all disciplines, motivation is a key element, and it is an essential component of the teaching and learning process (Mann, 1999). Hence, motivation is considered, in HPE, as an influential factor for positive outcomes (Ryan and Deci, 2000a).

Since the early twentieth century, researchers have developed different theories to explain motivation (Mayer, Faber and Xu, 2007; Kusurkar et al., 2012). In 1938 the *Needs to achieve theory* was developed based on the observations that people had different tendencies to overcome obstacles, to exercise power, and to strive to do something as well and as quickly as possible. From an educational point of view, this theory did not understand motivation as a permanent characteristic but as one that could be manipulated to improve learning (Franken, 1982). Afterwards, the *Needs Drive Theory*, in 1943, proposed that learning and behaviour were driven as a way to fulfil different needs, describing motivation as a permanent state as opposed to the aforementioned theory (Weiner, 1992). Along with

this theory came Maslow's *Hierarchy of Needs Theory*, in which drive or motivation was reflected as a need for self-actualization (including the need for academic achievement), and this was achieved only when several other needs were satisfied first, such as psychological, safety, love and belonging, and esteem needs (Maslow, 1943).

In 1957, the *Expectancy-value theory* proposed that motivation was the result of an individual's motivation to succeed and to avoid failure. This was dependent on motive, expectancy, and incentive value of success or failure (Atkinson, 1957). Later, the *Motive to avoid success theory*, in 1968, added a gender characterisation, claiming that women displayed lower achievement motivation compared to men, due to greater fear of success (Horner, 1968). Since then, other researchers have continued expanding the investigation on gender profiles in motivation (Vallerand and Bissonnette, 1992; Scarbez and Ross, 2002).

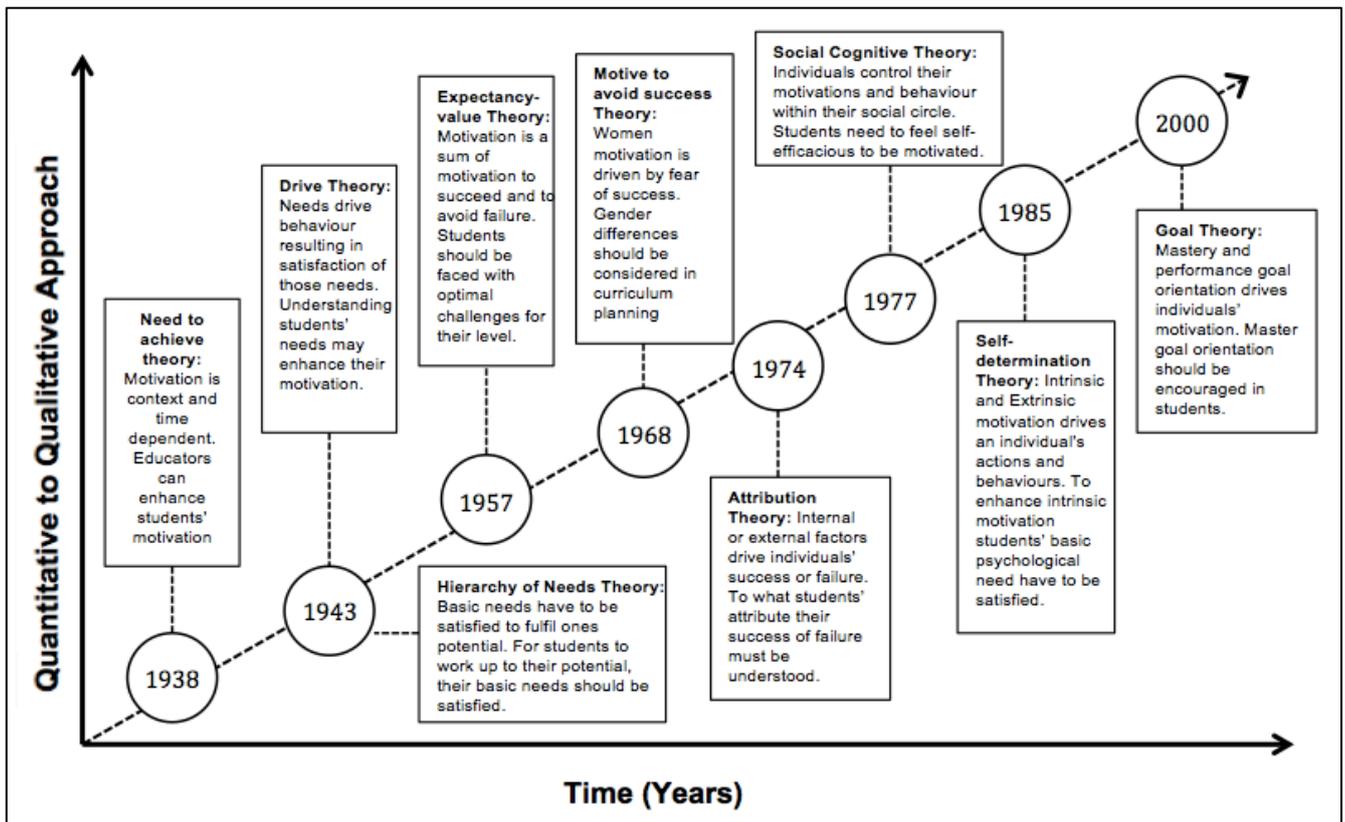
The *attribution theory*, postulated in 1974, was based on the interpretation that individuals give to certain events (e.g., task difficulty, effort, luck), and how these are related to their conducts and actions (Weiner, 1974). Following this line of thought, in 1977 the *Social cognitive theory* suggested that motivation comes from self-efficacy, which is the belief that one has the capability to carry out a specific task (e.g., perform a successful teeth restoration). Therefore, individuals engage in tasks or activities that they perceive themselves capable of performing and avoid the ones that make them feel incompetent (Bandura, 1977).

Most of the above-mentioned theories have seen motivation in quantity and as a unitary concept. In contrast, in 1985 SDT (Deci and Ryan, 1985a) described quality types of motivation (i.e. intrinsic vs. extrinsic motivation, initially), and that the most self-determined and intrinsic forms could lead to better outcomes if an individual's psychological needs of feeling autonomous, competent, and related to the surrounding environment were satisfied (Ryan and Deci, 2000a). The underlying concepts of SDT will be expanded in the following sections, as they constitute the basis of this thesis.

Finally, in 2000 the *Goal theory* proposed that an individual's motivation is centred amongst mastery and performance orientation, in which mastery orientations refers to personal goals and performance orientation refers to the constant comparison with others (Pintrich, 2000).

The different theories of motivation through time have changed their focus from a solely 'quantifiable and one-dimensional' way of seeing it, towards a more 'quanti/qualitative and multi-dimensional' perception of motivation (Kusurkar et al., 2012). For education, researchers have highlighted the importance of studying and measuring motivation based on different quality types, as a way of enhancing quality of teaching and learning. This is being transferred to HPE as well (Kusurkar et al., 2012; Williams, Saizow and Ryan, 1999; Williams and Deci, 1998). Figure 2 depicts the progression of motivational theories and their influence on education.

Figure 2. The progression of motivational theories and their influence in education. Source: Adapted from Kusurkar et al., 2012.



1.2.1 The Self-determination Theory: a multidimensional approach to human motivation

As stated above, the topic of motivation relates to what moves an individual to act, think, and develop. Therefore, the focus of motivation research is on the conditions and processes that facilitate persistence, performance, healthy development, and vitality in our activities (Deci and Ryan, 2008a). These processes are mostly functions of sociocultural conditions in which individuals find themselves, and they do not only influence what people do but also how they feel and the outcomes of their acting. This is why most of the aforementioned theories have focused on interventions and the effects of social environments to understand better what stimulates and maintains effective functioning (Deci and Ryan, 2008b).

In contrast to other theories that have studied motivation as a unitary concept varying only in amount (Bandura, 1997), SDT has postulated that there are different types of motivation, and that their particular influences on outcomes are more relevant than those of a quantifiable single-construct. These types of motivation are categorised as autonomous motivation, controlled motivation, and amotivation. Autonomous motivation involves behaving with a full sense of volition, choice and self-determination, while controlled motivation involves behaving under pressure and demands towards specific outcomes, which come from forces perceived to be external to the self. On the other hand, amotivation is the absence of intent or drive to pursue an activity, due to one's failure to establish contingencies between activity and behaviour (Deci and Ryan, 2008a).

Developed in the 1970s by Deci and Ryan (1975), SDT is currently one of the major theories of human motivation and has been researched across many life's domains, including education. SDT is a dynamic theory, which is still the object of on-going research, however it is an emerging topic and little is known of it within the medical (Ten Cate, Kusrkar and Williams, 2011) and dental education communities (Orsini, et al., 2015a). Several authors have contributed to its development in HPE (Williams and Deci, 1998; Kusrkar et al., 2013a; Orsini et al., 2015b), stressing the use of more methods that stimulate autonomous motivation and less methods that attempt to control motivation and behaviour.

The basis of SDT assumes that individuals are naturally curious, active, self-determined and willing to succeed, as this brings personal reward and satisfaction. On the other hand, it also acknowledges that people can be disaffected and passive (Deci and Ryan, 2008a). These

contrasting behaviours can be encouraged or diminished by internal or external forces that are operationalized by the different types of motivation, which in turn, result from the interaction between people's inherent active nature and the surrounding social environment that can either support or hinder them (Ten Cate, Kusrkar and Williams, 2011; Deci and Ryan, 2008a).

In addition, SDT proposes that all individuals have the need to feel autonomous, competent, and related to the surrounding social environment in order to be self-determined in their actions (Ryan and Deci, 2000a). Therefore, the effects of social factors on motivation are postulated to be indirect. Past research has found that social factors are mediated by how they facilitate or prevent an individual's perception of autonomy, competence, and/or relatedness (Deci, 1975; Deci and Ryan, 1985a; Guay and Vallerand, 1996); this facilitation supports and maintains optimal motivation, leading to positive developmental and psychological outcomes. In contrast, social factors that do not facilitate individual's perceptions of the three needs will yield less optimal forms of motivation, leading to more negative outcomes (Ryan and Deci, 2000a). In the case of HPE and dental education, the facilitation of self-determined forms of motivation is expected to contribute towards students becoming better practitioners (Kusrkar, 2012).

As explained earlier, these concepts and their interaction have been integrated in an academic motivational model (Fig. 1). In addition, this model has been expanded to several levels of a person's life, including the motivation towards a particular situation, towards a particular context, and towards a global or personality context (Vallerand, 1997). This *hierarchical model of motivation* (Fig. 3) takes the main ideas derived from SDT and explains that motivation can be a dynamic variable and that the different levels can influence one and another.

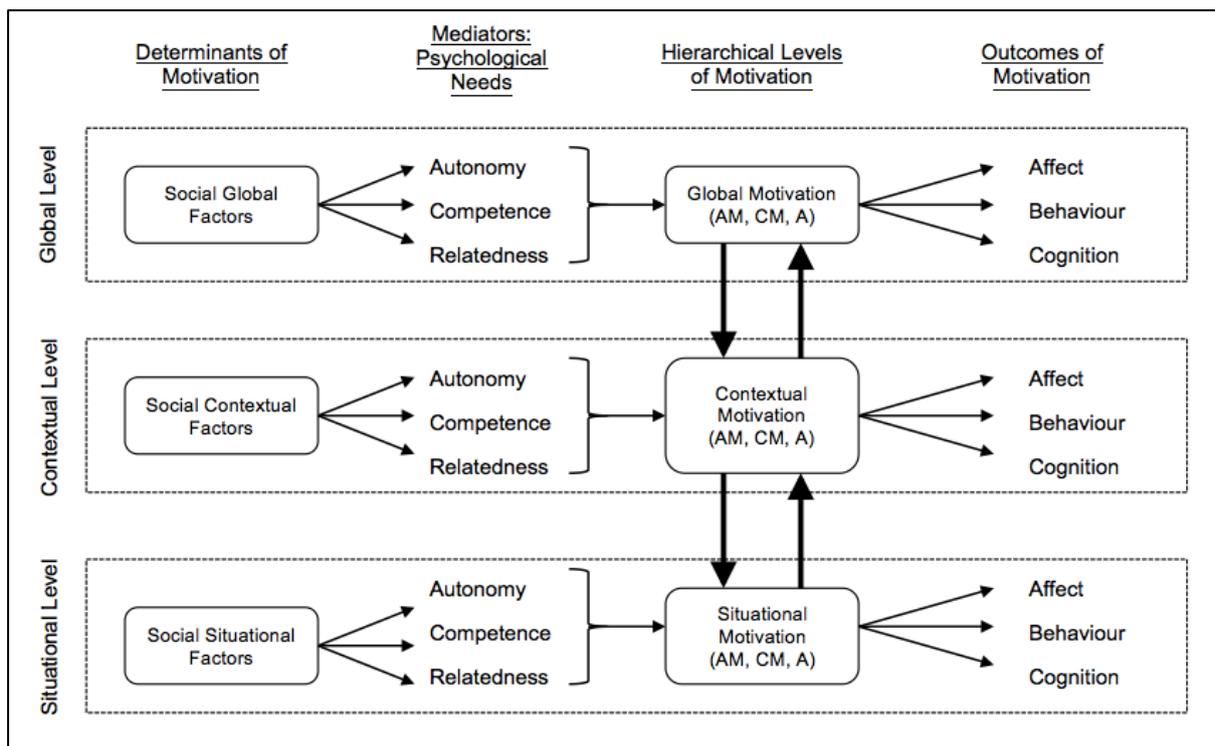
The most dynamic level is the situational one, as it can change very quickly from one situation to another. This represents the motivation experienced when an individual is currently engaging in an activity, it is the here and now of motivation (Ryan, 1995b). For example, in clinical dental courses, a student can be autonomously motivated to engage in a local anaesthetics workshop, but in turn later that day, the same student can experience controlled motivation to engage and participate in a restorative dentistry class.

Moving along the hierarchy, the contextual level refers to motivation towards a specific life context, such as education, sport, or work (Vallerand, 1997). This level of motivation is more

stable than the situational one, but more dynamic to change than the global level. For instance, a student might experience autonomous motivation to attend university, but controlled motivation to exercise and engage in sports.

Finally, the global level of motivation refers to one's personality and represents the general motivational orientation to interact with the environment in an autonomous, controlled, or amotivated way (Deci and Ryan, 1985b). It represents the more stable level of motivation, and therefore, the most difficult to change.

Figure 3. The hierarchical model of human motivation depicting determinants of motivation, psychological mediators, levels of motivation, and outcomes, at the three levels of generality; from the global, contextual, and situational level. Note: AM: Autonomous Motivation, CM: Controlled Motivation, A: Amotivation. Vertical arrows represent the recursive top-down and bottom-up effects. Source: Adapted from Vallerand, 1997.



The relevance of differentiating the three levels relies in that past research has shown a longitudinal recursive relationship between motivation at the different levels of generality (i.e., the double vertical arrows in Figure 3) (Vallerand, 1997; Williams and Deci, 1996a; Haddad, Pelletier and Bazana, 1995). Therefore, motivation does not only result from the horizontal model depicted in Figure 1, but also from bottom-up and top-down effects at the proximal levels in the hierarchy. The bottom-up effect implies that motivation at lower levels can have a recursive effect on motivation at higher levels of the hierarchy. Thus,

experiencing constant autonomous motivation at the situational educational level may eventually lead to a contextual autonomous motivation in education; and experiencing autonomous motivation in important life contexts may lead to global autonomous motivation. For instance, if we refer back to our initial example, the constant situational autonomous motivation experiences of Mark in the course of oral surgery may contribute to his experience of autonomous motivation in the overall context of education.

On the other hand, the top-down effect suggests that autonomous motivation at a higher level will facilitate autonomous motivation levels at the next level down the hierarchy (Vallerand, 1997). For example, despite the fact that Karen's motivation was not as self-determined as Mark's, and considering that she did not enjoy the course as much as the other courses she had taken, she did well. The situational autonomous motivation of other courses may have contributed to her autonomous motivation towards education, and the top-down effect of this contextual autonomous motivation might have influenced her somewhat self-determined motivation towards the course of oral surgery.

Even though the recursive effects of motivation may seem to some extent as obvious, it is relevant to consider them to predict better and explain the multidimensional characteristics of students' motivation. A detailed description of the three levels of generality and the recursive effects is beyond the scope of this thesis, as it will be focused on the contextual level (i.e., dental education). We have focused our research on this level as a starting point because past research has shown its relevance in providing a better understanding to applied wider educational problems, such as dropout rates or satisfaction with education for instance, and to the processes involved in such problems, leading to possible future interventions (Vallerand, Fortier and Guay, 1997; Vallerand and Bissonnette, 1992).

What follows is a more detailed description based on the main areas described by SDT. These will be presented as three postulates, which have been adapted from Vallerand (1997): *'Hierarchical model of intrinsic and extrinsic motivation'*

- **Postulate 1:** *A complete analysis of motivation must always consider autonomous and controlled motivation, and amotivation.*
- **Postulate 2:** *Motivation is determined by social factors, which are mediated by perceptions of autonomy, competence, and relatedness.*

- **Postulate 3:** *Motivation leads to important outcomes at the affective, cognitive, and behavioural dimensions, decreasingly positive from autonomous motivation to amotivation.*

1.2.1.1 Postulate 1: A complete analysis of motivation must always consider autonomous and controlled motivation, and amotivation.

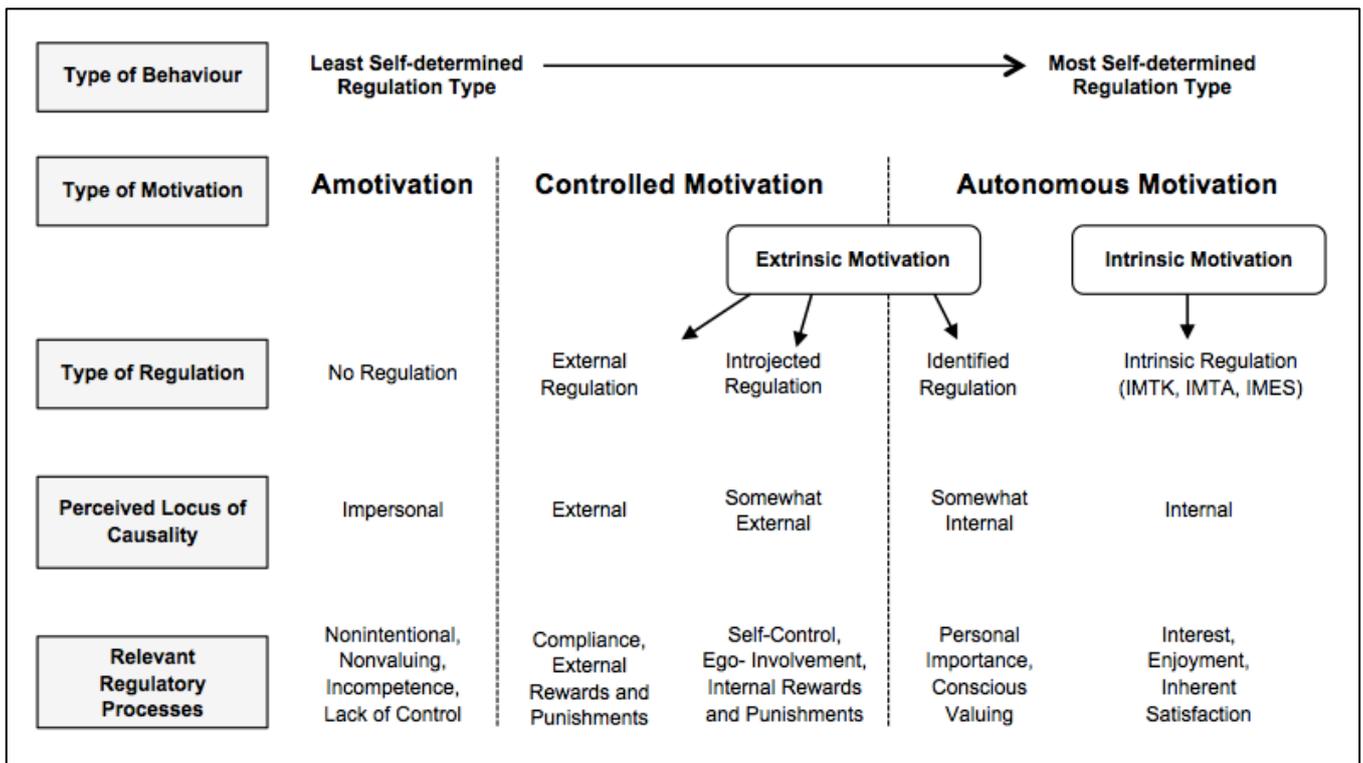
SDT postulates that individuals are motivationally complex; consequently, analysing a student's motivation through an only summative and general view would be insufficient. A central element to analyse motivation is to consider its various quality types, including the constructs of autonomous motivation (i.e., engaging out of pleasure and satisfaction, valuing the importance of an activity), controlled motivation (i.e., engaging in an activity in order to obtain something outside the activity or being moved by external forces), and amotivation (i.e., the relative absence of motivation) (Ryan and Deci, 2000a). These concepts are important, as they explain large part of human behaviour, represent an important aspect of an individual's experience, and lead to important and varied outcomes (Vallerand, 1997). Moreover, the different types of motivation are not exclusive, as they can be present within the individual in different degrees (Ryan and Deci, 2000a).

Early differentiations of the different quality types of motivation during the 1970s involved amotivation, extrinsic motivation (i.e., internalization and regulation that comes from external sources), and intrinsic motivation (i.e., internalization and regulation that comes from the self) (Deci, 1975). Amotivation has been studied as a unitary construct, whereas extrinsic and intrinsic motivation have been subdivided into four and three types of regulations, respectively. These multiple dimensions exist as a continuum, from the least self-determined conduct to a fully self-determined form of behaviour, i.e., from amotivation to intrinsic motivation (Fig. 4) (Deci et al., 1991).

The focus of intrinsic versus extrinsic motivation has changed to a focus on autonomous versus controlled motivation, mainly because vast amount of research has shown that not all forms of extrinsic motivation lead to negative consequences as it was believed in the past; the most self-determined regulation types of extrinsic motivation, that are very close to what an intrinsic form is, may lead to positive outcomes (Black and Deci, 2000; Grolnick and Ryan, 1987). The different types of regulations that compose intrinsic and extrinsic motivation are the same as the ones that compose autonomous and controlled motivation (Fig. 4), the underlying difference relies in the way these regulations are organised, based

on the consequences they lead to and not solely based on the locus of causality (i.e., internal or external). In this sense it is important now to describe which are the different types of regulations that compose intrinsic and extrinsic motivation and why and how are they currently organised in forms of autonomous and controlled regulation.

Figure 4. The SDT continuum, depicting types of behaviour and regulation, locus of causality, and relevant regulatory processes. The early differentiation of extrinsic and intrinsic motivation has been included to facilitate the readers understating of the differences between them and controlled and autonomous motivation. Note: IMTK: Intrinsic Motivation to Know, IMTA: Intrinsic Motivation Towards Accomplishment, IMES: Intrinsic Motivation to Experience Stimulation. Source: Adapted from Deci and Ryan, 2000b.



A non-regulation state is represented by amotivation, which results from an individual not valuing a behaviour or outcome, or believing that the behaviour is instrumental to a valued outcome but not feeling competent to do those instrumental behaviours. In other words, what students' do seems to be unrelated to the consequences derived from their actions. In part, this would be the case of Allan, in our first example from section 1.1, when he described the course as being too difficult and not knowing why he was attending.

Following the continuum, *extrinsic motivation* refers to pursuing an activity out of a sense of obligation, or as a means to an end (Deci and Ryan, 1985a). It has been subdivided into four types of regulations that can be ordered along a continuum. The lower self-determined form

is *external regulation*, in which students participate to obtain rewards or to avoid punishment, as Allan did, only studying when his parents or teachers were present. This is followed by *introjected regulation*, in which individuals begin to internalize the reasons for their actions; however, behaviour is still regulated by external demands or requirements from the environment to avoid internal conflict. In other words, individuals replace the exclusive external source of control by a somewhat external/internal one, and start imposing pressure on themselves to ensure engaging in activities. This is illustrated by the feelings of guilt when Karen claimed that she had to succeed in the course of oral surgery to maintain her performance as high as in other courses and to not disappoint her parents. The self-imposed pressure represents a somehow external motivation incorporating internal origins, but it is not fully self-determined (Deci and Ryan, 2008a).

Following, there is *identified regulation*, in which behaviour becomes valued, important, emitted out of choice, and seems similar to a form of self-determined regulation, although the conduct still represents an instrument to achieve an objective (Deci et al., 1991). This form of regulation is illustrated when Karen claimed not being so interested in the contents of oral surgery, but she knew it was important for her future as a dentist. Therefore she freely chose to engage with the course and, despite not being perceived as a pleasant activity, the contents and clinical activities were valued and regarded as highly important to her. Finally, a fourth form of regulation termed *integrated regulation* has been described by SDT as similar to identified regulation, but the sense of choice represents a fully endorsement of the activity, it is an awareness involving other aspects of the self but it is still instrumental rather than pursued for pure pleasure or satisfaction (Deci et al., 1991). This type of regulation has been excluded from the analysis of motivation in adolescents and young adults, as initial focus groups and factor analyses revealed that such types of reasons were not endorsed or mentioned by them (Vallerand, Blais, Brière and Pelletier, 1989; Vallerand, 1997). Since the self is still developing, it may prevent them to be motivated out of integrated regulation and therefore we have excluded this type of regulation from our analyses as well.

The most self-determined form of behaviour, represented by intrinsic motivation is *intrinsic regulation*, which denotes the drive to pursue an activity simply for the pleasure or satisfaction derived from it, without internal or external pressures (Karagüven, 2012). Vallerand, et al. (1989) have considered it as a global construct with three subdivisions being at the same level and not following a continuum, but categorized as subtypes. First, there is *intrinsic motivation to know*, which relates to concepts such as curiosity or motivation to learn (Gottfried, 1985); following there is *intrinsic motivation towards accomplishments*, which reflects commitment towards an activity for the pleasure and satisfaction gained when

one attempts to accomplish or create something (Deci and Ryan, 1985a; Deci et al., 1991); and finally there is *intrinsic motivation to experience stimulation*, which indicates engagement for fun, excitement, and positive sensations (Vallerand et al., 1989, 1992). These are represented, in our example, by the reasons why Mark engaged in the course of oral surgery, claiming pleasure and satisfaction when learning and when performing the course activities, and being curious enough to go beyond and deepen in his areas of interest.

Early research described only intrinsic regulation as leading to positive educational outcomes and therefore the overall distinction was made between intrinsic and extrinsic motivation (Ryan and Deci, 2000b). Recently, Deci and Ryan (2008b) have shifted this multidimensional approach, and non-intrinsic but internalised forms of regulation, such as identified regulation, have been described as promoting positive adaptive consequences (e.g., persisting at difficult tasks) compared to other forms of regulation that are mainly dominated by external forces (i.e., external and introjected regulation). In this sense, external and introjected regulations are considered forms of controlled motivation, while identified and intrinsic forms of regulation constitute autonomous motivation. Autonomous and controlled motivation reflect an individual's intention to act (though leading to different quality outcomes), conversely amotivation reflects the lack of intention to act.

Studying motivation from a multidimensional perspective has enabled researchers to be more specific in their predictions. While it is important to categorise motivation by the three 'big types' as autonomous, controlled or absent, it is also necessary to describe the different regulation types along the continuum that characterises students' involvement in education. This provides a better way to predict motivational determinants and to uncover which configurations lead to the most desirable outcomes (Vallerand, 1997).

1.2.1.2 Postulate 2: Motivation is determined by social factors, which are mediated by perceptions of autonomy, competence, and relatedness.

After describing the different quality types of motivation, the question that naturally rises is what are the determinants that make students' adopt a certain type of regulation and engage in academic activities? A first point to consider when answering this question is that motivation is influenced by both intrapersonal and interpersonal factors (Vallerand, 1997).

By intrapersonal factors we mostly refer to an individual's inherent characteristics (e.g., gender, age, or ethnicity) and to personality traits. Past research has shown that profiles of females, mature-aged, and white students seem more autonomous and self-determined than males, young-aged, and non-white students (Vallerand et al., 1989, 1992; Nunez, Martin-Albo and Navarro, 2004; Harth, Biggs and Thong, 1990; Kusrkar et al., 2011a; Wagoner and Bridwell, 1989).

On the other hand, the interpersonal forces are represented by social factors. In other words, by social experiences in which others have powerful impact on our motivation (Deci and Ryan, 2008a). Having said this, it is important to emphasise that motivation results from social factors at each of the three levels of the hierarchy (i.e., global, contextual, or situational). Therefore, contextual factors, and not situational factors, will affect contextual motivation (i.e., dental education as an overall and not a single class or activity). Contextual social factors represent variables that exist on a general or regular basis on one's specific life domain (e.g., having autonomy-supportive or controlling clinical tutors) but not in another contexts (e.g., the clinical tutor is not part the students' sport context).

The teaching and learning environment cannot manipulate intrapersonal factors, whereas interpersonal ones can be, potentially, manipulated (Kusrkar et al., 2011a). Even though we will test some intrapersonal factors throughout this research, our attention will be mainly focused on how interpersonal factors influence motivation. Past research has highlighted, in educational contexts, the influence of interpersonal factors such as autonomy-support, type of curriculum, extent of responsibility, selection procedure, type of assessments, and early patient contact, amongst others (Kusrkar et al., 2011a; Williams and Deci, 1996a; Woltering, Herrler, Spitzer and Spreckelsen, 2009; Cantillon and Macdermott, 2008; Hulsman et al., 2007; Wilkinson, Wells and Bushnell, 2007).

A second point to consider is that these interpersonal social factors would not impact motivation in a direct way (Vallerand, 1997). As mentioned earlier, SDT has postulated that their effect is mediated by the impact they have on students' perceptions of three basic psychological needs (autonomy, competence, and relatedness) that represent essential needs that every individual tries to fulfil (Maslow, 1943; Deci, et al., 1991b). Therefore if social factors satisfy perceptions of the aforementioned needs, autonomous motivation will increase and become sustainable (Ryan and Deci, 2000b; Deci, et al., 1991b). It is the perception of the social factors and not their planned objective that mainly affects motivation.

In first place, the need for autonomy refers to making decisions by one's own will, based on one's own needs and values (Ten Cate, Kusurkar and Williams, 2011). This does not mean 'independence', which refers to function alone and not relying on others, it means to act volitionally, with a sense of choice (Ryan and Lynch, 1989). For instance, in clinical dental education, autonomy does not mean that students act independently from their tutors, it means that they engage in clinical activities because they want to and because they have chosen to act (Orsini et al., 2015b). Therefore, students are autonomous when they freely choose to devote time and energy to their studies or to a particular academic activity.

Secondly, the need for competence refers to the desire for self-efficacy with regards to the task desire, or in other words, it is feeling capable of performing a determined task, and it is related to seeking challenges that are optimal to one's abilities (Ten Cate, Kusurkar and Williams, 2011; Ryan and Deci, 2000a). In this context, competence is not defined as an attained skill or ability per se, but rather as a perception of confidence and effectiveness (Ten Cate, Kusurkar and Williams, 2011). A dental student, for example, would increase his perception of competence if s/he is challenged to perform a clinical treatment according to his current clinical capabilities, neither too easy nor too difficult (Orsini, et al., 2015b).

Thirdly, the need for relatedness is described as the need for belongingness or connectedness with important others, as well as with a significant community (Ryan and Deci, 2000b; Levesque, et al., 2004). It means being accepted and valued by people surrounding us. In the dental education teaching environment, 'important others' are represented by fellow students, teachers, and patients amongst others. Therefore students may fulfil their needs of relatedness by building close working relationships with their tutors, classmates, and patients, based on respect, empathy and assertiveness (Orsini, et al., 2015b).

Postulate 2 is especially important in educational contexts. Teachers and the environment would increase students' autonomous motivation and facilitate its maintenance if they promote a social context in which students feel that the learning process depends on them, the behaviour is related to their interests, they feel competent, and belong to and are connected with the group. Past research has tested the mediating role of the three basic psychological needs in different domains at the contextual level, such as in sports (Blanchard and Vallerand, 1996), education (Guay and Vallerand, 1996), and health (Cadorette, Blanchard and Vallerand, 1996), in which results from path analyses have provided support for the mediating hypothesis. Consequently, as social factors have positive

impact on students' perceptions of autonomy, competence, and/or relatedness, autonomous forms of motivation will be facilitated, which in turn may lead to positive educational outcomes.

1.2.1.3 Postulate 3: Motivation leads to important outcomes at the affective, cognitive, and behavioural dimensions, decreasingly positive from autonomous motivation to amotivation.

If educational social factors can affect motivation and influence the type of regulation by which students engage in academic activities, then what are the consequences of these different kinds of academic motivation for everyday academic life? Ryan and Deci (2000b) have postulated that motivation leads to important outcomes, at the cognitive, behavioural, and affective level (Fig. 1).

In education, cognitive outcomes of motivation such as concentration or attention (Vallerand et al., 1989) and conceptual learning and memory (Grolnick and Ryan, 1987) have been studied. Behavioural outcomes have included persistence at task (Vallerand and Bissonnette, 1992), performance (Kusurkar, et al., 2013a), and choice of behaviour (Swann and Pittman, 1977). Finally, examples of affective outcomes include positive emotions (Orsini, et al., 2015a), interest (Vallerand et al., 1989), and satisfaction with education (Vallerand, et al., 1993). The relevance of studying the outcomes of motivation separately at the cognitive, behavioural and affective level is mainly based on two aspects.

Firstly, studying these variables separately and by outcomes rather than as 'indices of motivation', permits us to determine and specify when and how motivation will affect behaviour, emotions, and thoughts (Vallerand, 1997). In other words, this highlights that motivation may lead to different outcomes depending on the context or specific situation. For instance, a student acting in accordance with external regulation enrolled in a restorative dentistry course in which the type and quantity of clinical procedures are free of choice with a minimum requirement of three, may choose to perform only three amalgam restorations claiming no interest in doing more. Will the outcomes be the same under different conditions or if the student was more interested in performing amalgams or other types of restorations? If the rules changed and the course required students to perform six instead of three amalgam restorations in a highly pressured environment, the same student lead by external regulation might engage and perform the six required amalgam restorations (i.e., leading to

an adaptive behavioural outcome), but it may also lead to poor concentration (i.e., a negative or maladaptive cognitive outcome) and perhaps to anxiety (i.e., a negative affective outcome). Therefore, the three types of outcomes might, at times and depending on the context, be negatively correlated (Ryan, Koestner and Deci, 1991).

Secondly, it allows us to make a distinction and to test how the different types of regulations will affect each type of outcome. Past research has shown that the level of outcomes, from the most positive ones to most negative ones, are associated with the continuum pattern of motivation, from the highest to the lowest self-determination types (Deci and Ryan, 1985b). In this sense, autonomous motivation leads to positive outcomes and effective adaptation, while least and non self-determined types (i.e., controlled motivation and amotivation) do not (Ryan, 1995b). By studying the outcomes of motivation separately, we may investigate which type of regulation will promote better behavioural, cognitive, or affective outcomes. Thus, leading us to plan and implement interventions that may stimulate students to engage in activities in a more self-determined fashion, which in turn may lead to positive outcomes benefiting themselves and their patients.

It is therefore essential to consider postulate 3 when conducting research on academic motivation, as it is the end point of the SDT model depicted in Figure 1. A complete study of motivation forces us to pay attention to the outcomes at the aforementioned different levels, as different types of motivation, influenced by the impact of social factors, may lead to different outcomes; and on the other hand, these may not positively correlate amongst each other.

Having described the main concepts and relations of the SDT model and its relevance for the study of academic motivation, we will turn our attention now to the methodological aspects of measuring motivation when conducting research.

1.2.2 Measuring Motivation: How and Why?

As motivational theories have progressed through the years, giving more importance to a multidimensional and quality type approach; so has the way in which researchers measure and assess an individual's amount and type of motivation (Mayer, Faber and Xu, 2007).

Early research tended to measure motivational variables based on affective variables (such as interest or positive attitude towards tasks) or behavioural measures (such as time spent on a particular task), in which a high exhibited level implied an intrinsic or a more self-determined profile, and lower levels implied extrinsic or non self-determined forms of regulation (Vallerand, 1997). Inferring motivation from a variable it supposedly causes has been termed as measuring “effectance motivation” (Bandura, 1977). Therefore, researchers were not measuring motivation as an independent construct; they were relying on external variables, that in most cases are considered outcomes of motivation, rather than measuring motivation by itself and as an independent variable.

Relying on external criteria to serve as both the index and outcome of motivation leads essentially to two kinds of problems. On the one hand, it creates a conceptual problem of circularity. If, for instance, we focus on the affective measure ‘interest in a particular task’ in order to assess motivation, how would we determine if students are motivated? We would assess how interested they are on a particular task or topic. But what leads students to be interested on a particular task? Motivation. This is problematic, and clearly illustrates that the affective variable ‘interest’ is being used both as an index and as an outcome of motivation. Perhaps, it is understandable that from a methodological point of view that one measures motivation and its outcome based on one same variable, but from a conceptual point of view it is impossible to refer to both motivation and its consequences based on a single construct (Vallerand, 1997).

On the other hand, assuming that high levels of behavioural or affective indices are associated with intrinsic forms of regulation denies the possibility that any form of extrinsic regulation (such as identified regulation) can possibly influence these outcomes in a positive way, automatically assuming that low levels of these outcome variables are associated with amotivation and with all external forms of regulation. This interpretation contrasts with that of vast research arguing that some forms of extrinsic regulation may lead to positive affective and behavioural outcomes (Blais, et al., 1990; Vallerand and Bissonnette, 1992; Vallerand et al., 1989; Vallerand, et al., 1993; Vallerand, Fortier and Guay, 1997).

From the above, it is fair to say that we should always aim at measuring motivation independently from its determinants and outcomes (Fig. 1). Measuring motivation as an independent construct should provide conceptual clarity and also allow us to determine how social factors affect the different quality types of motivation, and in turn compare their impact on the different cognitive, affective, and behavioural outcomes. To effectively accomplish

this approach on assessing motivation, research has focused on measuring motivation as the ‘why of behaviour’ (McClelland, 1987). This has enabled researchers to operationalize motivation as the perceived reasons (i.e., autonomous or controlled) for engaging in an activity (Deci, 1971), along with using this operational definition to correlate it with different determinants and outcomes; without the previously mentioned circularity problems.

The way in which this has been operationalized is mainly through self-reported questionnaires that offer participants reasons for engaging in activities. They are presented based on several concepts outlined in previous sections (i.e., autonomous and controlled motivation, perception of the basic psychological needs and autonomy support, amongst others). As a result, a high endorsement of the reasons presented is then assumed to reflect the analysed variable (Vallerand, 1997; Mayer, Faber and Xu, 2007). A brief description of the most relevant tools, which cover measurements of almost all concepts described within SDT, is outlined in table 1.

Table 1. Measuring instruments derived from SDT. Source: Adapted from Ten Cate, et al., 2011a.

Instrument	What does it measure?
Academic Self-Regulation Questionnaire	Separate scores on intrinsic motivation, identified regulation, introjected regulation and external regulation.
The Self-Determination Scale	The extent to which people tend to function in a self-determined way.
The General Causality Orientations Scale	Autonomy, controlled and impersonal orientations in an individual.
The Learning Climate Questionnaire	The students’ perception of autonomy support in their educational setting.
The Perceived Competence for Learning Questionnaire	How students’ perceive their competence in their learning.
The Basic Psychological Needs Scale	The extent to which an individual feels his needs for autonomy, competence and relatedness satisfied.
The Motivators’ Orientations Questionnaires	A relatively stable orientation in adults towards their approach to motivating others.
Academic Motivation Scale (AMS)	Scores on intrinsic motivation (three further sub-scales measuring IM to know, IM towards accomplishment and IM to experience stimulation), identified regulation, introjected regulation and external regulation, and amotivation

Specifically referring to motivation in educational settings, there has been increasing need for a standardized, validated and reliable measure of academic motivation. Amongst the different instruments derived from SDT, some scales attempt to measure some of the regulation constructs, and no scale currently allows to assess them all. Integrated regulation, which is difficult to measure and frequently overlaps with the intrinsic motivation subtypes, has not been assessed and until now there is no scale to measure it.

The most comprehensive scale attempting to measure the constructs of motivation described by SDT in higher education contexts is the Academic Motivation Scale (AMS). It was developed in 1989 in Canadian-French and subsequently validated in English (Vallerand et al., 1989), Spanish (Nunez, Martin-Albo and Navarro, 2004) and Turkish (Karagüven, 2012), amongst other languages, in response to the lack of instruments that permitted assessment of the different quality types of motivation within the continuum of SDT. The AMS is aimed at adolescents and adults in academic post-secondary environments (Vallerand et al., 1989), it is recognised by the levels of validity of its proposed factor structure, and by the correlations to other key determinants and outcomes that other scales yet do not achieve. It has been used in many countries and in different educational contexts such as psychology (Stover, et al., 2012), business (Smith, et al., 2010), medicine (Sobral, 2004) and dentistry (Orsini, et al., 2015a).

Initial validation studies (Vallerand et al., 1989) revealed that the AMS had satisfactory internal consistency values (Cronbach Alpha .80) and high levels of temporal stability (mean of .75 test-retest). Results of confirmatory factor analysis confirmed a seven-subscale structure and construct validity was assessed through correlations between the seven subscales, verifying the presence of the SDT continuum (Fig. 4), with minimum deviations (i.e., representing the continuum of SDT in which adjacent scales show positive correlations, and the subscales at the opposite ends of the continuum display the highest levels of negative correlations). Furthermore, the AMS has been integrated in empirical models that incorporate determinants (e.g. teachers' behaviours) and outcomes of academic motivation (e.g. dropout, positive emotions, academic performance), providing support for its concurrent validity (Vallerand, 1997; Vallerand and Bissonnette, 1992).

A final consideration that needs to be highlighted with respect to the assessment of academic motivation is that the large number of variables and the stress they generate on statistical analyses when testing the overall model (Fig. 1), has lead researchers to combine the different subscales into an index, known as the self-determination index (SDI), Relative Autonomy Index (RAI) or as Relative Autonomous Motivation (RAM) (Fortier, Vallerand and Guay, 1995; Grolnick and Ryan, 1987; Vallerand and Bissonnette, 1992). Considering that the seven subscales follow a continuum (Fig. 4), these indices result from weighting and adding the scores derived from each subscale, according to their respective position in the continuum, so as to derive a single score that reflects the individual's relative degree of self-determined motivation. Therefore a positive score suggests a self-determined profile, and a negative one indicates non self-determined motivation.

Despite of the usefulness of these indices, especially when needing to reduce the number of latent variables to test the model in structured equation modelling analyses, its exclusive use may lead to incomplete information, as it does not indicate which specific type of motivation is associated with resulting outcomes. Thus, to test the model in a more comprehensive way, a dual approach should be accomplished combining the use of the indices in path analyses or in structured equation modelling, and the multidimensional correlational analysis of the different subscales, determinants, and outcomes.

1.3 Context

This thesis proposes to study the aforementioned concepts of academic motivation in dental education by testing a model in which educational social determinants, mediated by the students' perceptions of autonomy, competence, and relatedness, will affect motivation and promote the adoption of self-determined forms of motivation when engaging in academic activities, which in turn will have positive impacts in dental education outcomes. But why should we study academic motivation in HPE and specifically in dental education if motivation is a transversal concept to all humans and has been tested in different general education and psychology studies?

Several authors have stressed the relevance of studying motivation in different educational domains and across cultures (Williams, Saizow and Ryan, 1999; Deci and Ryan, 2008b; Nunez, Martin-Albo and Navarro, 2004). As different curricula and exit profiles of students from different professions vary between each other, it is coherent to think that the process of motivation might be different as well. For instance, a student enrolled in a HPE programme dealing with patients, may experience inputs and outputs of motivation in a different way from a student enrolled in an engineering related profession. Therefore, studying the particularities of each profession may help in understanding which contexts stimulate or hamper the internalisation of external behaviour regulation, the locus of causality, and above all, it can aid on identifying the different processes in dental education by which the teaching and learning environment can hamper or foster feelings of competence, autonomy, and relatedness (Ten Cate, Kusurkar and Williams, 2011).

Moreover, research has shown that students in health professions who learn in environments that support autonomous motivation tend to act in more autonomy-supportive

ways in their interactions with their patients (Williams and Deci, 1996a). This autonomy supportive practitioner-patient interaction has shown positive health outcomes in behaviour related areas such as smoking cessation (Williams and Deci, 1996b), weight loss (Williams, et al., 1996), prescription adherence (Williams, et al., 1998), glucose control (Williams, Freedman and Deci, 1998) and oral health care (Halvari, et al., 2012b).

Recently, several studies have been conducted in which the promotion of oral health care delivery, conducted in a self-determined way by dental practitioners, has resulted in an increased perception of competence and autonomous motivation of patients (Halvari, et al., 2013) leading to better oral health care behaviours (e.g., brushing and flossing), which in turn resulted in a reduction of dental plaque and gingivitis (Halvari and Halvari, 2006; Halvari, et al., 2012a) and anxiety (Halvari, et al., 2010). Therefore, a better understanding of academic motivation may eventually result in more effective health care delivery.

On the other hand, this educational domain difference is also reflected by the general impression that traditional approaches to HPE are highly controlling (Williams, Saizow and Ryan, 1999; Becker, et al., 1996). This is stressed in dental education, where students start treating patients during their early undergraduate training years (General Dental Council, 2015). This contributes to a highly demanding and sometimes stressful environment, in which students, guided by their tutors, are encouraged to increasingly take more and more responsibility for the treatment plan and clinical actions needed by their patients. In addition to traditional forms of assessment, feedback, curriculum design and clinical teaching strategies, which have been teacher-centred, tutors might be delivering education in a well-intended controlling form. Instead, by applying the principles of SDT, the dental teaching and learning environment can facilitate students' acquisition of dental knowledge, conceptual understandings, personal adjustment, and desire for lifelong learning (Williams, Saizow and Ryan, 1999). It has been recently postulated that the SDT principles might explain the better educational outcomes of student- and patient-centred approaches, such as PBL and integrated curricula (Williams, Saizow and Ryan, 1999). Consequently, research on determinants and outcomes of motivation in a widely perceived controlling climate is highly pertinent.

In addition, as I am a dental surgeon from Chile, this research intends to contribute to the study of dental education in this particular context and culture. I have been working in dental education since 2008, involved in courses such as oral anaesthesiology, oral surgery and clinical teaching of fourth and fifth year students in different Chilean Dental Schools.

The dental schools in Chile usually deliver a six-year discipline based curriculum. The first two years are comprised of basic sciences (such as biology, anatomy and histology), followed by a pre-clinical third year, and finally by a clinical-based fourth, fifth and sixth year. Students start their first patient contacts by the end of the second semester of the third year and move to fully patient-centred course on the first semester of the fourth year. Currently, a vertical integration is being partially introduced, aimed at an early clinical contact experience for students, in which first and second year trainees assist fellow fourth and fifth year students in their clinical procedures, and participate in several health promotion campaigns (USS, 2012).

As for the general higher educational context in Chile, in recent years concern has been shown about the increasing dropout rates, as informed by the 'Microdata Centre from the Department of Economics of the University of Chile' (University of Chile, 2008). This rate is estimated of 19% to 22% by the end of the first year, reaching a cumulative rate of 39% to 42% by the end of the third year. Even though for dentistry the dropout rates by the end of the first year are not amongst the highest, these data increases significantly by the end of the third year.

The three most prevalent causes determining dropout are associated with (1) vocational issues, (2) funding, and (3) academic performance. Several strategies of programmes promoting retention are being developed, such as academic support; social and financial support; and integration and motivational programmes. Results from the latter programme reflect the importance of developing research on motivation in Chilean higher education, showing that one of the most relevant strategies was 'promoting innovative and stimulating learning environments'.

Moreover, an interesting result from one of our recent studies (Orsini, et al., 2015a) showed that first year Chilean dental students were significantly more intrinsically motivated than second, third, fourth, and fifth-year students, and that third and fourth year students, in which they have their first contact with patients, showed the highest amotivation scores. The decrease in intrinsic motivation and increase in amotivation throughout the dental curriculum supports the need to conduct research and to possibly incorporate learning strategies that supports the principles of SDT of autonomy, competence, and relatedness.

The fact that every discipline has its own language and invites particular ways of thinking, makes it a challenge for dental educators to become more familiar with educational theory

and research, including theories of motivation, in order to better inform the process of dental education.

This section has reviewed the fundamental theoretical aspects of this thesis, highlighting the principles of SDT and the relevance that research on academic motivation may have on the development of dental education. The following section will be centred on reviewing the existing HPE literature regarding the motivational model of SDT, so as to inform, describe, and analyse the relations between different social determinants, their impact on academic motivation, and the resulting educational outcomes.

2. SYSTEMATIC LITERATURE REVIEW

* A modified version of this chapter has been published: Orsini C, Binnie VI, Wilson SL. **Determinants and outcomes of motivation in health professions education: a systematic review based on self-determination theory.** J Educ Eval Health Prof. 2016;13:19. DOI: <http://dx.doi.org/10.3352/jeehp.2016.13.19>

The aim of this narrative systematic literature review (Snilstveit, Oliver and Vojtkova, 2012) is to identify, summarise and critically analyse the empirical evidence in the HPE literature concerning the identification of quantitative-qualitative relationships between determinants, mediators, and outcomes of academic motivation based on SDT.

The review was organised following the steps suggested by the AMEE Guide No. 94 'Systematic reviews in medical education: A practical approach' (Sharma, et al., 2014). Therefore, it has been divided in five sections. The first comprises the *planning phase* and it is aimed at describing the characteristics of the review and how it was reported, presenting the question explored, together with a preliminary scope search. The second section outlines the *methods*, including the procedures for searching sources, data collection, and data analysis. The third section concerns the *findings*, which include an analysis of the methods applied by previous authors and a synthesis of their findings. The fourth section deals with the *discussion*, involving what was learned from conducting the review, along with its limitations. Finally, in the fifth section we summarise the work done presenting the most relevant *conclusions and practical implications* for future research and for the subsequent chapters of this thesis.

2.1 Planning the review

2.1.1 Organisation

The first step of the planning phase was to organise the review by defining its focus, goal, coverage, and organisation (Cooper, 1988).

The primary *focus* was outcome-oriented, with the aim of analysing the resulting relationships between variables. Nevertheless, a secondary focus on methods was also taken into account with the objective of identifying key approaches to data collection and analysis that would inform the outcomes. We decided to include all disciplines of HPE and

not limit the review to dental education, as these related fields might suggest relevant theoretical frameworks and methodologies.

The *goal* of the review was centred on both integration and criticism of the extracted data. The review was planned to select sources recognised as important within the field. This type of *coverage* is referred to as an *exhaustive review with selective citations* (Randolph, 2009).

The *organisation* and presentation was planned to methodologically follow the 'Introduction, Methods, Results and Discussion (IMRAD) format, based on the '**Structured approach to the Reporting In healthcare education of Evidence Synthesis statement (STORIES)**' (Gordon and Gibbs, 2014). A detail description of this statement is presented in appendix I. While key elements of presenting systematic reviews can be found in several guidelines such as the 'Preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement (Liberati, et al., 2009), it has been recently suggested that this general guidance is of limited value for health education synthesis of evidence (Gordon, 2014), therefore, the STORIES statement provides a specific approach for this field of research.

2.1.2 Formulating the review question

The second step of the planning phase was to develop a precise and focused review question. We opted to follow the CAPS mnemonic (**C**urrent state of knowledge, **A**rea of interest, **P**otential impact for education and **S**uggestions from experts in the field) to guide the formulation of the research question (Sharma, et al., 2014).

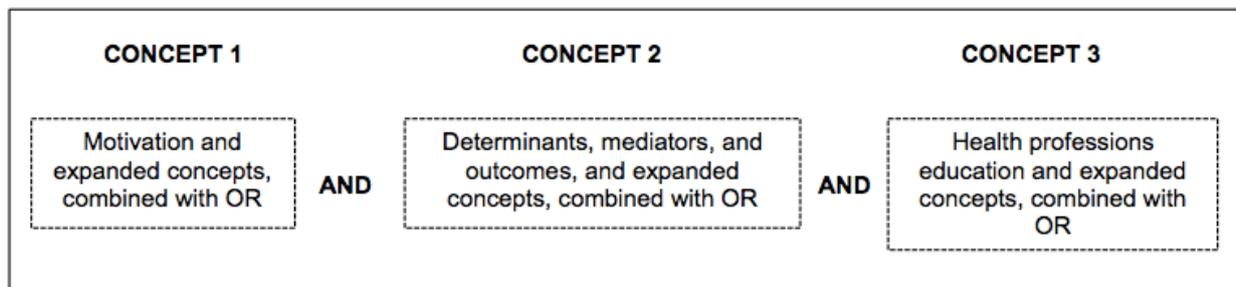
The *current state of knowledge* is presented in section 1.2. The *area of interest* of the review is both descriptive-narrative and seeking clarification about correlates between determinants, mediators and consequences of academic motivation. The *potential impact* of the review is two-fold. First, its results are intended to inform and guide the thesis' empirical research, and second, to better inform the process of motivation in HPE, which might influence teacher-student interactions and provide suggestions for curriculum developers and educational policy makers. Finally, *suggestions from experts* were taken from the author's supervisors and from key authors in the field.

Therefore the objective of the review was to answer the following question: '**Which determinants, mediators and outcomes of academic motivation, based on SDT, have**

been identified in the health professions' education literature and what are the relationships amongst them?'

A final step before proceeding to the data collection phase was to identify the essential subjects of the question (Haig and Dozier, 2003). Three main concepts were identified: '*motivation based on SDT*', '*determinants, mediators, and outcomes*', and '*health professions education*'. The objective of identifying these basic concepts was for them to guide the search and to be expanded using synonyms, alternative spelling, and related terms, in order to increase the sensitivity and specificity of the search (Haig and Dozier, 2003). The structure of the search query is presented in Figure 5, along with how these concepts were related to each other.

Figure 5. Organisation of essential subjects for the search query. Source: Own work.



2.1.3 Scoping Search

The final step in the planning phase was to preliminarily approach the existing evidence concerning the outlined topic. Therefore we conducted a non-systematic search with a two-fold aim. Firstly, we intended to identify any existing evidence of similar reviews that had been conducted, so we could refocus our question and identify additional key words used by previous authors. Secondly, we aimed at increasing our own awareness of the breath and depth of the existing evidence, so as to support the next phases of the review. The use of a scoping search has been referred to as a useful approach for 'reconnaissance' and to clarify conceptual boundaries of a topic (Peters et al., 2015).

We searched the Cochrane databases of systematic reviews, previous 'Best Evidence Medical and Health Professional Education reviews' (BEME), and Medline and PsycINFO databases on 22nd June 2015. These were chosen because of their relevance as important

sources for both systematic reviews and primary research in the HPE field. We revised the 32 systematic reviews of the BEME collaboration that had been published at the time the study took place (BEME, 2015). For all other sources, the search was based on the three concepts derived from the review question, which were expanded as follows:

(academic motivation OR motivation OR self-determination) AND (determinants OR antecedents OR psychological needs OR mediators OR outcomes OR consequences) AND (medical education OR dental education OR nursing education OR health professions education)

The search identified 263 references, from which 2 were cited in the Cochrane database, 32 in the BEME reviews, 108 in Medline, and 121 in PsycINFO. Several learning points resulted from this phase. The initial search was not as sensitive as expected, resulting in few references. Therefore we included more key words, such as more and less formal terms arising from this preliminary search (detailed in the next section). Secondly, of the references identified, many of them were irrelevant. Thus, to increase the specificity, we also planned to include more databases, specific journals, and additional sources to explore the published articles of key authors in the field. In third place, and also related to increasing the sensitivity, the inclusion of subject headings (i.e., specific terms from each database thesaurus) and the reduction of free-text keywords was thought to bring about a higher proportion of relevant records, reduce polysemy (i.e., to find the exact key word but applied in a different context), and granularity (i.e., the relative size, scale, or scope of a term) (Haig and Dozier, 2003).

Finally, we found two literature reviews comparable to ours. In the first, the authors aimed at answering the question on 'how the literature has evaluated motivation as either an independent or dependent variable in medical education?' (Kusurkar, et al., 2011a). Despite similarities in focusing on motivational relationships in the health professions education field, we did not consider our proposed review to be redundant, and did consider them different in a number of important ways. First, these authors studied motivation based on a general perspective whereas our focus is on research on motivation exclusively derived from SDT. Second, their results are based on medical education only, while we intend to expand these to all health professions education areas, such as dentistry, nursing, and psychology amongst others. Third, their search was limited to English articles published between 1979-2010; however, we intend to include English, Spanish, and French literature, and expand the time frame from 1971 to 2015. Therefore, our work intends to take forward and build from

the aforementioned review, adding specificity and sensitivity, by relying specifically on SDT and expanding the findings to different health profession fields.

The second review was performed by our research team in 2013 as part of Course 1 of this doctoral programme, and it intended to answer the question 'How to encourage intrinsic motivation in the clinical teaching environment?' (Orsini, Evans and Jerez, 2015). This review aimed to specifically analyse how the basic psychological needs were encouraged in undergraduate students, based on SDT or non-SDT research, so to be transferred to the clinical teaching environment. Our proposed review differs in that we intend to rely only on research conducted under the theoretical framework of SDT and to cover the entire horizontal model of SDT (Fig.1), not solely focusing on one aspect of it.

From the above, we concluded that the scoping search was a relevant phase that contributed to enhance the quality of the subsequent phases of the review, and therefore our research question and objectives were maintained unaltered.

2.2 Methods

This section moves on to describe the methods for conducting the review, with details of sources searched, methods for data collection and analysis. The first part deals with setting the scope of the search query in terms of inclusion/exclusion criteria. Following, there is a detailed section describing the sources of information selected and how we reached the final number of papers included. Next, the data analysis phase provides details on how we extracted relevant information, and methods for synthesizing and analysing the data collected.

2.2.1 Setting out the scope of the review

The rationale for the inclusion/exclusion criteria were based on the research question, considering the **PICO** framework (**P**opulation, **I**ntervention, **C**omparison, **O**utcome) (Cook and West, 2012) and are presented in table 2.

Table 2. Inclusion/Exclusion criteria set for the review. Source: Own work.

Inclusion Criteria	Exclusion Criteria
1. Empirical studies on academic motivation from the Self-determination theory perspective, focusing on determinants, mediating factors, or outcomes of academic motivation.	1. Studies not empirical in nature like reviews, view-points, editorials, papers expressing opinion and books.
2. Empirical studies that report research on students or teachers in undergraduate or postgraduate education.	2. Studies on populations other than students or teachers in health professions education.
3. Empirical studies within Health Professions Education.	3. Studies not focusing on motivation from the self-determination theory perspective and not considering determinants, mediating factors, or outcomes of academic motivation.
4. Quantitative research studies with well-formulated definitions, operationalization of concepts and data analysis, including correlational designs.	4. Studies not referring to motivation in undergraduate or postgraduate health professions education.
5. Qualitative research studies with well-defined concepts, reliable methods, well-reasoned conclusions and analysis	5. Studies published before year 1971.
6. Articles available in English, Spanish, and French language.	6. Studies published in Languages other than English, Spanish, or French
7. Studies published from 1971 to 2015.	

In first place, we decided to include all primary research on determinants, mediators, and outcomes of motivation in the HPE field from the SDT perspective. The population included students and teachers either at the undergraduate or postgraduate level. It was decided to include quantitative and qualitative research of acceptable quality (referred to in the following sections). The first publication relating to the concepts of SDT was published in 1971 (Deci, 1971), therefore this was set as the starting date for data inclusion. English is the primary source of published evidence on the topic, but we acknowledge the work that has been conducted in other languages such as Spanish and French. A vast amount of work has been conducted by researchers at the University of Las Palmas de Gran Canarias, Spain, and by the Research Laboratory on Social Behaviour at the University of Quebec at Montreal, Canada. Consequently, and considering the language knowledge of the author and his supervisors, we decided to set a tri-lingual limit to the search.

2.2.2 Data Collection: Search Strategy and Selection of Studies

A comprehensive search was conducted between June-July 2015, including databases, hand search of key journals, grey literature, and additional sources. A flow chart of the search strategy and process to select the final set of articles to be reviewed is presented in Figure 6. A detailed description follows on.

Medline, Embase, CINHAL, PsycINFO, and ERIC databases were searched between 15th and 28th June 2015. As no database is specific for HPE, the use of a combination of key ones is advisable (Haig and Dozier, 2003). Medline, Embase, and CINHAL were chosen because of their relevance in medicine and allied health literature. The decision to include two databases related specifically to medicine (Medline and Embase) was justified on the basis that Medline indexes more North American journals and Embase indexes more European journals, therefore this would provide the desired literature coverage. On the other hand, searching through ERIC and PsycINFO was thought to complement the medical and allied health literature with educational and psychological content respectively, both of which are fundamental topics in this research.

As stated earlier, the three essential subjects for the search query (Fig. 5) were expanded considering the results of the scoping search. The final set of keywords for the general database search are outlined as follows:

- **Concept 1 (words combined with OR): Motivation**

Motivation - Academic Motivation – (intrinsic or extrinsic or controlled or autonomous) motivation – Self-Determination – Self-Determination Theory – Self Regulation – SDT.

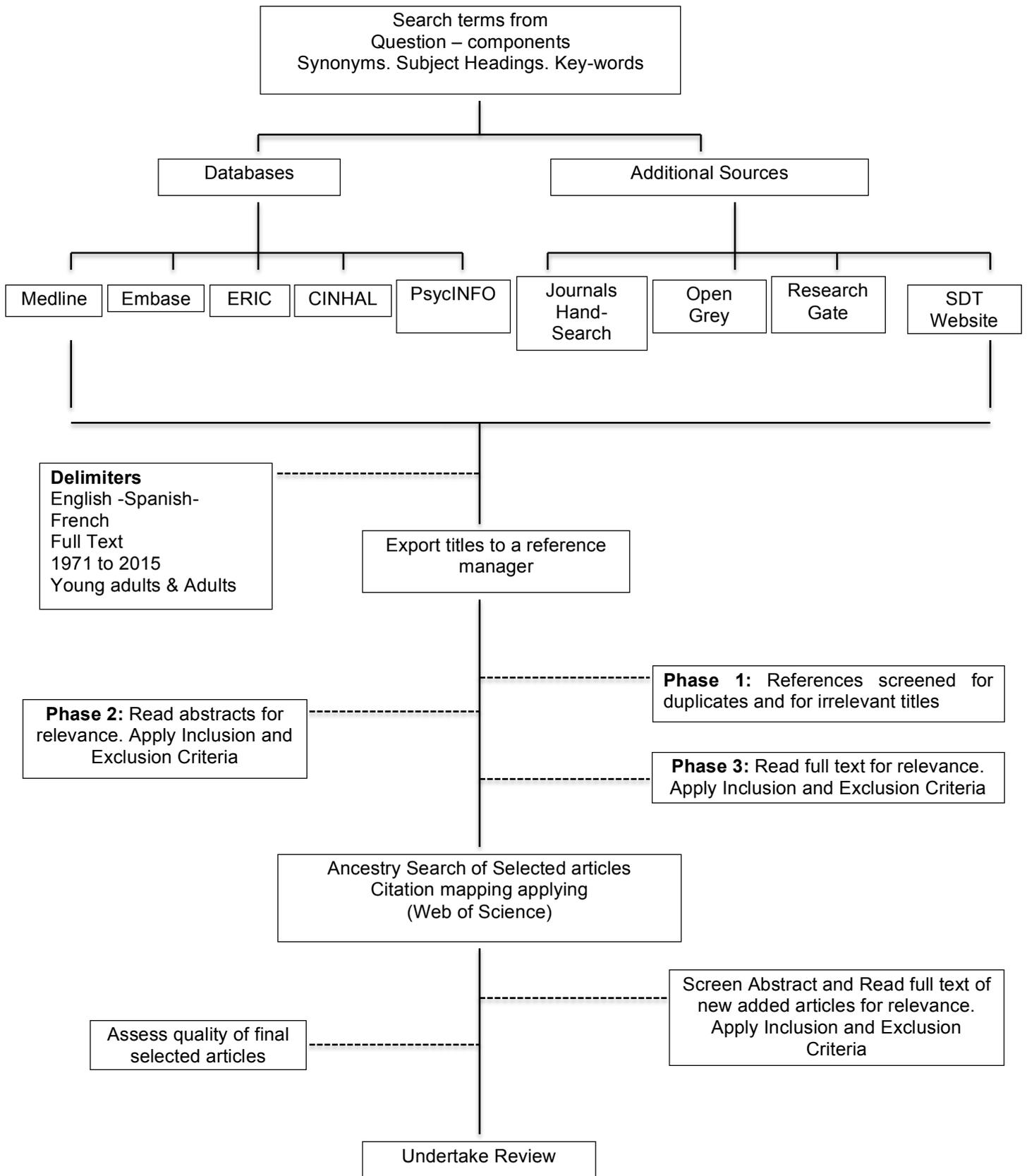
- **Concept 2 (words combined with OR): Determinants, Mediators, and Outcomes**

Determinants – Antecedents – Autonomy Support – Mediators – Mediation – Psychological Mediators – Autonomy – Competence – Relatedness – Outcomes – Consequences – (Cognitive or Behavioural or Affective) (Outcomes or consequences) – Cognition – Behaviour – Affect.

- **Concept 3 (words combined with OR): Health Professions Education**

Student – (Undergraduate or Postgraduate) Student - Higher Education – (Dental or medical or psychology or nursing) (education or student or school) – Education – Health Professions Education – Clinical Teaching – Clinical Teacher.

Figure 6. Flow chart of search strategy. Source: Own work.



Nevertheless, each database has its own indexed subject headings; therefore we had to adapt our keyword combination according to each thesaurus. The search strategy, with the adapted subject headings and free text keywords, with the respective boolean, truncation and proximity combining commands is summarised in Table 3.

While relevant information was thought to be obtained from the database search, previous authors have pointed that a search strategy based solely on databases might retrieve only half of relevant articles in the field (McManus, et al., 1998; Haig and Dozier, 2003). Additionally, Greenhalgh and Peacock (2005) described that, in systematic reviews, 51% of selected articles come from 'snowballing' and 24% are identified by personal knowledge or personal contacts, whereas only 30% come from predefined database search protocols. Therefore, we decided to combine our database search strategy with additional relevant sources.

In first place, we hand-searched relevant journals between 29th June and 11th July 2015 through their printed and/or online versions, and selected articles based on the relevance of their titles. From the search-scoping phase and from personal knowledge of the author and supervisors, the following journals were selected: *European Journal of Dental Education*, *Journal of Dental Education*, *Medical Education*, *Medical Teacher*, *Academic Medicine*, *Advances in Health Science Education*, *Education for Health*, *Motivation and Emotions*, *Journal of Personality*, *Educational and Psychological Measurements*, and *Educational Psychology*.

In second place, and to account for publication bias, we accessed unpublished and grey literature on 15th July 2015 through the 'System for Information on Grey Literature in Europe' (Open Grey, 2015) using the same set of keywords for the general database search.

Finally, between 17th and 30th July 2015 we reviewed the publications of experts in the field. To conduct this in a systematic way, we accessed the publications of key authors through their 'Research Gate' profiles (Researchgate, 2015) and through the publications of the faculty list on the 'Self-determination Theory's Website' (SDT, 2015). A list of the authors whose profiles were reviewed is presented in Appendix II. In total, we scoped through 4079 article titles corresponding to the profiles of 94 researchers. This approach provided a useful way to systematically review SDT-related publications from leading authors and also provided a fast and simple way of contacting them when additional information was required.

Table 3. Search strategy of each selected databases. Note: + or exp= Explode function, * = Truncation, w1 or adj1= Proximity command, MH or DE= Subject heading, mp= Free text search. Source: Own work.

Medline (25 June 2015) Concept 1	- Subject Headings: (MH "Motivation+") OR (MH "Personal Autonomy") - Free text search: Academic motivation OR (intrinsic OR extrinsic OR controlled OR autonomous) w1 motivation OR self w1 determination w1 theory OR self w1 determination OR SDT OR Self w1 regulation
AND	- Subject Headings: (MH "Cognition") OR (MH "Behavior") OR (MH "Emotions+")
Concept 2	- Free text search: Determinants OR Antecedents OR Autonomy w1 Support OR Mediator OR Mediation OR Psychological w1 Mediators OR Autonomy OR Competence OR Relatedness OR Outcome* OR Consequence* OR (Cognitive OR Behavioural OR Affective) w1 (Outcome* OR consequence*)
AND	- Subject Headings: (MH "Education+") OR (MH "Education, Medical, Undergraduate")
Concept 3	- Free text search: 'Postgraduate Student*' OR (Dental OR medical OR psychology OR nursing) w1 (Education OR student OR school) OR Health w1 professions w1 education OR Clinical w1 teach*
Embase (26 June 2015) Concept 1	- Subject Headings: 'exp motivation/' OR 'personal autonomy/' - Free text search: 'Academic motivation.mp' OR '(intrinsic OR extrinsic OR controlled OR autonomous) adj1 motivation.mp' OR 'self adj1 determination adj1 theory.mp' OR 'self adj1 determination.mp' OR 'SDT.mp' OR 'Self adj1 regulation.mp'
AND	- Subject Headings: 'competence/' OR 'cognition/' OR 'behavior/' OR 'exp emotion/'
Concept 2	- Free text search: 'Determinants.mp' OR 'Antecedents.mp' OR 'Autonomy support.mp' OR 'mediator*.mp' OR 'mediation.mp' OR '(psychological adj1 mediator*).mp' OR 'autonomy.mp' OR 'relatedness.mp' OR '(outcome* OR consequence*).mp' OR '(Cognitive OR Behavioural OR Affective) adj1 (Outcome* OR consequence*).mp'
AND	- Subject Headings: 'exp student/' OR 'medical education/' OR 'paramedical education/' OR 'clinical education/' OR 'dental education/' OR 'residency education/' OR 'nursing education.mp'
Concept 3	- Free text search: '(undergraduate OR postgraduate) adj1 student*.mp' OR 'higher education.mp' OR 'psychology education.mp' OR 'Health adj1 professions adj1 education.mp' OR 'clinical adj1 teach*.mp'
CINAHL (26 June 2015) Concept 1	- Subject Headings: (MH "Motivation+") - Free text search: 'Academic motivation' OR (intrinsic OR extrinsic OR controlled OR autonomous) w1 motivation OR self w1 determination w1 theory OR self w1 determination OR SDT OR Self w1 regulation
AND	- Subject Headings: (MH "Autonomy+") OR (MH "Cognition") OR (MH "Behavior") OR (MH "Adolescent Behavior") OR (MH "Affection") OR (MH "Attitude") OR (MH "Emotions+")
Concept 2	- Free text search: Determinants OR Antecedents OR Autonomy w1 Support OR Mediator* OR Mediation OR Psychological w1 Mediator* OR Competence OR Relatedness OR outcome* OR consequence* OR (Cognitive OR Behavioural OR Affective) w1 (Outcome* OR consequence*)
AND	- Subject Headings: (MH "Students") OR (MH "Students, Health Occupations+") OR (MH "Students, Nursing+")
Concept 3	- Free text search: (Undergraduate OR Postgraduate) w1 Student OR (Dental OR medical OR psychology OR nursing) w1 (education OR student OR school) OR Clinical w1 teach*

ERIC (26 June 2015) Concept 1	- Subject Headings: DE "Motivation" OR DE "Achievement Need" OR DE "Learning Motivation" OR DE "Reading Motivation" OR DE "Self Motivation" OR DE "Student Motivation" OR DE "Teacher Motivation" OR DE "Self Determination" OR DE "Personal Autonomy" - Free text search: Academic Motivation OR (intrinsic OR extrinsic OR controlled OR autonomous) w1 motivation OR 'Self w1 determination w1 theory' OR 'SDT'.
AND	- Subject Headings: DE "Competence" OR DE "Cognitive Measurement" OR DE "Behavior" OR DE "Affective Behavior" OR DE "Student Behavior" OR DE "Psychological Needs"
Concept 2	- Free text search: determinants OR antecedents OR Autonomy w1 Support OR Mediator* OR Mediation OR Psychological w1 Mediator* OR autonomy OR relatedness OR Outcome* OR Consequence* OR (Cognitive OR Behavioural OR Affective) w1 (Outcome* OR consequence*) OR cognition
AND	- Subject Headings: DE "Allied Health Occupations Education" OR DE "Undergraduate Students" OR DE "Premedical Students" OR DE "Graduate Medical Education" OR DE "Graduate Students" OR DE "Medical Education" OR DE "Nursing Education" OR DE "Pharmaceutical Education" OR DE "Veterinary Medical Education" OR DE "Clinical Teaching (Health Professions)" OR DE "Dental Schools" OR DE "Medical Schools" OR DE "Medical Students"
Concept 3	- Free text search: '(Dental OR psychology) w1 (education OR student*)'
PsycINFO (26 June 2015) Concept 1	- Subject Headings: DE "Motivation" OR DE "Educational Incentives" OR DE "Extrinsic Motivation" OR DE "Hunger" OR DE "Incentives" OR DE "Intrinsic Motivation" OR DE "Thirst" OR DE "Academic Achievement Motivation" OR DE "Self Determination" - Free text search: (intrinsic OR extrinsic OR controlled OR autonomous) w1 motivation OR Self w1 determination w1 theory' OR SDT
AND	- Subject Headings: DE "Psychological Needs" OR DE "Need Satisfaction" OR DE "Competence" OR DE "Cognition" OR DE "Behavior" OR DE "Affection"
Concept 2	- Free text search: determinants OR antecedents OR Autonomy w1 Support OR Mediator* OR Mediation OR Psychological w1 Mediator* OR autonomy OR relatedness OR Outcome* OR Consequence* OR (Cognitive OR Behavioural OR Affective) w1 (Outcome* OR consequence*)
AND	- Subject Headings: DE "Undergraduate Education" OR DE "Students" OR DE "Dental Students" OR DE "Medical Students" OR DE "Postgraduate Students" OR DE "Medical Education" OR DE "Nursing Education" OR DE "Dental Education" OR DE "Psychology Education"
Concept 3	- Free text search: Health w1 professions w1 education OR Clinical w1 teach*

All retrieved articles were exported to the reference manager Mendeley® for article selection procedures. This stage was divided in three phases (Figure 6). In phase one, duplicates and all articles with irrelevant titles and keywords were removed. In phase two, applying the inclusion/exclusion criteria, the abstracts of the remaining articles were reviewed. Whenever there was doubt on the exclusion of a particular article, it was advanced to phase three so it could be assessed based on the full text rather than on the abstract. Therefore, in phase three, the full text of each article was screened applying the inclusion/exclusion criteria and a final decision was made. Subsequently, applying the same three phases, an ancestry search of the selected articles' references was conducted through the Web of Science. This systematic approach to select the articles was thought to enhance the transparency of the review process and it was quality assured by the first and second supervisor.

2.2.2.1 Quality Appraisal

The next step was focused on defining quality criteria for inclusion of the selected papers in the data synthesis. We expected a mixture of qualitative and quantitative papers to emerge and although there is a growing body of literature on techniques for combining different types of evidence in systematic reviews, this evolution is very much a work in progress with no established consensus on how to assess quality (Dixon-Woods, et al., 2005; Harden, et al., 2004). Therefore we opted for a semi-structured analysis based on the “*Questions to ask of research or evaluation evidence*” published in the first BEME Guide (Harden, et al., 1999).

This tool has 17 items aimed at analysing the quality of different areas of a research paper with two questions asked in a negative voice. We reversed the latter for positive voice, and included studies for which we could agree on the answer “yes” to the items of the modified version of the instrument (Table 4). To be more specific, more than one “No” excluded the study immediately, and if a single “No” was reported, further discussion was planned amongst the author and supervisors to decide whether this should prohibit the inclusion of the study or not.

After experimenting with other critical appraisal tools, such as the ‘Critical Appraisal Skills Programme’ checklists (Singh, 2013), which are more focused on clinical research and do not report checklists on observational cross sectional studies (a very common methodology to adopt in health professions educational research), we decided to rely on the BEME quality

appraisal instrument, as it is applicable to several methodologies. Another reason to adopt this approach was that it does not rely on a single score or in an overall rating to assess the studies, which may lead to an unnecessary simplification of an innately complex and multifaceted issue, with the only advantage of an imaginary clarity of the process (Dixon-Woods, et al., 2007). Instead, showing the items for each study in a single table with explicit “No” answers to indicate areas of concern and reasons for exclusion from the final review, offers a clear and easily understandable method of presenting such complex data.

Table 4. Quality Appraisal guide for selected studies. Source: Adapted from Harden, et al., 1999.

Area	Questions	Yes	No
Background	Is the research free of theoretical views already held by the authors?		
	If the evidence is based on cited papers, are those papers researched based rather than theory only?		
	Are the researchers independent?		
Sample	Is it large enough for the purpose?		
	Is it pertinent enough for the purpose?		
	Is there a reasonable response rate?		
	Is the sample unbiased?		
Data collection	Do you know how the data were collected?		
	Is the data collection instrument properly described?		
	Was the data collection instrument properly developed and piloted or tested?		
Data analysis	Is the way the data were analysed properly described <i>so that you could do it in the same way?</i>		
Validity, reliability and generalizability	Did the study try to establish the validity of the data and findings?		
	Did the study try to establish the reliability of the data and findings?		
	Is the likely generalizability of the study discussed?		
Conclusions	Are the conclusions reached actually borne out by the data?		
	Do the recommendations actually follow on from the findings?		
	Does the research justify the conclusions? E.g., small numbers in a qualitative study should not merit general conclusions for action.		

2.2.3 Data Analysis.

After defining the process by which the final number of papers were selected, we turn now to describe how we analysed the emerged data. We were unable to combine the results in a meta-analysis due to methodological heterogeneity i.e., when specific approaches of the studies in question differ, such as in the outcome measures used, time of assessment or basic study design (Sharma, et al., 2014). Nevertheless, it has to be said that conducting a meta-analysis was never thought to be the objective of this review, mainly because our inclusion criteria permitted the integration of data coming from quantitative and qualitative

research, and because the quantitative research in this area mostly comes from cross-sectional studies using diverse measures and diverse research designs. Therefore we approached the data analysis mainly as a narrative synthesis through a thematic analysis (Dixon-Woods, et al., 2005) in a way to make possible to combine the different types of studies included.

This section is divided in two, beginning with a description of how data were extracted and secondly on how it were synthesised and analysed.

2.2.3.1 Data extraction

In order to extract and analyse the data in a systematic way, we used the Nvivo® 10 software (QSR International, Doncaster, Australia), designed originally for the analysis of qualitative or mixed research.

Within the Nvivo® environment, we analysed each paper and initially created two major themes concerning methods and outcomes. As we extracted the relevant information, each step of this process was registered in an analytical journal, which detailed problems and solutions, coding rationale, ideas, meanings and memos. This analytical journal was also used during the data synthesis and analysis phase. The objective of doing so was to use the reflections gathered to additionally inform the result and discussion sections.

As we extracted data of methods and findings, we developed a data extraction form (presented as table 6 in the findings section), which contained information for each study about the authors and country setting, research objectives, type of study, sample, methods of data collection and analysis, and selected findings and comments relevant to the research question. Providing such detailed and transparent information to the readers, was thought to help them verify and interpret the results and reach their own conclusions (Cook and West, 2012).

2.2.3.2 Data Synthesis and analysis

As mentioned earlier, we opted for a thematic analysis as a way to synthesise and analyse the extracted data. This method facilitates the translation of concepts between studies by identifying prominent and recurrent themes and summarising the findings of different studies under recurrent headings, therefore allowing the integration of qualitative

and quantitative evidence (Thomas and Harden, 2008; Dixon-Woods, et al., 2005). Additionally, Cook and West (2012) postulate that when having qualitative or mixed data sets, the use of techniques such as thematic analysis, which are mostly used in primary research, may be a useful way to allow the data captured to be clarified and interpreted.

The unit of analysis for the synthesis of findings was focused on the identification and establishment of relations between determinants, mediators and educational outcomes of motivation base on the SDT framework. Nevertheless, we also coded information on methods to complement the information provided in the extraction form.

We organised the synthesis and analysis of data in three phases (Creswell, 2003). The first phase was an open coding stage mainly aimed at reducing the data and extracting the essential ideas (Miles and Huberman, 1994). It was based on constant comparison, resulting in the grouping of segments into different categories. Multiple cycles of coding and constant comparison were conducted, reflecting, clarifying, and renaming categories.

The second phase was a central coding stage, which aimed to combine and relate different categories amongst each other and to group them in themes and subthemes.

The third phase was an interpretative stage in which we reflected about the descriptions of the different categories and themes, their meanings, and the relations amongst them. The aim of this phase was to draw conclusions and explain the findings. A discussion meeting between the author and his supervisors permitted crosscheck agreement on the emerged information. Finally, and attempting to make sense and integrate the extracted data, the most relevant themes were identified and grouped (presented as Figure 8 in the findings section).

2.3 Findings

Electronic and additional source searches identified 2966 references. Of these, 1967 were identified through database search and 999 were identified through additional sources. Table 5 details the specific source, search interface through which they were accessed and number of articles retrieved. When duplicates were removed 2436 articles were kept, and after irrelevant titles were deleted, 385 papers were advanced forward for abstract screening and later full-text assessment applying the inclusion/exclusion criteria. Of these, 17 met the eligibility criteria. Articles were excluded in the abstract screening stage mainly because they were based on other populations, were not referring to motivation or to SDT and were not empirical in nature.

Subsequently we revised all references from the selected papers through the website of the Web of Science. A total number of 570 titles were screened. After deleting duplicates and irrelevant titles, 8 articles were advanced for abstract inspection. No new articles were found after applying the inclusion/exclusion criteria, as 6 articles were referring to motivation but not from the SDT perspectives and 2 were written in other languages (Korean and Japanese).

Afterwards, the 17 selected papers were inspected for quality purposes. On the one hand, 10 papers were assigned with a 'Yes' to all of the items of the quality assessment instrument (Table 4), and on the other hand, 7 articles presented a single "NO". The latter, specifically in the items referred to sample bias and response rate. Consequently, these papers were analysed in a meeting together with the author's supervisors to decide whether this unique source of bias would constrain them for inclusion in the final review. Appendix III details the full list of papers and their assessment on the 17 items of the appraisal instrument.

For the papers questioned in the item of sample bias: the first (Kusurkar, Croiset and ten Cate, 2013) aimed to analyse medical students motivation profiles based on gender distribution with a sample that comprised 68 females and 27 males. The results showed more positive results for females, but was this biased by the sample distribution and selection? The answer is that we actually do not know, and perhaps, this distribution reflects that overall student distribution in this particular medical school. This, added to the fact that the literature mostly agrees that females show more self-determined profiles than men (Vallerand and Bissonnette, 1992; Nunez, Martin-Albo and Navarro, 2004), made us conclude that it was not a source of threat that would justify the exclusion of the article from the review.

Table 5. Specific source, search interface and number of papers retrieved. Source: Own work.

	Search Interface	Articles retrieved
<i>1. Database search</i>		
Medline	EBSCO	907
Embase	OVID (Embase 1947-Present, updated daily)	733
CINHAL	EBSCO	48
ERIC	EBSCO	197
PsycINFO	EBSCO	82
<i>2. Journal Search</i>		
European Journal of Dental Education	Wiley Online Library	37
Journal of Dental Education	www.jdentaled.org	56
Medical Education	Wiley Online Library	129
Medical Teacher	Taylor & Francis Online	59
Advances in Health Science Education	Springer Journals	43
Motivation and Emotions	Wiley Online Library	31
Journal of Personality	Wiley Online Library	163
Educational and Psychological Measurements	SAGE Journals	42
Educational Psychology	Taylor & Francis Online	39
Education for Health	www.educationforhealth.net	14
Academic Medicine	Lippincott, Williams and Wilkins	22
<i>3. Grey Literature</i>		
Open Grey	www.opengrey.eu	179
<i>4. Free search of Key Author's profiles</i>		
Research Gate	www.researchgate.net	28
SDT's website Faculty list	www.selfdeterminationtheory.org	157

The second (Tanaka, et al., 2009) and third paper (Tanaka and Watanabea, 2011) came both from the same research group and with a similar objective, aiming at analysing how personality traits and family and academic conditions influence medical students' academic motivation. The source of bias detected was once again in their sample selection. The authors, without citing evidence, deliberately excluded all students having any form of mental or physical condition, as it could act as confounding factor (e.g., depression, gastric ulcer, irritable bowel syndrome, bronchial asthma, atopic dermatitis and seasonal allergic rhinitis). We believe that excluding students based on conditions that may affect anyone and that do not impair their judgment, was unjustified and it rather seems to be an attempt of getting responses only from the 'appropriate' students. Nevertheless, and because of the relevance of their results, we decided that this was not enough reason for them to be discarded based on quality reasons.

For the four papers that were questioned in the item of response rate, we predefined a cut-off point of 60% to be considered as low risk (Fincham, 2008). The first paper had a response rate of 55% (Williams, et al., 1997), this was close to the cut-off point and therefore we decided to include the study in the final review. The remaining three papers had a response rate of 42% (Kusurkar, et al., 2013b), 36.2% (Kusurkar, et al., 2011b) and 26.6% (Kusurkar et al., 2013a), which might represent a possible threat to the study's internal validity. Despite this, we took in consideration that their data was collected through electronic surveys, in which response rates can be considerably lower than face-to-face and paper-based surveys, being as low as 20-30% (Cohen, Manion and Morrison, 2013). Consequently, we decided to include them in the final review and interpret their results with caution.

Finally, these 17 papers met the eligibility criteria and were rated as good evidence. Figure 7 presents a flow chart summarising the review process, indicating the number of articles reviewed and retained at each stage. We will now move on to discuss the findings from these papers. First we present a critical appraisal on the methodological aspects, and secondly, a critical appraisal of the findings relating to determinants, mediators and outcomes of motivation in health professions education. Table 6 provides a summary of the key findings from the articles reviewed.

2.3.1 Analysis of Methods

All selected studies stated clear objectives and were found to be relevant for the study of self-determined motivation in health professions education. Reports came from different latitudes and from different cultures, i.e., North and South America, Europe, Asia and Australia, thus providing evidence of the relevance of the topic for different health professions education settings. In terms of the specific subjects, the majority of the research has been dedicated to explore motivation in medical education, and to a lesser extent in dental (Orsini, et al., 2015a; b) and psychology education (Stoeber, et al., 2011; Bailey and Phillips, 2016; Baker, 2004).

The majority of papers were based on a quantitative approach, relying on cross-sectional data collection strategies with correlational or psychometric designs. Two studies incorporated longitudinal methods based on panel group designs (Williams and Deci, 1996a; Sobral, 2004), i.e., changes collected in the same group of students over time (Creswell, 2002), and two studies adopted a qualitative phenomenological approach (Orsini, et al., 2015b; Wouters, et al., 2014).

Figure 7. Flow chart summarising the review process with number of articles reviewed and retained at each stage. Source: Adapted from the PRISMA statement, Liberati, et al., 2009.

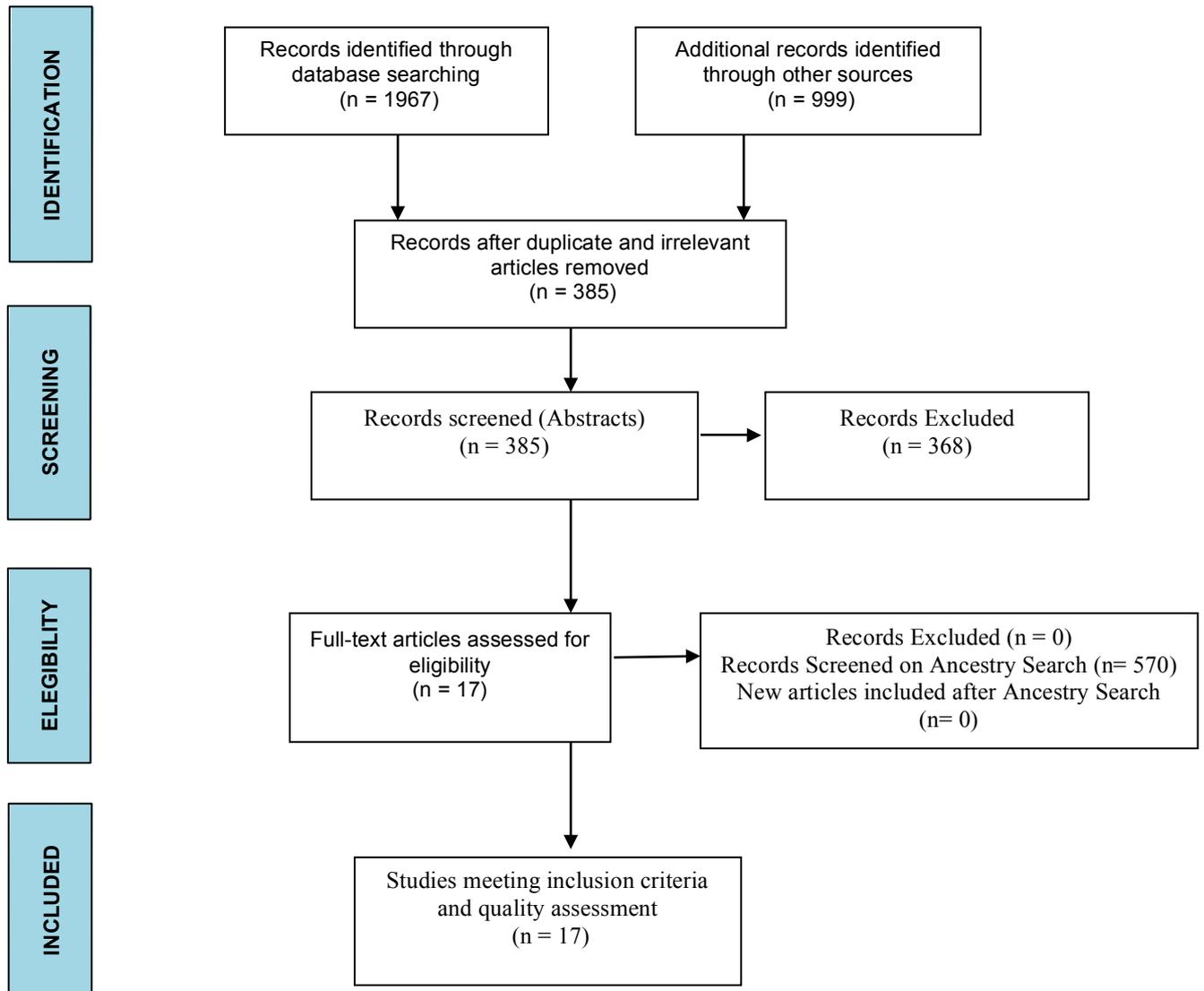


Table 6. Summary of key findings from research papers included in the review. Source: Own work.

Author(s) (year, country)	Research Topics	Type of study	Sample	Data collection method	Data analysis method	Selected findings & comments on Determinants, Mediators and/or Outcomes of Self-determined Motivation
Bailey & Phillips (2016, Australia)	Explore relationships between motivation, university adaptation, wellbeing, and academic performance	Cross-sectional correlational	184 first-year psychology students, 73% females, mean age 19.3	Self-report of demographics, academic performance, AMS, Student Adaptation to College Questionnaire, the anxiety and depression subscales of General Health Questionnaire, Meaning in Life Questionnaire, Satisfaction With Life Scale and Positive And Negative Affect Schedule	Correlations and hierarchical regression	Outcomes: Intrinsic Motivation was positively associated with wellbeing, meaning in life, positive emotions and academic performance, and negatively associated with negative emotions. Amotivation had the reverse pattern. Introjected Regulation showed a positive association with positive emotions and with anxiety. Motivational orientations predicted wellbeing, mental health and academic performance.
Baker (2004, UK)	Examine relations between motivation and adjustment to university, stress, well-being and academic performance	Cross-sectional correlational	91 second-year psychology students, 78% females, mean age 19.5	Self-report of demographics, academic performance, AMS, College Adaptation Questionnaire, General Health Questionnaire and Perceived Stress Scale	Correlations and hierarchical regression	Outcomes: Controlling for gender and age, amotivation led to worse psychosocial adjustment to university, higher levels of perceived stress, and greater psychological ill being. Intrinsic motivation (to know) was associated with lower levels of stress. Neither extrinsic nor intrinsic motivation, nor amotivation were related to academic achievement.
Kusurkar et al (2011b, The Netherlands)	Validity of the Strength of Motivation for Medical School questionnaire	Cross-sectional Psychometric	1,494 medical students from two Universities, 72% females	Self-report of demographics, Strength of Motivation for Medical School Questionnaire, AMS and exhaustion subscale of Maslach Burnout Inventory	Correlations, group differences and exploratory factor analysis	Determinants: Overall Strength of Motivation and its subscales of willingness to sacrifice, readiness to start and persistence correlations were positively correlated with autonomous motivation, and it decreased and became negative as moving towards controlled motivation and amotivation.
Kusurkar et al (2013a, The Netherlands)	Explore relationships between motivation, study strategy, effort and academic performance by gender and method of admission	Cross-sectional correlational	383 second-to-six year medical students, 72% females, mean age 23.3	Method of admission and academic performance provided by University. Self-report of demographics, Study Effort, AMS and Revised Study Process Questionnaire	Correlations, regression, group differences and structured equation modelling	Outcomes: Relative autonomous motivation was positively associated with good study strategy, which was positively associated with high study effort and better performance. Females and qualitative selection procedures showed a higher self-determined profile.
Kusurkar et al (2013, The Netherlands)	Implications of gender on motivation, performance, learning approaches, exhaustion, autonomy support and perceived competence	Cross-sectional correlational	95 fourth year medical students, 71.5% females	Academic Performance provided by University. Self-report of demographics, AMS, Revised Study Process Questionnaire, Maslach Burnout Inventory, Learning Climate Questionnaire and Perceived Competence Questionnaire	Group differences	Determinants: Males reported higher Controlled Motivation and higher Perceived Competence even when reporting higher surface learning strategy, lower deep learning strategy and lower or equal performance.
Kusurkar et al (2013b, The Netherlands)	Generate motivational profiles and test associations with different outcomes	Quantitative, Cross-sectional correlational	844 year one-to-six medical students, 71.5% females	Academic performance provided by University. Self-report of demographics, AMS, study hours per week, Study Process Questionnaire and exhaustion subscale of Maslach Burnout Inventory	Correlations, K-cluster, analysis of variance and multivariate analysis of covariance	Outcomes: High Intrinsic Low Controlled motivation was associated with good study hours, deep learning strategy, good academic performance and low exhaustion. High Intrinsic High Controlled motivation was associated with a good learning profile, except showing high surface strategy. Low Intrinsic High Controlled and Low Intrinsic Low Controlled motivation were associated with least desirable learning behaviours.

Author(s) (year, country)	Research Topics	Type of study	Sample	Data collection method	Data analysis method	Selected findings & comments on Determinants, Mediators and/or Outcomes of Self-determined Motivation
Orsini et al (2015b, Chile)	Understand how clinical teachers encourage intrinsic motivation	Phenomenology	9 clinical teachers, 7 males, mean age of teaching experience 15	Self-reported demographics and Semi-structured interviews on how teachers supported students' needs for autonomy, competence, and relatedness	Thematic analysis	Determinants: Teachers emphasise the influence that the learning climate has on students' intrinsic motivation, stressing the relevance of empowering, supporting and building a horizontal relationship. Themes included: transference of responsibility; personal interests; constructive feedback; vicarious learning experience; teamwork, and safe environment.
Orsini et al (2015a, Chile)	Validity of the AMS in a dental students sample	Cross-sectional Psychometric	989 year one-to-six dental students, 62% females, mean age 22.5	Academic performance provided by University. Self-report of demographics, AMS, deep and surface motives subscales of Revised Study Process Questionnaire, academic subscale of abbreviated Five-Factor Self-Concept Questionnaire and Positive Subscale of Positive and Negative Affect Schedule	Confirmatory factor analysis, correlations and group differences	Determinants: Third and fourth years showed the highest amotivation scores. Outcomes: Intrinsic and identified regulation showed positive correlations with deep motives, academic self-concept and positive affect, and negative correlation with surface motives. Amotivation showed the reverse pattern.
Park et al, (2012, Republic of Korea)	Examine relationships between stress, motivation, personality, academic performance, and depression	Cross-sectional correlational	160 first year medical students, 72.5% males	Academic performance provided by University. Self-report of demographics, AMS, Medical Stress Scale, Personality Inventory, Beck Depression Inventory and Hamilton Depression Scale	Correlations, group difference, regression and path analyses	Determinants: Psychopathology was negatively correlated with self-determined motivation. Outcomes: Self-determined motivation was positively associated with performance and negatively associated with depression. Stress was positively correlated with amotivation and identified regulation and negatively correlated with intrinsic motivation and with external regulation
Sobral (2004, Brazil)	Describe medical students' motivation relationships with different learning outcomes	Cross-sectional correlational with a longitudinal panel design component	297 Second year medical students, 57% males, mean age 20.4	Academic performance provided by University. Self-report of demographics, AMS, Reflection-in-Learning Scale, Approaches to Studying Inventory, 4 semesters follow up on peer tutoring activity and intention to continue studies	Correlations, K-cluster and group differences	Outcomes: Autonomous motivation was associated with higher levels of meaning orientation, reflection in learning, academic achievement, cross-year peer-tutoring, and intention to continue with studies, and had negative relationship with reproductive orientation to learning. Amotivation showed the reverse pattern and Controlled Motivation was positively related to reproductive orientation.
Stoeber et al (2011, UK)	Investigate relationships between passion for studying, academic engagement, burnout and motivation	Cross-sectional correlational	103 second-year psychology students, 89% females, mean age 20	Self-report of demographics, Passion Scale, Utrecht Work Engagement Scale-Student, Maslach Burnout Inventory and Sheldon's idiographic method for motivational analysis	Correlations, multiple analysis of variance, multiple regression	Outcomes: Autonomous motivation showed positive association with harmonious passion and engagement for studying, and negative significant association with burnout. Controlled motivation showed the reverse pattern.
Tanaka et al (2009, Japan)	Examine relationships between personality traits and intrinsic motivation	Cross-sectional correlational	119 Second year medical students, 70% males, mean age 20.5	Self-report of demographics, Temperament and Character Inventory and Intrinsic Motivation Scale Toward Learning.	Regression analyses	Determinants: On simple regression, persistence, self-directedness, cooperativeness and self-transcendence were positively associated with intrinsic motivation. On multiple regressions, adjusted for age and gender, persistence, self-directedness and self-transcendence were positively associated with intrinsic motivation.

Author(s) (year, country)	Research Topics	Type of study	Sample	Data collection method	Data analysis method	Selected findings & comments on Determinants, Mediators and/or Outcomes of Self-determined Motivation
Tanaka et al (2011, Japan)	Examine relationships between academic and family conditions and intrinsic motivation	Cross-sectional correlational	120 Second year medical students, 69% females, mean age 20.5	Self-report of demographics, lifestyle, family and academic conditions and Intrinsic Motivation Scale Toward Learning.	Regression analyses	Determinants: Spending time with family, taking pleasure in school and learning, understanding lectures and attending school regularly, were positively associated with intrinsic motivation.
Williams & Deci (1996a, USA)	Exploration of SDT in students' adoption of psychosocial values and an autonomy-supportive style in patient interviewing skills	Longitudinal-panel design	Study 1: 91 second-year medical students Study 2: 56 second-year medical students and course instructors	<i>Data collection:</i> Two times over 24 weeks on study 1 and five times on study 2 (three within the course, after 6 months and after 2 years) <i>Instruments:</i> Self –report of demographics, Physician Psychosocial Belief Scale, General Causality Orientations Scale, Learning Climate Questionnaire, Learning Self-Regulation Questionnaire, Interviewing Competence Scale. Instructors' psychosocial beliefs and Health-Care Climate Questionnaire	Correlations and regression analyses	Determinants, mediators and outcomes: Positive relations between autonomous motivation, psychosocial beliefs, and perceived competence at interviewing before starting the course; perceived autonomy supportiveness of instructors promoted autonomous motivation, perceived competence, psychosocial beliefs, and behaving more autonomy-supportive with simulated patients. Increased relative autonomy mediated relations between instructors' autonomy support and the enhancement of psychosocial values and perceived competence.
Williams et al (1994, USA)	Compare effects of 'facilitating students' interest' versus 'controlling students learning' during internal medicine clerkship	Cross-sectional correlational	89 fourth year medical students at two Universities	Self-report of demographics, Modified Learning Climate Questionnaire, Competence in Internal Medicine Scale, Interest in Internal Medicine Scale, Pressure, Tension Scale, Internal Medicine Career Choice and prior likelihood for career choice	Correlations, and structured equation modelling	Determinants, Mediators and Outcomes: An autonomy supportive learning climate predicted increased perceived competence and interest, which in turn predicted specialty choice. Conversely, a controlling learning climate did not predict perceived competence or interest.
Williams et al (1997, USA)	Examine relationships between autonomy-support, perceived competence, interest, prior likelihood and choosing internal medicine or surgery as a career	Cross-sectional correlational	210 fourth year medical students at three Universities, 61% males, mean age 27.4	Self-report of demographics, Modified Learning Climate Questionnaire, Competence in Internal Medicine and surgery Scale, Interest in Internal Medicine Scale, Internal Medicine and surgery Career Choice and prior likelihood for career choice	Correlations, multiple regression and structured equation modelling	Determinants, Mediators and Outcomes: Perceived autonomy support predicted students' choices of internal medicine or surgery, even after the effects of prior (and actual) likelihood had been removed. The relationship between perceived autonomy support and career choice was mediated by perceived competence and interest.
Wouters et al (2014, The Netherlands)	Investigate type of motivation and differences between selected and non-selected applicants of medical school.	Phenomenology	96 applicants, 72% females, mean age 23	Document Review of motivation statements	Thematic and content analysis, and frequency and group comparison	Determinants: Selected and non-selected applicants did not differ in types of motivation, reporting mainly autonomous motivation for applying. Findings raise questions on the validity and reliability of the statement on motivation as a tool for selection.

A large number of the studies adopting a cross-sectional design declared this as one of their limitations (Bailey and Phillips, 2016; Park et al., 2012; Stoeber et al., 2011; Tanaka and Watanabea, 2011; Tanaka et al., 2009; Williams et al., 1994, 1997; Baker, 2004). They argued that, while relevant data emerged, it was not possible to infer causal relationships between motivational determinants and outcomes. Therefore the findings of regression and path analyses were taken as hypothetical and could not be interpreted in a temporal sense.

With regards to participants, all studies included convenience undergraduate student samples, which in most cases involved accessing and inviting the entire aimed population to participate. There were two exceptions: the first involved a purposive sample of dental clinical teachers (Orsini, et al., 2015b) and the second incorporated medical teachers in addition to a student sample (Williams and Deci, 1996a). Selected studies reported neither sampling calculations nor power analyses. Students were not rewarded for their participation, except in one study where they obtained extra credit in return (Bailey and Phillips, 2016). The mean age of participants was within the parameters of traditional undergraduate students (min: 19.3 max: 27.4). Sample sizes ranged from medium to large (min: 56 max: 1,494), including one or multiple years of study, depending on the objectives of the study.

In quantitative studies, sample sizes were large enough to find differences, however the low response rates reported (i.e., 60% or less) discussed earlier represented a limitation in four studies (Williams et al., 1997; Kusurkar et al., 2011b, 2013b; a). This might have attempted against the representativeness of the sample and could have potentially introduced response bias. All other studies reported more than 60% response rates, which represented strength to their internal validity.

Several studies also reported a skewed gender distribution towards females and the arbitrary exclusion of a group of students with medical illnesses not associated with judgment impairment (discussed in section 2.3) that could be considered as another source of response bias (Wouters et al., 2014; Tanaka and Watanabea, 2011; Stoeber et al., 2011; Orsini et al., 2015a; Kusurkar et al., 2011b, 2013a; Kusurkar, Croiset and ten Cate, 2013; Kusurkar et al., 2013b; Bailey and Phillips, 2016; Baker, 2004; Tanaka et al., 2009). This left a degree of uncertainty whether findings were representative of male students. Further research should aim, for instance, at a more balanced gender representation.

Four studies followed a multiple centre design (Williams et al., 1997; Williams and Deci, 1996a; Williams et al., 1994; Kusurkar et al., 2011b), however most studies were single-sited. Consequently, the possibility to generalise results to wider populations cannot be

assumed. Large numbers of subjects from different educational institutions are essential if results are to be generalizable amongst diverse populations, however, it has to be said that much of the research in healthcare education continues to be single-sited (Cleland, 2015).

With regards to ethical principles, the majority of the studies, followed the principles of the Declaration of Helsinki (World Medical Association, 2002), thus obtaining approval from their institution's ethics review committees, and followed the principles of the Belmont Report (National Institutes of Health, 1979) of respecting participants' autonomy, beneficence, and justice.

The majority of the reported quantitative data collection were based on self-reported instruments, which had been used on earlier research and have demonstrated good psychometric properties and reported scores that followed similar results across different samples. There were two exceptions where the authors' aimed at validating instruments (Kusurkar et al., 2011b; Orsini et al., 2015a), nevertheless, these showed high validity and reliability scores and were therefore considered as valuable evidence. This would suggest that the use of these self-reported instruments probably introduced very little bias effect

Most instruments were presented in the students' native language, and at the same time, in two articles the authors undertook a face validation phase to account for linguistic differences that might have lead to misunderstandings (e.g., original instrument in Spanish and English, but being applied in a Chilean-Spanish and in an Australian-English speaking sample, respectively) (Orsini et al., 2015a; Bailey and Phillips, 2016).

It is also worth noting that the majority of the studies measured quality types of motivation based on the AMS (Orsini et al., 2015a; Kusurkar et al., 2011b, 2013a; b; Kusurkar, Croiset and ten Cate, 2013; Bailey and Phillips, 2016; Sobral, 2004; Park et al., 2012; Baker, 2004), which was described in detail in section 1.2.2. As it was pointed out in the aforementioned section, the combination of the different subscales of the AMS to compute a self-determination index has been a common strategy when needing to incorporate these variables in complex statistical models. The reviewed studies were no exception to this. Williams and Deci (1996a) computed a 'Relative Autonomy Index' based on the 'Learning Self-Regulation Questionnaire', by subtracting the controlled motivation subscale score from the autonomous motivation subscale score. Following from this, the study of Kusurkar et al., (2013a) tested structured equation model weighting the scores of the AMS subscales into a 'Relative Autonomous Motivation score'.

Four studies did not use the AMS to measure motivation and relied on different instruments, however, they all showed certain limitations. The first study used self-generated goals as units for the analysis of motivation, i.e., writing two personal goals to be achieved by studying psychology and then rating them with respect to intrinsic, identified, introjected, and external reasons with a 7-point Likert scale. The reliability of this measure was only marginally acceptable and therefore the authors recommended that future research should use conventional questionnaires of self-determined motivation with standard items, such as the AMS (Stoeber, et al., 2011).

The second and third study used the Japanese 'Intrinsic Motivation Scale Toward Learning', which had the limitation of being aimed at primary and junior high school students instead of at higher education students (Tanaka, et al., 2009; Tanaka and Watanabe, 2011). The authors suggested the development or use of a scale aimed at higher education students in future research.

Finally, the fourth study relied on the 'General Causality Orientations Scale' (Table 1), however this instrument measures motivation at a general level and across different contexts instead of focusing on the educational context (Williams and Deci, 1996a). Despite this, the authors also used the 'Learning Self-Regulated Questionnaire', which measures controlled and autonomous reason for engaging in academic activities.

In terms of data analysis, the selection of different statistical tests was well justified by the study's hypothesis or research question. Most of the studies were attempting to test correlations between variables, assessing the influence of predictor variables over outcome variables, and to test their direct and indirect relations. These were tested mainly by means of Pearson correlation tests, regressions analyses and structured equation modelling. When additional objectives were to compare group differences, authors mostly used independent t-tests or analyses of variance, depending on the number of variables and the number of categories within them. It is important to highlight that, despite reporting p-values and the test statistics, only two studies reported confidence intervals and/or effect sizes (Orsini, et al., 2015a; Kusrkar, et al., 2013b)

With regards to the two qualitative studies included (Orsini, et al., 2015b; Wouters, et al., 2014), both clearly stated how data were collected and made the methods explicit. The use of semi-structured interviews with clinical teachers on how they encouraged students' intrinsic motivation (Orsini, et al., 2015b) and the review of applicants motivation statements to study medicine (Wouters, et al., 2014), were in alignment and justified by the research

objectives (Table 6). Data collection and analysis were conducted as iterative phases, relied on multiple researchers to analyse and code the data, and collected data until a saturation point was reached. Thematic and content analyses were reported with an in-depth description of the process, making clear how the categories/themes were derived from the data. Moreover, sufficient data were presented to support the findings, including contradictory ones and taking into account the potential limitations of the role of the researchers on selecting and analysing the data. All of these contributed to enhance credibility and dependability, and allowed for future replication.

This section has described the research methods of included studies, what follows is a description of the main findings.

2.3.2 Analysis of Findings

This section first describes students' overall motivation orientation, moving afterwards to analyse determinants, mediators and outcome variables and how they affect and are affected by students' self-determined motivation. Figure 8 presents a summary of the identified variables and their relationship with motivation.

2.3.2.1 Students' Motivation orientation

Students reported a mix of autonomous and controlled reasons for studying, thus supporting the idea that internal and external sources of motivation play an important role in students' engagement in academic activities (Orsini et al., 2015a; Kusrkar et al., 2013b; Williams and Deci, 1996a; Sobral, 2004). Nevertheless, their primary reason for attending university was driven by autonomous motivation specifically by identified regulation first, followed by the subtypes of intrinsic motivation, and subsequently by the external and introjected forms of controlled motivation, and being amotivation the least endorsed form (Williams and Deci, 1996a; Stoeber et al., 2011; Kusrkar et al., 2013b; Baker, 2004; Orsini et al., 2015a; Sobral, 2004).

Moreover, evidence suggests that different types of motivation inter-relate and affect one another. This was the case for dental (Orsini, et al., 2015a), medical (Kusrkar, et al., 2013b), and psychology students (Bailey and Phillips, 2016; Baker, 2004), where autonomous motivation positively correlated with controlled motivation and negatively correlated with amotivation. Similar results were obtained when using the 'relative autonomous motivation' index, as it positively correlated with autonomous motivation and

negatively correlated with controlled motivation and amotivation (Kusurkar, et al., 2013a). The latter additionally supports that the computation of such indices is well founded. A contrary finding was reported by Stoeber et al., (2011), where autonomous and controlled motivation were negatively correlated. However, as described in section 2.3.1, their results should be interpreted with caution since the motivation measure used was marginally reliable.

2.3.2.2 Determinants of Motivation

Determinants were divided into intrapersonal and interpersonal determinants. What follows is a detailed description.

Intrapersonal determinants

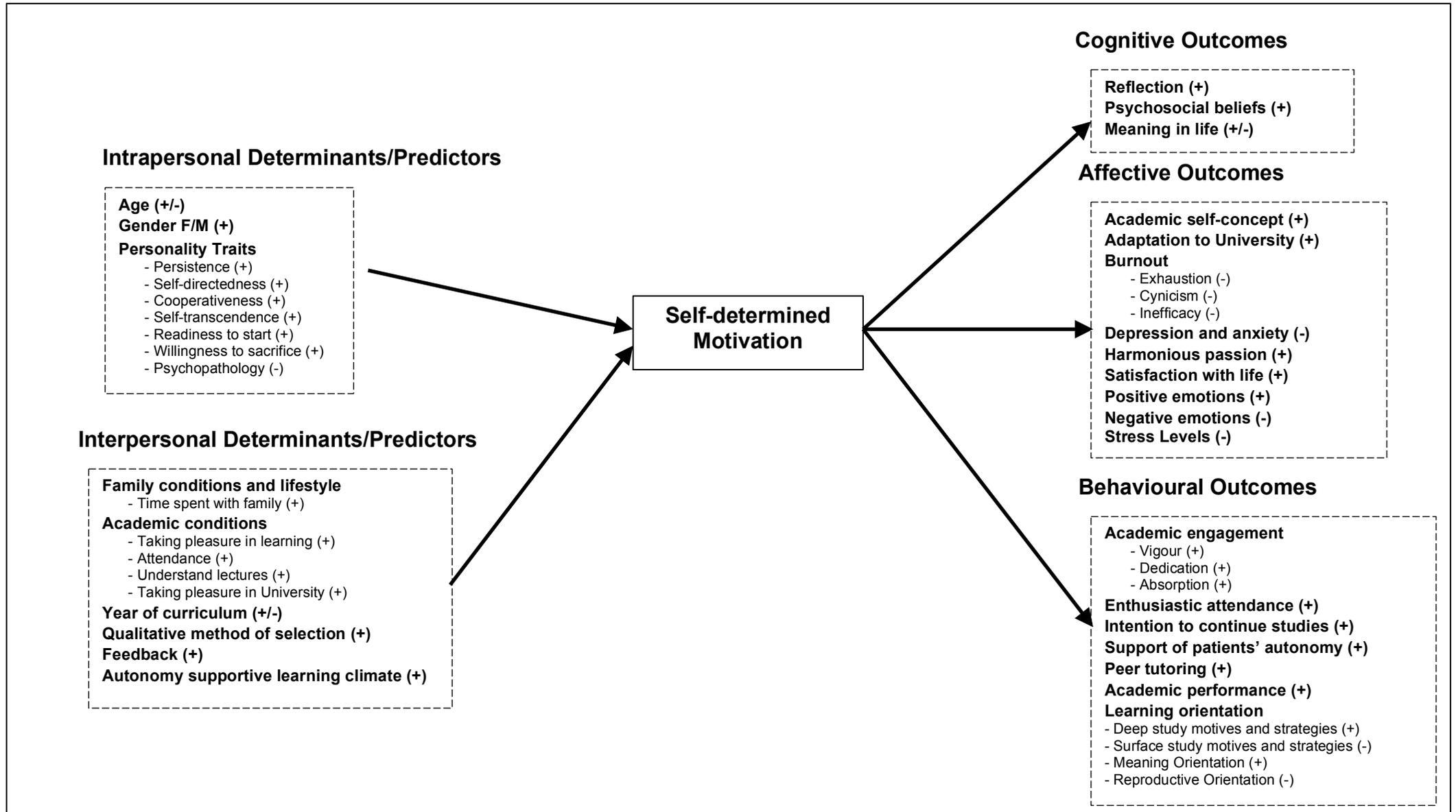
Age

There is limited evidence on the association between age and motivation. Williams et al. (1996b) found that older medical students exhibited a more autonomous profile, endorsing less impersonal reasons ($r = -.14, p < 0.01$) and perceiving themselves as more competent ($r = .19, p < 0.01$). On the other hand, non-significant associations in regression analyses were reported for Japanese (Tanaka, et al., 2009) and Dutch (Kusurkar, et al., 2013a) medical students.

Gender

Female students have shown a more self-determined profile than males. Kusurkar et al. (2013a) found that gender affected relative autonomous motivation ($R^2 = 0.046, p < 0.001$), and that female and male medical students reported, respectively, higher relative autonomous motivation and higher controlled motivation. These results were supported by Williams and Deci (1996a), where a correlation of .21 ($p < 0.001$) was reported between females and an autonomous orientation, and by the study of Kusurkar, Croiset and ten Cate (2013), where males scored significantly higher in controlled motivation. Similar results were found for Brazilian medical students, where females reported higher identified regulation and males reported higher external regulation and amotivation (Sobral, 2004). On the other hand, Tanaka et al (2009) found non-significant gender differences in Japanese students' intrinsic motivation, nevertheless, their motivation instrument was designed for secondary education.

Figure 8. Summary of determinant and outcome variables and their relationship with self-determined motivation. Note. (+) Positive correlation, (-) Negative correlation, (+/-) Inconclusive Correlation. Source: Own work.



When analysing gender differences in dental students' motivation, Orsini et al. (2015a) reported higher and significant scores in all AMS subscales for females, except for intrinsic motivation to experience stimulation (higher but not significant) and amotivation (males scored significantly higher). Nevertheless, the authors advised that effect sizes were small to medium, and therefore, results should be interpreted with caution. Additionally, when clustering Dutch medical students by their motivational profiles, gender showed significant differences ($X^2= 21.42$, $p<0.001$) (Kusurkar, et al., 2013b), with males reporting a higher status-motivated profile (i.e., lower intrinsic motivation and higher controlled motivation), and females showing a higher interest-motivated profile (i.e., higher intrinsic motivation and lower controlled motivation).

Personality traits

Three studies analysed the relationship between personality traits and self-determined motivation. Tanaka et al., (2009) found that, when controlling for age and gender, the temperament dimension of persistence ($r= .42$ $p<0.001$, $\beta= .24$ $p<0.01$) and the character dimensions of self-directedness ($r= .42$ $p<0.001$, $\beta= .37$ $p<0.001$), cooperativeness ($r= .29$ $p<0.001$) and self-transcendence ($\beta= .22$ $p< 0.01$), were positively associated with medical students' intrinsic motivation. This results were supported by Kusurkar et al., (2011b), which showed that persistence in medical study, readiness to start and will to enter medical school, and willingness of a student to sacrifice for his/her medical study, were positive and significantly correlated with the three intrinsic motivation subtypes and with identified regulation, which then became less positive and increasingly negative as moving towards controlled forms of motivation and amotivation. Moreover, Park et al., (2012) reported that psychopathology levels of personality (i.e., mental illness) were negatively associated with self-determined motivation in Korean medical students.

Interpersonal determinants

Family conditions and lifestyle

In multiple regression analysis, when controlling for age, gender, and lifestyle variables such as exercise, drinking, and smoking habits, Japanese medical students' time spent with family (≥ 1 hour per day) was found to be a positive ($\beta= .20$ $p<0.05$) predictor of intrinsic motivation (Tanaka and Watanabea, 2011).

Academic conditions

Taking pleasure in learning ($r = .48$ $p < 0.001$) and in university ($r = .22$ $p = 0.015$, $\beta = .26$ $p < 0.05$), attending university ($r = .37$ $p < 0.001$) and being able to understand lectures ($r = .41$ $p < 0.001$), were positively correlated with intrinsic motivation (Tanaka and Watanabea, 2011).

Year of study

The influence of students' progression throughout the curriculum over motivation shows inconclusive relations. For instance, Chilean dental students' autonomous and controlled forms of regulation and amotivation showed significant differences per year of study (Orsini, et al., 2015a), however amotivation showed an increasing pattern, with the highest scores corresponding to the fourth year i.e., when students start their clinical and patient-based learning, and decreasing from that point until the end of the sixth year. The reverse pattern was reported for intrinsic motivation, which started with high scores in first year. This could be reflecting a 'halo effect' with students showing a positive predisposition and excitement towards this new academic environment, which then tends to fluctuate. Additionally, in a study on Brazilian medical students, autonomous and controlled motivation showed a moderate one-year temporal stability in students' preclinical-clinical transition (Sobral, 2004). This supports the idea that contextual academic motivation constitutes a dynamic state and should not be considered a stable personality trait; therefore as students move from preclinical to clinical courses, differential but related motivational endorsements should be expected. Contrary to the above exposed ideas, year of study was found to be a non-significant predictor of relative autonomous motivation for Dutch medical students (Kusurkar, et al., 2013a).

Qualitative method of selection

Qualitative vs. weighted lottery system of medical students was found to affect relative autonomous motivation ($R^2 = 0.015$, $p = 0.009$) (Kusurkar, et al., 2013a). Indeed, students that underwent a qualitative method of selection reported higher autonomous motivation as well as less amotivation scores than weighted lottery selected students. When integrated in a model, qualitative selected students' relative autonomous motivation showed a positive indirect effect on GPA through good study strategies ($\beta = .32$, $p < 0.01$), which was stronger than the effect reported for weighted lottery selected students ($\beta = .18$, $p < 0.01$). Additionally, when applying to medical school, the study of Wouters et al., (2014) found that both selected and non-selected medical students' statement for application showed strong autonomous reasons, therefore questioning the validity and reliability of the statement of motivation for

selection, as it tends to emphasize socially desirable answers highlighting autonomous reasons and underreporting controlled motivation.

Feedback

Dental teachers reported the relevance of providing timely and constructive feedback as a way of supporting students' intrinsic motivation (Orsini, et al., 2015b). In their experience, this feedback had to be given as a dialogue, highlighting the good things and what should be improved, and focusing on the task rather than on the person. The ultimate goal was to make students aware of their actions and still encourage their perception of competence.

Autonomy supportive learning climate

Four studies informed about the significance of an autonomy supportive learning climate to support students' autonomous motivation. In the study of Williams and Deci (1996a), the autonomy supportiveness of teachers was found to predict American medical students' autonomous self-regulation towards a 24-week patient-interview course ($\beta = .45$, $p < 0.001$), accounting for 20% of students' autonomous motivation change from the beginning until the end of the course. Additionally, teachers' autonomy support predicted students' long-term change in relative autonomy for learning about interviewing and about doctor-patient relationships over a 2½-year period ($\beta = .29$, $p < 0.05$). Likewise, but in a different setting, learning in an autonomy supportive climate for a specific subject predicted students' autonomous motivation to follow a surgery ($\beta = .17$, $p < 0.001$) or an internal medicine ($\beta = .21$, $p < 0.001$) residency path, even after the effects of prior and actual likelihood for that specialty were removed (Williams, et al., 1997). This was also the case for a structured equation model of medical students preference of choosing an internal medicine residency after being taught by autonomy supportive instructors compared to students being taught by controlling instructors (Williams, et al., 1994). Dental faculty defined an autonomy supportive climate as a teaching style that supports the transfer of responsibility, manages external motivators, refocuses uninteresting activities, identifies and encourages personal interests, supports proactivity and choice, as well as making students feel more competent and connected to the clinical environment, to fellow students and teachers (Orsini, et al., 2015b). Therefore, when students experience an autonomy-supportive climate they are more likely to adopt an autonomous learning approach and to integrate the material being taught.

2.3.2.3 Mediation variables

No studies were found to explicitly test the mediation effect of students' perception of the basic psychological needs of feeling autonomous, competent and related to significant others between determinants and quality types of motivation. Nevertheless, three studies reported the effects of teachers' autonomy support on medical students' perceived competence. The first showed that an autonomy supportive climate predicted the increased change in perceived competence ($\beta = .41, p < 0.001$) over a 24-week patient-interviewing course, which was in turn significantly correlated with an autonomy orientation ($r = .42, p < 0.001$) and negatively correlated with an impersonal orientation ($r = -.46, p < 0.001$) (Williams and Deci, 1996a). Similarly, in the studies of Williams et al., (1994, 1997), autonomy support was significantly correlated and predicted medical students' sense of competence towards their studies.

2.3.2.4 Outcomes of Motivation

The influence of quality types of motivation has been divided into cognitive, affective and behavioural outcomes. We now proceed to describe them in detail.

Cognitive outcomes

Reflection

Brazilian medical students reported different correlation coefficients for quality types of motivation and reflection in learning, showing $r = .44$ for autonomous motivation, $r = .09$ for controlled motivation, and $r = -.31$ for amotivation (Sobral, 2004). Therefore, as students' self-determined motivation increases, so does their metacognitive expertise.

Psychosocial beliefs

The biopsychosocial approach compared to the biomedical approach to medicine highlights the importance of practitioners being empathic, patient-centred, and sensitive to patients' psychological and social needs to provide high-quality care. In a 24-week patient-interviewing course, students who mostly engaged out of an autonomous orientation showed stronger psychosocial beliefs at the end of the course ($r = .25, p < 0.01$) than students who engaged mostly out of controlled orientation ($r = -.14, p < 0.05$) or expressing an impersonal orientation ($r = -.27, p < 0.001$). Furthermore, when controlling for gender, an autonomous

orientation ($\beta = .23$, $p < 0.001$) and an impersonal orientation ($\beta = -.22$, $p < 0.01$) were found to be significant predictors of psychosocial beliefs (Williams and Deci, 1996a). Similar results were found within the same study but in a different medical school under a 20-week patient-interviewing course.

Meaning in life

For Australian psychology students, intrinsic motivation to know ($r = .21$ $p < 0.001$, $\beta = .16$ $p < 0.05$), intrinsic motivation to experience stimulation ($r = .25$ $p < 0.001$, $\beta = .15$ $p < 0.05$), introjected regulation ($r = .16$ $p < 0.05$) and external regulation ($r = .23$ $p < 0.001$, $\beta = .24$ $p < 0.01$) had positive associations with presence of meaning in life i.e., cognitive appraisals of whether life is meaningful (Bailey and Phillips, 2016). Amotivation was the exception ($r = -.25$ $p < 0.001$, $\beta = -.36$ $p < 0.001$), as it was associated with low scores of presence of meaning in life. In the same study, with the exception of intrinsic motivation to know, all autonomous and controlled motivation variables and amotivation showed positive and significant correlations with search for meaning in life i.e., tendency to actively seek meaning and purpose in life. The above-mentioned results are somehow inconclusive, as they do not follow the theoretical correlation pattern of SDT, and one reason might be due to the association of a contextual variable (academic motivation) with a general variable (meaning in life, as not being meaning in academic life).

Affective outcomes

Academic self-concept

A pattern consistent with SDT was found for dental students' motivation and academic self-concept (Orsini, et al., 2015a). The three intrinsic motivation subtypes and identified regulation (i.e., autonomous motivation) showed the strongest positive correlations (from $r = .18$ to $.24$, $p < 0.01$), introjected regulation showed a weaker but still positive association ($r = .10$, $p < 0.01$), external regulation score was very weak and non-significant, and amotivation showed a negative and significant correlation ($r = -.15$, $p < 0.01$).

Adaptation to University

Bailey and Phillips (2016) reported correlations between Australian psychology students' motivation and measures of adaptation to university. Intrinsic motivation to know and to experience stimulation were positive and significantly associated with academic adjustment (i.e., Ability to manage the educational demands of university) and with institutional attachment (i.e., Degree of commitment felt towards the university), whereas introjected

regulation showed a negative significant correlation with personal adjustment (i.e., Level of psychological distress), as well as amotivation that showed a negative significant association with social adjustment (i.e., Ability to deal with interpersonal experiences) and with all the aforementioned forms of adaptation to university. Furthermore, Baker (2004) reported similar results for British psychology students', showing that correlations between different adaptation measures decreased from intrinsic motivation to amotivation and suggest that, as students' self-determination decreases, so does their adaptation to university.

Burnout

British psychology students' autonomous and controlled motivation showed, respectively, significant negative and positive correlations and regressions weights with exhaustion, cynicism and inefficacy, which are the three main characteristics of the burnout syndrome (Stoeber, et al., 2011). These results were supported by Dutch medical students' correlations between autonomous ($r = -.12$, $p < 0.001$) and controlled motivation ($r = .09$, $p < 0.05$) with exhaustion (Kusurkar, et al., 2013b).

Depression and anxiety

Amotivation showed a positive correlation with Australian psychology students' depression ($r = .44$, $p < 0.01$) and anxiety levels ($r = .36$, $p < 0.01$) (Bailey and Phillips, 2016). All other motivation types were unrelated, with the exception of introjected regulation, which showed similar results when correlated with anxiety ($r = .16$, $p < 0.05$). This is of special interest, as students endorsing this type of controlled motivation depend on success and achievements to alleviate internal pressure and avoid feelings of guilt, shame and self-derogation, therefore experiencing higher levels of anxiety in order to maintain their self-esteem, ego and sense of pride. In line with these findings, Park et al., (2012) reported that Korean medical students' self-determined motivation predicted lower levels of depression ($\beta = -.75$, $p < 0.05$).

Harmonious passion

Stoeber et al., (2011) defined harmonious passion as a strong inclination, based on free will, towards an activity that individuals like, find important and in which they invest time and energy not posing conflict to other life domains. On the contrary, obsessive passion involves individuals engaging because of intra-interpersonal pressure, diverting time and resources from other life domains. As expected, autonomous motivation of psychology students had a positive correlation with harmonious academic passion ($r = .44$, $p < 0.001$), occurring when

individuals incorporate an activity freely into their self-identity, without incorporating any behavioural contingencies or rewards.

Satisfaction with life

Intrinsic motivation to know ($r = .21, p < 0.01$) and amotivation ($r = -.40, p < 0.001, \beta = -.14, p < 0.05$) showed significant associations with psychology students' satisfaction with life (Bailey and Phillips, 2016). All other autonomous and controlled forms of motivation, despite being non-significant, showed respectively positive and negative associations with satisfaction with life.

Positive and negative emotions

Self-determined motivation has also been associated with positive and negative emotions experienced in university. Increasingly stronger positive correlations from controlled to autonomous forms of regulation (ranging from $r = .20$ to $.42, p < 0.01$), and negative correlations of amotivation ($r = -.33, p < 0.01$) with positive emotions have been reported by dental students (Orsini, et al., 2015a). Similar results were reported for psychology students, who additionally reported a positive association between amotivation and negative emotions (Bailey and Phillips, 2016) and psychological distress (Baker, 2004).

Stress

Korean medical students' stress levels towards university showed a positive correlation with amotivation ($r = .39, p < 0.01$) and identified regulation ($r = .18, p = 0.02$), and an increasingly negative correlation with external regulation ($r = -.16, p = 0.04$), intrinsic motivation to know ($r = -.20, p = 0.01$) and towards accomplishment ($r = -.20, p = 0.01$) (Park, et al., 2012). Identified regulation (component of autonomous motivation) was found to be positively correlated and higher in stressed students, however this type of regulation still is an extrinsic form of regulation, therefore and taken together, these results support the idea that stress levels are negatively associated with students' self-determined motivation. This was supported by the study of Baker (2004), in which intrinsic motivation and amotivation showed negative and positive relations with perceived stress of British psychology students ($r = -.31, p < 0.01 / r = .32, p < 0.01$).

Behavioural outcomes

Academic engagement

Stoeber et al., (2011) measured psychology students' academic engagement as a positive and fulfilling work-related state of mind characterised by vigour (i.e., energy one invests in studying), dedication (i.e., meaning and purpose one experiences when studying) and absorption (i.e., extent to which one is engrossed in one's studies). Autonomous and controlled motivation showed positive and negative correlations and regression weights, respectively, with vigour, dedication and absorption.

Enthusiastic attendance to class

When attending a 20-week course on patient interviewing skills, second year medical students studying from autonomous reasons showed a significant positive correlation with enthusiastic attendance, both on the first and second 10-week block ($r = .46$, $p < 0.001$, and $r = .45$, $p < 0.001$, respectively) (Williams and Deci, 1996a).

Intention to continue studies

Self-determined motivation was also associated with intentions to continue studying medicine in Brazilian students (Sobral, 2004). Specifically, autonomous motivation showed a positive correlation ($r = .46$, $p < 0.05$), whereas amotivation showed a negative correlation ($r = -.60$, $p < 0.05$). The latter strong negative correlation was also supported by the fact that the only 3 students who dropped out of the medical programme, while the study took place, showed a high amotivation profile.

Support of patients' autonomy

In the longitudinal-design study of Williams and Deci (1996a), medical students autonomous orientation at the end of a patient-interviewing course was positively correlated, six months later, with the autonomy-supportiveness towards standardized patients on cardiovascular risk and smoking cessation counselling ($r = .42$, $p < 0.001$).

Peer tutoring

Motivational patterns of medical students' choices of cross-year peer tutoring activity showed autonomous motivation as having a significant positive correlation with number of courses tutored within a four-semester timeframe (Sobral, 2004).

Academic performance

Five studies found significant correlations between quality types of motivation and academic performance. This was the case for Australian psychology students (Bailey and Phillips, 2016), and for Dutch (Kusurkar, et al., 2013a; b), Korean (Park, et al., 2012) and Brazilian (Sobral, 2004) medical students, in which autonomous motivation was positive and significantly associated with high performance, and as motivation increased in its controlled form the correlation became weaker and non-significant, which in turn became negative and significant when associated with amotivation. However, inconsistent findings were found in two studies. First in Chilean dental students, the self-determination continuum showed inconclusive correlations with academic performance (Orsini, et al., 2015a). Nevertheless, as motivation is dynamic and likely to change over time, authors recommended cautious interpretation of their findings, as these came from cumulative instead of concurrent GPA. Second, for British psychology students, all relations between motivation orientations and GPA were found to be non-significant (Baker, 2004).

Learning orientation

Students' reasons for studying showed significant correlations to the way students approached their learning process. Kusurkar et al., (2013b) reported that as Dutch medical students' autonomous forms of motivation increased, so did their deep study strategies ($r= 0.46, p<0.01$). On the other hand, as controlled forms of motivation increased, deep study strategies decreased ($r= -.15, p<0.01$) and surface study strategies increased ($r= 0.26, p<0.01$). On another study, based on the same student population, relative autonomous motivation was found to predict good study strategies ($r= .35, p<0.01, \beta= .35, p<0.001$), whereas amotivation showed a negative correlation with the aforementioned variable ($r= -.31, p<0.01$) (Kusurkar, et al., 2013a). Similar results were found by Orsini et al., (2015a), in which dental students' reasons for attending university, from the most (i.e., autonomous motivation) to the least self-determined form (controlled motivation and amotivation), showed a positive to negative correlation pattern with deep study motives. The reverse pattern was reported for surface study motives. These results were supported by Sobral (2004), in which medical students' autonomous motivation related positively to meaning orientation to learning, and had a negative relationship with reproductive orientation to learning. These were gradually reversed as meaning and reproductive orientations were related to controlled motivation and to amotivation. This suggests that stronger autonomous motivation goes together with enhanced self-regulation of learning.

2.4 Discussion

The study of motivation in HPE from the SDT perspective has been investigated in different cultural educational settings, however, the health-profession-context in which it has been explored is quite narrow, being mostly dedicated to medical education with some exceptions focusing in dental (Orsini, et al., 2015a; b) and psychology education (Stoeber et al., 2011; Bailey and Phillips, 2016; Baker, 2004).

On the one hand, SDT argues that its principles are independent of the individuals' origin or culture (Ryan and Deci, 2000b; Lynch, La Guardia and Ryan, 2009; Deci et al., 1991). This is consistent with the findings from the reviewed articles, in which studies coming from different latitudes showed similar results. Future investigations should continue expanding the cultural aspects, such as gender, race, and ethnic differences, as they provide important evidence about the external validity of SDT.

On the other hand, the limited evidence of the role that self-determined motivation plays in different health areas represents an important challenge for educational researchers. As it was discussed in section 1.3, studying motivation in HPE is important because of the differences from general education and in-between the diverse health professions. These are different in several aspects, such as the intensity of study, the timing and responsibility of patient contact, the requirement to carry out clinical work along with study, and the needs to follow a highly specifically defined path to be able to qualify to practice as a health professional (sometimes referred to as a very controlling environment). To develop a full picture of the process of motivation, additional studies are needed that investigate the particularities of each health profession. Indeed several authors have highlighted the needs to continue expanding this research to other health areas (Bailey and Phillips, 2015; Orsini, et al., 2015a; b), and similarly in medicine, authors have claimed that literature exists on students' motivation to enter medical school yet very little is known about what happens afterwards (Kusurkar et al., 2011b; Sobral, 2004).

The fact that most of the data collected came from cross-sectional correlational studies was not a surprise, as this has been referred to as one of the most common types of studies conducted in educational research (Creswell, 2002). Despite the valuable data emerged from them, there appears to be a lack of higher evidence-related research, such as from longitudinal or experimental designs, which might lead to more robust conclusions (Creswell, 2003). This said, experimental designs in educational research are often difficult to conduct because of practical and ethical reasons (Cleland, 2015). For instance, it would be unethical to conduct an intervention aimed at students being taught in a more autonomy supportive

way and withhold that experience from a control group. In this sense, quasi-experimental designs (i.e., groups naturally formed or pre-existing rather than randomised) would appear to be more suitable. Additionally, several authors have also stressed the need for longitudinal designs in future research, so to establish the temporal and causal pathways between variables (Bailey and Phillips, 2016; Park et al., 2012; Stoeber et al., 2011; Williams et al., 1997).

However, the use of cross-sectional designs in a somehow unexplored field has served as a useful strategy to establish logical associations between variables and possibly lead to future research of higher evidence. In addition, the use of more sophisticated data analysis methods in cross-sectional studies leads to stronger research conclusions. For instance, authors have begun to incorporate the use of structured equation modelling (Williams et al., 1997, 1994; Park, et al., 2012; Kusrkar, et al., 2013a), which in itself is a highly conservative statistical technique, i.e., one unsupported path in a given model may be sufficient to lead to poor statistical fit (Kline, 2010). Therefore, as findings across the reported studies inform very good fit, they do provide support for the direction of causality proposed in their models (Violato and Hecker, 2007). Another aspect to consider is that reports from correlational studies, specially when using structural equation modelling techniques, have reported results directly in line with much of the experimental literature in other fields involving SDT (Vallerand, 1997). In sum, while future research should consider the advantages of experimental and longitudinal designs, they might not always be a viable research option, hence the use of the aforementioned techniques should lead to sound identification of directions of the causality of the various relations proposed.

The use self-reported measures were somehow considered as potential contributors to response bias. However, their use is a long-standing, valuable and valid measurement strategy in the behavioural and educational sciences (Howard, 1994; Cohen, Manion and Morrison, 2013). This is the case, for example, with self-reported and actual academic performance in the form of grades, where previous research has shown a correlation of .96 between them (Salmela-Aro and Tynkkynen, 2010). Several other measurements were also self-reported, such as students' motivation, their behaviour, thoughts and emotions, and perception of teachers' teaching attitudes. Using these perceptions of social agents (instead of actual ones by other means) has shown for instance, in recent research, that students' perceptions of their teachers' behaviours highly correlates with the perception that the same teachers declare of their own behaviour, and are also highly consistent with independent judges' perceptions of teacher behaviour (Pelletier and Vallerand, 1996). It can be therefore assumed that students' perceptions can be approximately equivalent to objective contextual

variables.

To measure the study variables, authors collected data based on well-designed and highly reliable instruments, which represented strength in their methods. Using SDT-related instruments when measuring motivation (specifically the AMS) and adapting the measurements when parsimony was needed, such as in the case of using the Relative Autonomy Index, has led to valid and reliable results and it is recommended for future research. It is however, important to be consistent with the levels of generality, so as to generate strong conclusions, and therefore researchers should show care not to mix the general level with the educational contextual level.

Most of the reviewed studies were based on what has been termed as a variable-oriented approach (Vansteenkiste, et al., 2009), as they explored relationships between motivation and its determinants and outcomes, as group variables. This has been the way by which motivation (based on SDT or not) has been mostly researched in health professions education (Kusurkar, et al., 2011b), specially because of its usefulness and simplicity when attempting to understand how motivation influences outcomes and how it is influenced by different determinants. Two exceptions were the studies of Kusurkar et al (2013b) and Sobral (2004), which adopted a person-oriented approach, clustering individual students' motivational differences and observing how these groups related to different determinants and outcomes. This is especially useful when the aim is to understand motivational orientations of individual students. Both approaches carry with them different strengths and relying on one or another should be determined by the research objectives.

Medium to large sample sizes were included, which increase power and therefore the possibility of detecting small effects. Nevertheless, the fact that no studies reported power analyses to inform the intended effect sizes to be found, risks increasing the probability of a type II error (i.e., not finding a statistically significant result when the effect actually does exist) (Stansfield and Gruppen, 2015). Reporting power analyses is an important step to decide how many subjects are needed to find certain effect size and therefore statistical significance, such as with an educational outcome or the relationships between variables, or if the sample is pre-defined, to inform the power and estimate the ability of the test being used to separate the effect size from random variation (Cohen, Manion and Morrison, 2013). Additionally, probabilistic sampling methods and calculations (considering confidence level, confidence interval, and population) would have served as methods to reduce potential response bias and increase representativeness. This is specially the case when researchers have to take into account non-responses, attrition, missing values, and unengaged responses.

On the other hand, few articles reported confidence intervals and effect sizes of their inferential statistics, relying solely on the p-value. The latter can be potentially influenced by large sample sizes, leading to a Type I error (i.e., finding a statistically significant effect, when in reality, there is no effect) (Stansfield and Gruppen, 2015). This highlights the relevance for future research of informing effects sizes, as they are not influenced by sample size (Field, 2013).

Overall, it can be said that the included studies reflected acceptable internal and external validity and high reliability. Therefore, this made possible to judge the quantitative reports as objective and free of high-risk bias that would have prevented their inclusion on the review.

2.4.1 Determinants, mediators, and outcomes of motivation

Overall, health professions students reported a stronger autonomous drive to attend university. Nevertheless, both autonomous and controlled reasons were endorsed and seem to correlate, showing a somehow contribution to the learners' academic success in the context of a demanding undergraduate programme. Efforts should point at encouraging students to engage in activities out of interest and enjoyment, however it is unrealistic to think that they will participate all the time out of intrinsic forms of motivation. This highlights the relevance of the internalisation process of motivation, in which students need clear rationale and to bridge the importance that learning activities will have for their professional practice in order to internalise their actions and adopt autonomous forms of regulation (Ten Cate, Kusrkar and Williams, 2011).

Identifying students' quality types of motivation and how they are endorsed, appears to be important for teachers, administrators and curriculum developers to aid the identification of different determinants and how they impact students' motivation, and in turn how these different types of regulation will impact educational outcomes and students' wellbeing (Vallerand, 1997; Williams, Saizow and Ryan, 1999). The findings reported indicate that different types of motivation in students are predicted by both the educational environment and their personal characteristics (Figure 8). Of these, Kusrkar et al., (2011a) suggested that some can be manipulated and some cannot, therefore implying that motivation as a dependent variable can vary depending on its predictors.

Regardless of being unlikely to be manipulated, intrapersonal characteristics play an important role in students' self-determination. Concerning gender, females appear to have a more autonomous profile than men, which is in line with research on SDT coming from other

domains (Vansteenkiste, et al., 2009; Ratelle, et al., 2007). Indeed, females have been clustered into an interest-motivated group (i.e., higher autonomous motivation), whereas men have been clustered into a status-motivated profile (i.e., higher controlled motivation) (Kusurkar, et al., 2013b). Therefore, gender differences should not be overlooked, as they might provide teachers with different insights on how to mentor or give advice to female or male students (Kusurkar, Croiset and ten Cate, 2013). Similarly, well-balanced maturation of personality traits seems to be important for students' autonomous motivation (Tanaka, et al., 2009), and identifying these characteristics might lead to early interventions and guidance for 'immature' students. In the same way, Park et al., (2012) suggested that interventions against stress may help students to increase their self-determination.

With regards to age, findings were inconclusive and do not support the claims of Vallerand and Bissonnette (1992) in which more mature students showed higher self-determined levels than younger students. A possible explanation for this might be that the age range in the settings where the studies took place was quite narrow, and therefore further research should be undertaken where there exists a mix of traditional and non-traditional aged students.

On the other hand, interpersonal determinants were mostly related to the educational environment and represent a group of variables in which great attention should be paid, as these represent the 'day-by-day' influences over motivation that are likely to be manipulated by educators. Most of these were related to academic conditions and the learning climate, such as the autonomy supportiveness and quantity and quality of feedback given by teachers. The type of environment in which students learn, this being a controlling or autonomy supportive one, is suggested to influence their reasons for engaging in academic activities (Deci, Koestner and Ryan, 2001). The relevance of creating an autonomy supportive learning climate in clinical education has been recently discussed by several authors (Ten Cate, Kusurkar and Williams, 2011; Kusurkar, Croiset and Ten Cate, 2011; Orsini, Evans and Jerez, 2015), in which encouraging self-initiation, volitional activities, the use of constructive feedback, and providing rationale is pointed as crucial. The impact of learning in such environment has been suggested as beneficial for both, students and patients, as students engaging in activities based on autonomous reasons are more likely to interact and support their patients' autonomy towards their healthcare (Williams and Deci, 1996a). Moreover, the emerging development of curriculum based on entrusted professional activities proposed by Ten Cate et al., (2015), has common grounds with SDT by highlighting the importance of developing students' autonomy and competence over time.

Since several academic conditions were related to students' self-determination, these variables may well be used for developing interventions to lowering the incidence of and/or increasing the recovery from low self-determined forms of motivation and prevent future academic failure (Tanaka and Watanabea, 2011). As pointed by Kusurkar et al (2013a), interventions can be as early as when students are being selected to enter the specific programme by privileging qualitative methods of selection, which have also been related to higher motivation of students in past research (Hulsman, et al., 2007).

Despite the contradictory findings with regard to students' progression throughout the curriculum and their motivation, it is interesting to note that motivation fluctuates throughout the curriculum. It seems possible that this is due to the experience students have when transitioning through the different learning cycles (i.e., basic sciences, preclinical and clinical activities). It has been suggested that an early patient contact and vertical integration might increase students autonomous motivation and decrease the amotivation when experiencing an abrupt transition (Ten Cate, Kusurkar and Williams, 2011; Orsini et al., 2015a). Further research, however, needs to be undertaken before the association between clinical transition and motivation is more clearly understood.

One unanticipated finding was that no study had tested the mediating role of students perceptions of basic psychological needs between interpersonal determinants and quality types of motivation. SDT postulates that for social factors to have an impact on students' motivation, it is fundamental to assess how the different determinants impact these needs students (Vallerand, 1997; Deci and Ryan, 2008b). This has been tested with success in other domains (Chen, et al., 2014; Reis, et al., 2000; Deci, Ryan and Williams, 1996). So far, there is usefull evidence on how motivation is directly influenced by different determinants (Fig. 8), nevertheless there is no study describing the process by which those determiants reach their effect on motivation. Are the effects of interpersonal determinants on motivation mediated by the satisfaction of basic psychological needs? Which determinants impact on which psychological needs and how? What influences motivation is how students perceive these determinants to affect their needs and not their original intended effect; many questions are still unanswered leaving abundant room for further research.

When students were experiencing autonomous reasons to attend university and engaging in academic activities, positive cognitive, affective and behavioural outcomes were reported. As to how students processed information, cognitive outcomes such as reflection and psychosocial beliefs were higher as motivation became more autonomous. Reflection in- and on-action has been related to an increased lifelong learning experience (Kaufman and

Mann, 2010) and therefore, as students become more autonomous, so might their future self-regulation of learning. Additionally, in recent years there has been an increased emphasis on the technical-biological and pharmacological aspects of healthcare, which is believed to carry a dehumanisation of patient care with it (Becker, et al., 1996). Instead, as students' self-determination increased, so did their psychosocial beliefs towards a more humanistic approach to medical care.

With regards to students' affective outcomes, autonomous motivation showed positive relationships with academic self-concept, adaptation to university, harmonious passion, satisfaction with life and positive emotions, whereas higher controlled motivation and amotivation showed positive correlations with affective variables such as burnout, depression, anxiety and negative emotions. These findings are consistent with data obtained in research with primary and secondary school students and in other areas of higher education, in which autonomous motivation has been related to better psychological adjustment (Deci et al., 1991; Deci, Ryan and Williams, 1996). Moreover, these findings are also in line with those of Peterson & Seligman (1984) who suggested that amotivation is associated with negative affect and lowered self-esteem. The latter has been found to increase students' risk of discontinuing university (James, Krause and Jennings, 2010).

In terms of students' actions, as motivation orientation became more self-determined, behavioural outcomes became more positive. Therefore, autonomously motivated students showed higher levels of academic engagement, enthusiastic attendance to clinics, willingness to continue their studies, an approach towards the supportiveness of patients' autonomy, better disposition to peer tutoring, higher academic performance and more effective learning strategies. These findings seem to be consistent with research in domains of education other than HPE, where autonomous motivation was related to enjoying classes and showing sustained student involvement (Ames and Archer, 1988), and on the other hand where controlled motivation/amotivation was shown to correlate with cheating (Davy, et al., 2007), plagiarism (Angell, 2006) and dropout rates (Hardre and Reeve, 2003).

While autonomous motivation was considered to have an overall positive correlation with academic performance, there were few studies with contradictory findings. As Bailey and Phillips (2016) suggest, these discrepancies could be attributed to how academic performance was measured, the type of assessment, which timeframe was being considered (Cumulative vs. concurrent performance), and to the course or area of study. Thus, further studies with more focus on clinical workplace assessment are suggested. This inconsistency is also observed in other educational domains, where autonomous motivation

has been reported to have positive (Vansteenkiste, et al., 2005; Kaufman, Agars and Lopez-Wagner, 2008) as well as inconclusive correlations with performance (Petersen, Louw and Dumont, 2009; Conti, 2000).

2.4.2 Limitations

The present review has applied robust methods and has lead to relevant findings; nevertheless, there are a series of limitations that should be taken into account. First, we limited our analysis to English-, Spanish- and French-language articles, which might have excluded relevant literature from other languages. Second, we searched the literature through multiple sources, however the review is inherently limited to these and some relevant publications might have been excluded. Third, despite that seven articles were considered as biased in at least one aspect of the quality appraisal phase, this was not considered as reason for exclusion as their results were highly relevant, still this may have brought some unmeasured confounders to our summary of results. Fourth, the findings reported might be somewhat limited by the number of small-sized but still meaningful correlations, and should be interpreted within the context of each study. Finally, the downside of bringing together research conducted in different health related disciplines is that it involves a variety of educational contexts, study designs and participants. Therefore, results found in one context might not be generalised to others. Nonetheless, we have provided details of the methods and results of the included studies, so that readers can judge the transferability of findings to different health professions education settings.

2.5 Conclusions and Implications for future research

The present review brings together evidence from the broad spectrum of HPE in relation to different intrapersonal and interpersonal determinants of motivation from the SDT perspective, which in turn informs how the quality of motivation resulting from these determinants influences different educational outcomes. This study has found that generally, motivation could be enhanced by changes in the educational environment and by an early detection of students' characteristics. Doing so, may support students' self-determined forms of motivation and positively influence how they process information, their emotions and how they approach their learning activities.

There are several recommendations and implications for future research and for the development of the subsequent phases of this thesis. First, future research should be carried out to continue expanding the study of academic motivation in different health professions and in different cultures.

Second, while future studies should be designed to produce higher levels of evidence in order to provide more definitive conclusions, the use of correlational designs incorporating robust data analysis, such as when using structured equation modelling techniques, are useful when studying motivation in unexplored areas and when there are time constraint limitations.

Third, future research needs to take into account sample calculations, power analyses, confidence intervals and effect sizes in order to reduce the risk of Type I and II errors.

Fourth, it is recommended that further research considers the three levels of generality exposed in section 1.2 when operationalizing variables; therefore consistency is needed with the level under study. Mixing the general, contextual and situational level when the study does not aim to, could produce unreliable findings.

Finally, the three postulates exposed in section 1.2 seem to be transferable to health professions education, the exception was the lack of evidence concerning the mediating effect of the basic psychological needs satisfaction. Therefore a natural progression of the empirical work conducted so far is to develop and analyse a full picture of the hierarchical model of SDT presented in Figure 3, starting with the educational contextual level and expanding these findings to the general and situational level.

The findings of this review have also several implications for policy and practice. Understanding the different combinations of students' motivation profiles could help in customising mentoring and supporting activities for different groups of students. The multiple links presented amongst different variables and the central issue of developing students' self-determined forms of motivation, suggests that developing autonomous motivation is of key importance for future health practitioners. In terms of faculty development, it suggests that teachers should be trained to be autonomy supportive, and concerning curricular developments, it also suggests a move towards an interactive method of teaching and learning that promotes students involvement and autonomy.

Taken together, our results show strong support for the study of SDT in HPE; knowing the factors that influence students motivation could provide health professions educators with concrete means to develop students' autonomous forms of motivation and lead to an enhancement of their cognitive, affective and behavioural educational outcomes, which will ultimately contribute to the fundamental purpose of HPE; the improvement of healthcare practice, patient care and patients outcomes.

3. RESEARCH AIMS AND QUESTIONS

After defining in Chapter 1 the background of SDT and its relevance to HPE, and having systematically presented in Chapter 2 the relationships between determinants, mediators and outcomes of motivation in HPE, we will now move on to describe the specific aims and questions of the primary research of this thesis.

This section has been organised following the recommendations from Bezuidenhout and Schalkwyk (2015), and therefore we will present first the aims of the research in terms of general and specific objectives, followed by the research questions.

The relevance of motivation for the development of students in different areas of HPE has been well established in the previous chapters, not being only important for students but also having important benefits for patients. While there has been a slow but growing body of evidence around this topic over the last two decades, there is still ample scope for further research, especially in areas different from medicine, where academic motivation from the SDT perspective has been understudied. As it was mentioned in Chapter 1, our aim is to expand this evidence and continue our research in the field of dental education and specifically in the Chilean higher education context.

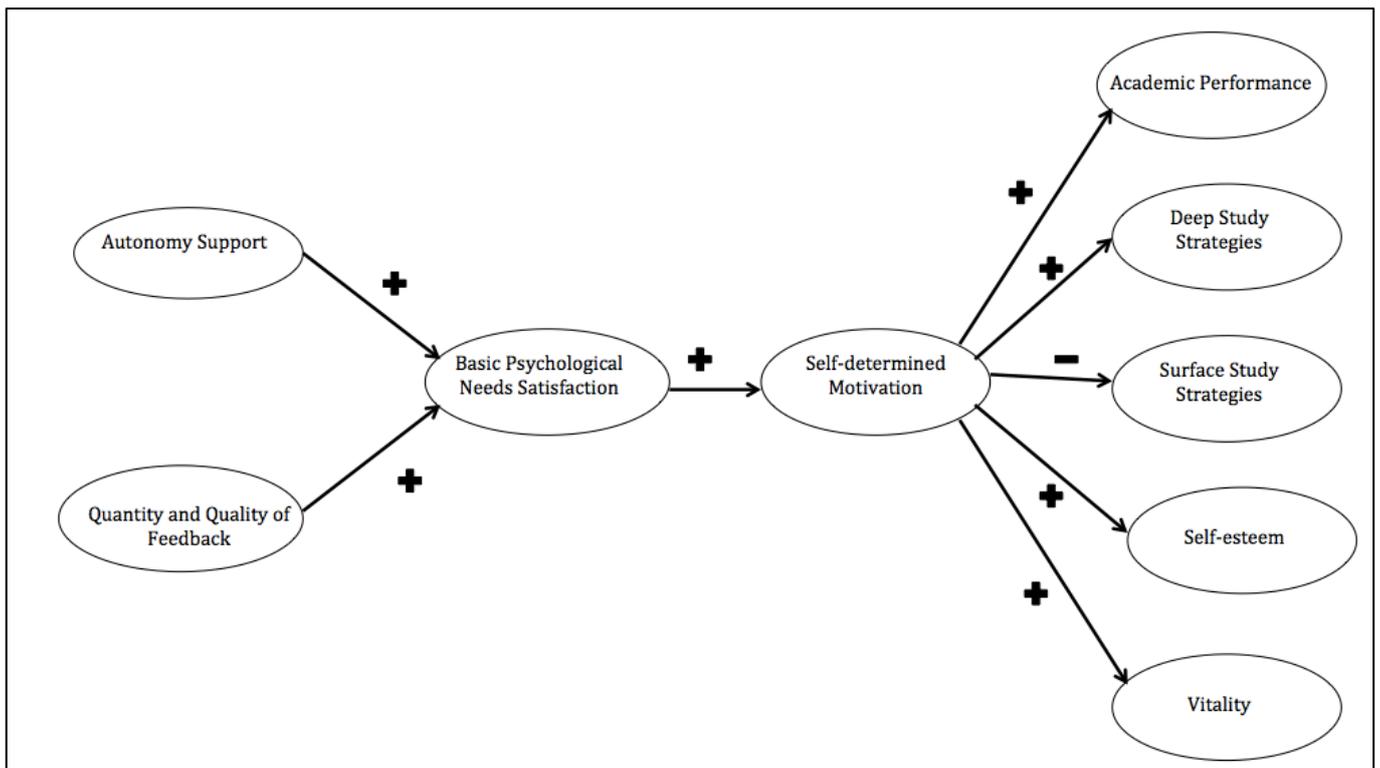
The *general objective* is therefore to test a model of academic motivation derived from the model depicted in Figure 1, by analysing the relationships and influences between different interpersonal determinants and self-determined motivation of dental students, mediated by their basic psychological needs satisfaction, and its influence on educational outcomes.

As the study has taken place in Chile, we selected our determinant and outcome variables based on previously validated Spanish instruments. On the one hand, the interpersonal determinants corresponded to autonomy support, quantity and quality of feedback and year of curriculum, while gender and age were included as intrapersonal determinants. On the other hand, for outcome variables, we based our analyses on affective and behavioural consequences. In terms of affective outcomes, we included academic self-esteem and vitality, whereas for behavioural outcomes we included academic performance and study strategies (Deep and surface). The lack of instruments developed in Spanish to measure cognitive academic variables at the time the study took place, prevented the inclusion of this type of outcome in our analyses. All the aforementioned constructs were chosen based on their relevance for motivation as well as for the high reliability and validity of the

measurement instruments tested in previous research (detailed in the next chapter). It is important to clarify that due to time constraints we were unable to conduct separate validation projects for each instrument, however, these had been validated in similar contexts and therefore were considered appropriate to use. Nevertheless, we took the precaution of assessing each instrument's face-validity and reliability in the context of the thesis. The one exception was the measure of academic motivation, which we previously validated in a Chilean dental student sample as part of a separate research project, specifically as part of course 3 of this doctoral programme (Orsini et al., 2015a).

Consequently, the *specific objectives* were threefold and were designed based on the model presented in Figure 9. Firstly, we aimed to test whether autonomy support and quantity and quality of feedback, mediated by students' basic psychological needs satisfaction, positively influenced self-determined motivation. Secondly, we intended to test the influence of self-determined motivation on the aforementioned behavioural and affective outcomes. Thirdly, we aimed to test whether the model worked in different ways for female and male students, and by year of curriculum. The model itself represents the research hypothesis (Figure 9).

Figure 9. Hypothesised model. Note. (+) Positive influence, (-) Negative influence, Source: Own work.



The objectives were then adapted as research questions, so these could guide and direct all activities during the research process and against which decisions regarding research design, presentation of results and interpretation will be measured (Regehr, 2010). According to the classification of research questions in health professions education (Bezuidenhout and Schalkwyk, 2015), we designed three questions aimed at predicting outcomes, as follows:

1. Do autonomy support and quantity and quality of feedback have a positive and significant influence on dental students' self-determined motivation? Is this influence mediated by students' basic psychological needs satisfaction?
2. Does self-determined motivation have a positive and significant influence on dental students' academic performance, deep study strategies, self-esteem and vitality, and a negative significant influence on surface study strategies?
3. Does the model (Fig. 9) work differently for females and males, and for different years of study? If yes, what are the differences?

Having defined the research aims and questions, the next chapter describes how we planned to answer them, presenting the theoretical framework and methodology, and the specific methods applied.

4. MEDOTHOLOGY AND METHODS

4.1 Theoretical Perspective and Methodology

As we aim to test a hypothesised model of dental education derived from the principles of SDT, the study has been conducted through the lens of a positivist approach to research (McMillan, 2015). As such, the assumptions about the nature of reality are based on a realistic ontology, opposed to the constructivist ontological perspective characterised by relativism and multiple realities (Illing, 2011). While some uncertainty is acknowledged, the positivist view can be understood through careful measurement and testing (Mann and MacLeod, 2015). Therefore, we understand our hypothesised model as the reality 'out there' and the principles of SDT to be the 'laws and mechanisms' that govern the workings of such reality. By measuring and testing we ought to find the true state of that reality in the context of our study (i.e., in the field of dental education).

In terms of the assumptions about the nature of knowledge, the epistemological perspective adopted is based on objectivism, where facts about the social world can be accurately collected being independent of individual interpretation and are understood as being 'true' (Illing, 2011). Consequently, the relation between the knower and the known is assumed as being two independent entities (McMillan, 2015). In other words, the researcher is capable of investigating the object of study without influencing it or being influenced by it, so as to discover its true form or process. The methods should show strategies to enhance rigour and to reduce bias and subjectivity to a minimum (Tavakol and Zeinaloo, 2004). Again, this is opposed to the subjectivist view of a constructivist approach, where the researcher and the researched are inseparable; their experiences influence knowledge, questions asked and how findings are understood, and there are multiple ways of knowing (Mann and MacLeod, 2015). Thus, perceptions and experiences of the author and his supervisors about the hypothesised model should not influence the results. These should be reported impartially, as a way to inform decisions and recommendations. Therefore the aim is to be objective and that any personal bias has no part in the research (Illing, 2011).

As far as methodology is concerned and to answer the question 'how can we know what can be known?' The positivist worldview works deductively and approaches are mainly quantitative (Illing, 2011). The aim is concerned with the prediction and control of phenomena to minimise subjectivity, and involves testing hypotheses to support or disprove a theory. Conversely, constructivist paradigms are mainly qualitative, including questions

such as why and how events and processes occur and how individuals and groups make meaning of them (Mann and MacLeod, 2015). In this project we therefore work with a quantitative methodology, where the underlying theory (i.e., SDT) determines the problems, with the research moving deductively from the theory to the data, generating the hypotheses and research questions about causal connections, as outlined in chapter 3.

In terms of the quantitative research design adopted, this depends much on the research question being addressed and the hypotheses being tested. Amongst the numerous classifications of quantitative educational research designs outlined in the literature (Norman and Eva, 2010; Creswell, 2002; Cohen, Manion and Morrison, 2013), Cleland (2015) has described four types that are commonly used specifically in the field of HPE. These correspond to descriptive, correlational, quasi-experimental and experimental research designs.

Descriptive research is used to describe characteristics of a population or to provide systematic information about a phenomenon. These types of studies do not answer how/ when/ why questions, just the 'what' questions, for instance, 'what are the characteristics of a population or situation being studied?' (Cleland, 2015). Correlational research is used to identify trends and patterns in data when the desire is to seek understanding by examining relationships amongst measured variables, but it does not go so far in its analysis as to explicitly prove causes for these observed patterns (Norman and Eva, 2010). Descriptive and correlational designs are observational or so called non-experimental, as they do not involve controlling or manipulating variables under study. Quasi-experimental and experimental research on the other hand, aim at testing questions of causality and their consequences by deliberately controlling or manipulating independent variables that are thought to affect dependant variables (Cohen, Manion and Morrison, 2013). Quasi-experimental research involves groups being naturally formed or pre-existing rather than randomised, and it is frequently used by healthcare education researchers as random assignment to study conditions are often difficult due to practical and ethical constraints. This also represents a limitation, as it leaves quasi-experimental designs open to biases and confounders of the conclusions about the relationship between the intervention and outcome studied (Cook, Campbell and Day, 1979). By contrast, in experimental designs subjects are randomly assigned to experimental and control groups, e.g., randomised control trial.

As the questions we attempt to answer are based on a search for relationships amongst variables, a quantitative correlational design was the most appropriate methodology to achieve our goal. This does not deny the usefulness of qualitative approaches, nevertheless

in this specific project we were not focusing on studying motivation through the lens of a constructivist approach and, as explained above, we did not seek to explore our research questions subjectively and through the experiences and interpretations of the researchers and participants. On the other hand, opting for a quantitative correlational design instead of an experimental research is justified by the fact that our goal is explicitly to understand the differences between people in how they perceived the different variables and how these are related, and not to test the effectiveness of an educational intervention. While experimental research has been suggested as generating one of the highest levels of evidence in quantitative research, Norman and Eva (2010) point out that many research questions cannot and should not be answered with this type of design. The method that is most appropriate is dependent on the question the researchers want to address. Consequently, one or the other are not better or worse and there is no point in trying to force use of a method when it does not fit with what is trying to be achieved; they are just different.

In terms of the timing of data collection, observational studies such as correlational research, can be either cross-sectional or longitudinal (Creswell, 2002). Time constraints prevented us from analysing changes over time through a longitudinal design, and therefore our study described variables and analysed their relationships across a unique period of time. This cross-sectional design involved objective measurements of the different variables via structured data collection techniques, which in this case corresponded to previously validated and published surveys (Cleland, 2015). The collected numerical data was presented and interpreted through statistical analysis, which is inherent to quantitative research. First descriptive statistics were used to provide a 'big picture' of the data, followed by inferential statistics aimed at testing the above-mentioned hypotheses and relating findings to the sample (Norman and Eva, 2010).

This study has been conducted ensuring methodological rigour. In quantitative research, the criteria to judge quality are mainly related to issues of validity, reliability and objectivity (Cleland, 2015). With regards to validity, there are internal and external forms of validity. The former refers to how well a measure captures what is meant to measure and the latter is the extent to which results of a study can be generalised to other situations and to other people. Reliability refers to a measure of precision and stability, that is the extent to which the same result would be obtained with repeated studies. Finally, there is objectivity that refers to freedom from bias. This is possible when the researcher has little opportunity to interact with or to influence participants or data, being the case when testing hypothesis through statistical tests.

To sum up, this study has been conducted from a positivist worldview, a realistic ontology, an objectivist epistemology and a quantitative methodology, with a correlational cross-sectional survey design and relying on descriptive and inferential statistical analysis. An exhaustive description of the data collection and analyses procedures, along with detailed descriptions on how quality has been assured is presented below.

4.2 Methods

This section presents the methods used to answer the research questions. Figure 10 describes an overview of the entire process of data collection and analysis. The study was conducted following the guidelines of the statement for '*Strengthening the Reporting of Observational Studies in Epidemiology*' (STROBE) (Vandenbroucke et al., 2007), which is outlined in appendix IV. Despite being developed as a specific guideline for medical research, it has been suggested as a useful framework to enhance quality when reporting cohort, case-control and cross-sectional studies in health behaviour and health education research (Glanz, Rimer and Viswanath, 2008).

4.2.1 Sample and Access

The study was conducted at the dental school of the Santiago campus of the University San Sebastian in Chile. The context of Chilean dental education is referred to in section 1.3. The sampling plan was based on the suggestions by Cohen, Manion and Morrison (2013) for conducting sampling methods in educational research.

Considering that in quantitative research, the larger the sample the better, as it will result in higher reliability, lower sampling error, and enable the use of more sophisticated statistical analyses and increase the likelihood of the sample being representative (Field, 2013; Cohen, Manion and Morrison, 2013), all students from year 1 to year 6 were invited to participate. They all constituted the study's population and the unit of analysis was each current undergraduate dental student. To access the students, the author contacted the leadership of the dental school, specifically the head and deputy head of the dental school, who agreed to participate in the project and granted permission to invite the entire student population to participate. Therefore, we did not initially select a sample strategy (i.e., probabilistic or non-probabilistic) as we had access to the entire population.

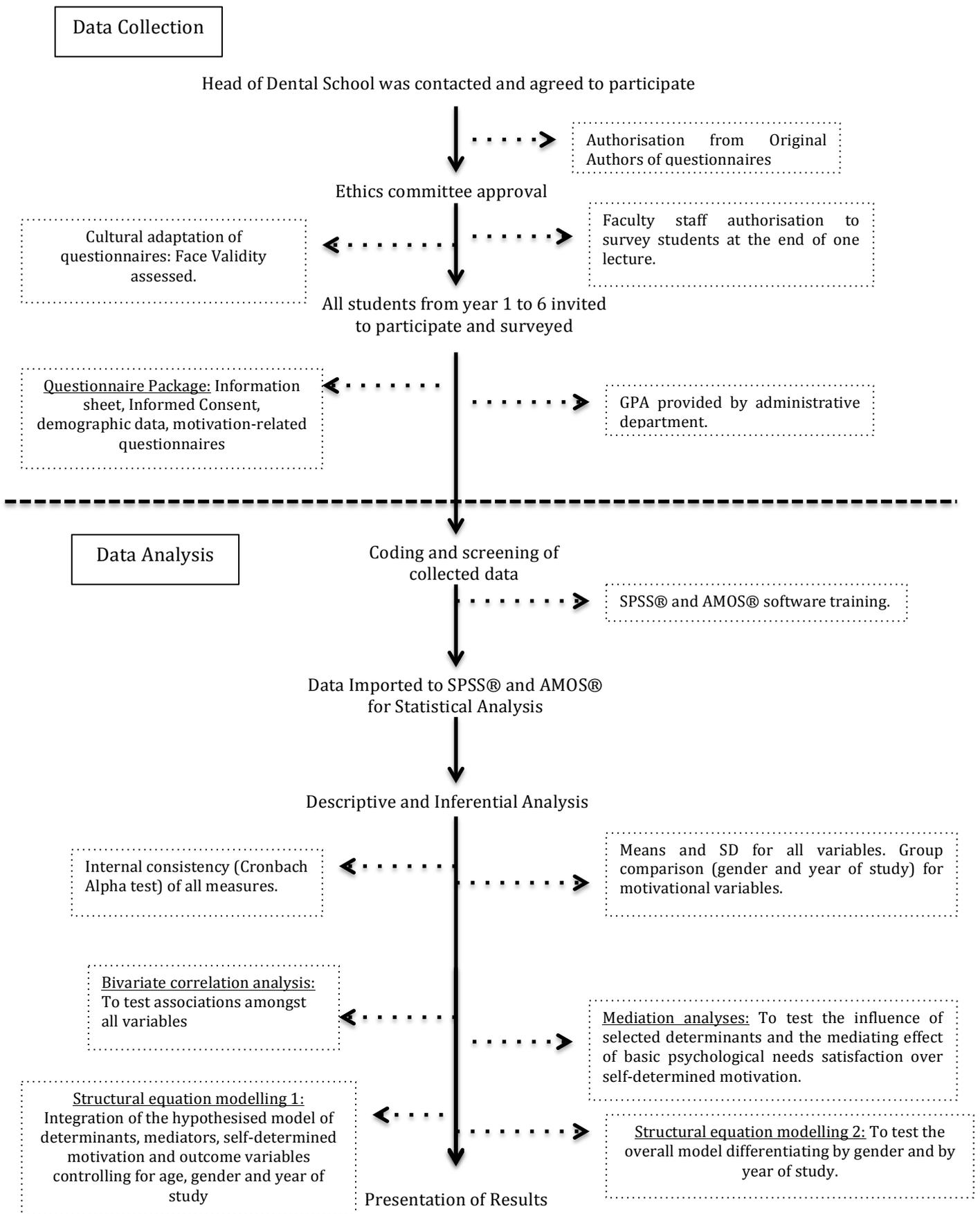
In terms of the sampling frame, at the time the study was conducted the dental school had 1024 students with a ratio of 60:40 female to male students, distributed by year of study as follows: 154 first year, 184 second year, 265 third year, 190 fourth year, 160 fifth year and 71 in sixth year.

Because of the numerous variables involved, and also because of the breaking of the sample into subgroups (by gender and by year of study) and to being able to find small differences and relationships, we aimed at a large sample that represented the overall student population (Gall, Borg and Gall, 1996). We took into account, however, possible non-responses and attrition, and therefore conducted sample calculations to be certain of the minimum number of subjects required to ensure representativeness. Following the suggestions of Cohen, Manion and Morrison (2013), we calculated the sample size needed, considering the population number, a confidence level of 95% and a confidence interval of ± 3 , resulting in a sample size of at least 523 students (calculated via <http://www.surveysystem.com/sscalc.htm>). The confidence level is an index of how sure we can be (in this case 95% of the time) that the responses lie within a given variation range between the population and the sample mean. The confidence interval is that degree of variation or variation range that one wishes to ensure.

Additionally, Barlett, Kotrlik and Higgins (2001) have suggested that the sample size needed will also vary according to the statistics that will be required to use. In the case of structural equation modelling (detailed below), which requires large samples in order for results to be reasonably stable, the minimum sample size should be thought in terms of the ratio of cases to the number of model parameters that require statistical estimates, being 20:1 an ideal size-to-parameters ratio (Jackson, 2003). Considering that the model to be tested (Figure 9) involves 8 parameters, our sample size should be of at least 160 cases. In more absolute terms, Kline (2010) refers to a minimum of 200 cases as the rule of thumb for sample size in studies where structural equation modelling is used.

Finally, in order to check that the study was planned adequately to find effects on the relationships between the aforementioned variables, an ad-hoc power analysis for multiple regression was conducted using the G*Power software version 3.1.9.2 (Erdfelder, Faul and Buchner, 1996). Considering an effect size of 0.02, a probability of type I error (alpha) of 0.05, power of 0.80, and with 6 predictor variables (the variables of autonomy-support, quantity and quality of feedback, need for autonomy, competence and relatedness, and self-determined motivation were considered as predictors for the power analysis), the minimum sample size resulted in 668 students.

Figure 10. Structure of the Data collection and Analysis process. Source: Own work.



The effect size is the strength of the relationship being examined in the study and measured in statistical units (Stansfield and Gruppen, 2015). As our intention was to find small effects, we set this parameter at 0.02. A type I error is the probability of (incorrectly) finding a statistically significant effect if, in reality, there is no effect. By convention, this parameter is set at 0.05. Power is the ability of a statistical test to detect significant effects that actually do exist. This is related to type II error (beta), which is the probability of not finding a statistically significant result when the tested effect actually does exist. Type II error is conventionally set at 0.20 and it represents the complement of power, which is therefore set by convention at 0.80.

Considering the results of the sample size calculation for representativeness (523 students), the required sample size according to the most conservative statistical test to be used (200 students for structural equation modelling), and the required sample size for our data analyses to achieve a power of 80% (602 students), we set a minimum of 60% response rate (614 students) that would satisfy all the above-mentioned calculations. This was based on the recommendations of Fincham (2008), who postulated this cut-off point for lowering the risk of response bias in survey research. By having access to the whole population, however, we expected the final sample size to be closer to the population number rather than to the 60% cut-off response rate.

4.2.2 Ethical Considerations

This research project was designed and conducted following the ethical code and principles for educational research proposed by Cohen, Manion and Morrison (2007). Therefore, and in agreement with the Declaration of Helsinki (World Medical Association, 2002), approval was obtained from the ethics review committee of the College of Medical, Veterinary and Life Sciences of the University of Glasgow (Appendix V) and from the Dental School of the University San Sebastian (Appendix VI). Additionally, the project was planned to respect the three ethical principles of agreeing individual's rights to privacy, ensuring beneficence and non-maleficence, and justice.

The principle of privacy was addressed by obtaining informed consent from the participating students and by ensuring the anonymity and confidentiality of the data provided. In first place, all students were invited to participate voluntarily, a written explanation requesting signed consent was included at the beginning of the survey package (Appendix VII) with full detailed information on the project through an information sheet (Appendix VIII), and

explaining that they had the right to non-participation and could withdraw from the study at any time, without any consequences. There was no coercion of any type to encourage participation. Moreover, to avoid students' feeling pressure to volunteer; they were invited to participate by one of their teachers who had not taken any responsibilities in the study and not directly by any of the researchers.

As argued by Howe and Moses (1999), the use of an informed consent is intended to respect individuals right to exert control over their lives and to take decisions for themselves. To do so, individuals must be competent to make a correct decision, freely choosing to take part after being given full information, and being able to understand the nature of the research project (Cohen, Manion and Morrison, 2013). All students, who were adults without any cognitive impairment, agreed to participate voluntarily and were presented with the above-mentioned information sheet detailing the procedures of the study, purposes, benefits to be expected, and offering to answer any queries. Hence we, as researchers, were reassured the subjects' rights had been appropriately considered.

To ensure anonymity, none of the information provided by the students revealed their identities. Thus, students were not required to provide their names. The only personal information that was asked from them corresponded to the first six digits (out of seven) of their ID numbers in order to match surveys with concurrent GPA. Consequently, these partially given ID number acted only as a code, and by not having the whole number it made it impossible for anyone to trace a student's name. Concerning permission for accessing students' GPA, they were asked in the informed consent to allow permission for the researcher to obtain these data from the University's administrative department. This information was confidential only to the researcher.

To ensure confidentiality, the data collected from the students was not disclosed in any way that could identify them or that might enable them to be traced. As suggested by Cohen, Manion and Morrison (2013), by means of microaggregation we disclosed the construction of 'average persons' in the reporting of results, either by referring to the overall mean, the distribution by gender or by year of study, rather than presenting any individual data. Moreover, all data were managed by the author, stored in an encrypted file in his personal computer and planned to be eliminated after a period of ten years following the date of submission to the course or subsequent publication. The one element that was disclosed, by request of the dental school, was the institution's name and location. This did not represent a problem, as Walford (2005) argues, some participants or educational institutions (in this

case), may wish or have a right to be identified, as it might advance their cause or institutions.

The second principle concerns non-maleficence and beneficence and deals with risks and benefits pose to participating in the study. In this project the sample was not exposed to any physical or psychological pain or danger (there were no risks of any kind), it did not cause any pain or indignity to the participants, self-esteem was not undermined nor confidence betrayed. Hence no major ethical dilemmas were involved, as the study did not deal with any sensitive topic, the only discomfort to students being the survey package that we asked them to answer.

On the other hand, students were informed of the benefits that this study could bring to current and future students, as the study of academic motivation intends to benefit undergraduate dental education outcomes by contributing to the enhancement of the learning process and approaches to teaching.

Finally, the principle of justice is present by means that all students were invited to participate and no student was denied the possibility of taking part in the study.

4.2.3 Variables and instruments

This section outlines the different variables included in the study and how they were operationalized. We collected data on demographic variables; academic motivation; perception of teachers' autonomy support and quantity and quality of feedback as determinant variables of motivation; perception of the satisfaction of the basic psychological needs as a mediator variable; deep and surface study strategies and academic performance as behavioural outcome variables; and academic self-esteem and vitality as affective outcome variables. We move now to describe these in more detail.

4.2.3.1 Demographic Variables

We collected data concerning age, gender, year of study, and the first seven digits of the students ID number in order to match the surveys with concurrent GPA. These data were collected as they have been referred to (in chapter 2) as intra-interpersonal variables that might influence or confound the scores from students' motivation towards university.

4.2.3.2 Academic Motivation

The central variable for this study was academic motivation; a detailed description of this construct from the SDT perspective has been presented in chapter 1. Motivation was measured using the AMS, which is a 28-item instrument divided in seven subscales of four items each, assessing the three subtypes of intrinsic motivation, in addition to external, introjected, and identified regulation, and amotivation, in a multidimensional approach (Vallerand et al., 1989). Each item constitutes an answer to the question 'Why do you go to University?' on a 7 point Likert scale, from 1 ('does not correspond at all') to 7 ('corresponds exactly'), and with a middle punctuation of 4 ('corresponds moderately'). The subscale scores could range from 4 to 28. A high score on a subscale indicated high endorsement of that particular motivation type. The English version is presented in appendix IX, which is available online and free to use.

We used the Chilean-Spanish version of this instrument, which was validated with a dental student sample by our research team, as part of course 3 of this doctoral programme (Orsini et al., 2015a). The Chilean-Spanish AMS has reported satisfactory internal consistency scores (Cronbach's alpha mean of 0.77), as well as high scores of temporal stability (mean of .74 test-retest correlation). Results of confirmatory factor analysis confirmed the seven-subscale structure over competing models, and construct validity was confirmed through correlation scores between the seven subscales, verifying the presence of the SDT-regulation-types continuum (Fig. 4), with minimum deviations (i.e., representing the continuum of SDT in which adjacent scales show positive correlations, and the subscales at the opposite ends of the continuum display the highest levels of negative correlations). Additionally, the support for the scale's concurrent criterion validity was confirmed by its correlation scores with external constructs, showing that as motivation became more autonomous students reported higher deep motives to study, higher academic self-concept, higher positive emotions and lower surface motives to study (Orsini et al., 2015a). The Chilean-Spanish AMS is presented in appendix X.

Besides the seven subscales of the AMS, we computed the variables of autonomous motivation, controlled motivation and relative autonomous motivation (RAM). As it was mentioned in Chapter 1, autonomous motivation is a measure of the amount of motivation coming from within the individual and it was calculated by summing up the average scores of the intrinsic motivation and identified regulation subscales of the AMS. Controlled motivation is a measure of motivation that has been originated outside the individual, meaning that it was determined by external factors or reasons. Controlled motivation was calculated by

summing up the average scores of the introjected and external regulation subscales of the AMS.

Furthermore, and due to the large number of variables involved in the construct of motivation and the stress this generates on the statistical analyses aimed at testing the overall hypothesised model, the different subscales of the AMS that form autonomous and controlled motivation were combined into an index, the aforementioned RAM. The latter provided a general score of student's levels of self-determination by estimating the degree of autonomous motivation over controlled motivation (Kusurkar et al., 2013a). This was calculated by combining, assigning weights, and adding intrinsic motivation (+2), identified regulation (+1), introjected regulation (-1) and external regulation (-2). Therefore, a positive RAM suggested an autonomous or self-determined profile, which is considered the 'good' type of motivation (Deci and Ryan, 2008b), whereas a negative RAM indicated a controlled or a non self-determined profile. Previous research has reported reliable scores for amotivation, controlled and autonomous motivation (Cronbach's alpha 0.83, 0.74 and 0.75 respectively), and the successful use of RAM to combine the measures of controlled and autonomous motivation (Kusurkar et al., 2013a). It is important to clarify that the subscale of amotivation was not considered neither in the controlled motivation nor in the RAM scores, as research on SDT postulates amotivation to be neither an autonomous nor a controlled form of motivation; it is the lack of it (Deci and Ryan, 2008b) and consequently we approached it as a separate construct in our analyses.

4.2.3.3 Perceived Autonomy Support

Teachers' autonomy support has been referred to as an important variable influencing students' autonomous motivation. It has been highlighted, in section 2.3.2.2, how previous research in HPE has postulated that students' perception of an autonomy supportive climate might facilitate the adoption of an autonomous learning approach and to integrate the material being taught. Furthermore, according to Deci and Ryan (1985a), supporting students' autonomy is an essential aspect that teachers should take into account in their activity.

A context of autonomy support is one that allows students to choose between different options, minimizing the pressure to perform work and encouraging students' own initiative. Students in classrooms with autonomy-supportive teachers, as compared with those with controlling teachers (i.e. providing controlling, punishment or evaluative contingencies), will

be better understood, and the teacher will accept students' decisions instead of directing their way of thinking (Deci, Connell and Ryan, 1989).

To measure this construct in educational settings, Williams and Deci (1996a) developed the Learning Climate Questionnaire (LCQ), which was adapted from the Health-Care Climate Questionnaire (Williams et al., 1996). The LCQ consists of 15 items with a single-factor structure presented in a 7-point Likert scale (ranging from strongly disagree to strongly agree), which reflects the degree in which the students perceive that their teachers support their autonomy. In its original validation study, all items loaded .66 or higher on the single factor with a Cronbach alpha score of .96. The English version is presented in appendix XI. Moreover, subsequent studies have confirmed the single-factor structure as well as reporting high reliability scores (Black and Deci, 2000), and have worked on its parsimony by developing a short LCQ version (6 items) (Ntoumanis, 2005).

In this research, the validated Spanish short-version of the LCQ was used (Nunez, et al., 2012), in which its 5 items are calculated by averaging the individual item scores and where higher average results represent higher levels of perceived autonomy support. In its Spanish validation study, internal validity and reliability were supported by the high fit indices of the single-factor structure through confirmatory factor analysis, a .91 Cronbach alpha score and a 4-week test-retest correlation of .66. Moreover, correlations with the long LCQ-version showed convergent validity scores of .96 in Pearson correlation and .95 in the Gower index. Discriminant validity was analysed by correlating the long version and the constructs of intrinsic motivation ($r = .21$) and students' autonomy need satisfaction ($r = .57$), which were similar to the correlations between the short version and intrinsic motivation ($r = .21$) and students' autonomy need satisfaction ($r = .52$).

The Spanish short LCQ-version is presented in appendix XII. Written permission to use the instrument was requested and granted by the corresponding author (Appendix XIII).

4.2.3.4 Perceived Quantity and Quality of Feedback

Feedback can be defined as a way in which learners become aware of the gap between their current level of knowledge or skill and the desired goal (Wood, 2010). This implies not only that the educational goals are clearly described, but also that students are able and empowered to take the necessary actions to achieve them. Deci (1971) established that the nature of feedback influences the interest and self-determination towards an activity.

If feedback is economic, interest diminishes; however, if the reinforcement is formative and constructive, interest in the activity increases.

To measure this construct, the subscale of quantity and quality of feedback from the validated Spanish version of the Assessment Experience Questionnaire (AEQ) was used (Nunez and Reyes, 2014). The original English instrument was developed by Gibbs and Dunbar-Goddet (2007) to assist teachers in the evaluation of the learning experience of their students and help them to make future changes to enhance the quality of their courses and optimise students' learning experience. It is a 28-item questionnaire presented in a 5-point Likert scale (ranging from strongly disagree to strongly agree), divided in 9 subscales: quantity of effort, coverage of syllabus, quantity and quality of feedback, use of feedback, appropriate assessment, clear goals and standards, surface approach, deep approach and learning from the examination, and an additional final item assessing students' overall satisfaction with a course. Exploratory factor analysis results showed this structure with items loading above .50 and with Cronbach alpha scores between .61 and .85. Specifically, the quantity and quality of feedback subscale is composed of three negatively worded items, in which their higher average score represents a better experience with regards to the quantity and quality of feedback throughout the course. The full AEQ is presented in appendix XIV.

The Spanish version, which has the same structure as the original version has reported acceptable fit indices in confirmatory factor analyses, Cronbach alpha scores between .70 and .74 (.74 for the subscale of quantity and quality of feedback) and 4-week test retest correlations between .52 and .74. The questionnaire was adapted so that students responded to their overall feedback experience in university instead of referring to a specific course. The Spanish version of the AEQ containing the subscale of quantity and quality of feedback is presented in appendix XV. Written permission to use the instrument was requested and granted by the corresponding author (Appendix XIII).

4.2.3.5 Basic Psychological Needs Satisfaction

Central to self-determination theory is the concept of basic psychological needs that are assumed to be innate and universal. According to the theory, the needs for autonomy, competence and relatedness must be constantly satisfied for people to develop and function in healthy or optimal ways (Deci and Ryan, 2000) . As it was outlined in section 1.2.1.2, many of the propositions of SDT derive from the postulate of fundamental psychological

needs, and the concept has proven essential for making meaningful interpretations of a wide range of empirically isolated phenomena.

In this context, and according to the hierarchical model of motivation proposed by Vallerand (1997) (Fig. 3), the basic psychological needs satisfactions represent the psychological mediators between social factors that act as determinants and the facilitation of autonomous motivation over controlled motivation, which in turn will lead to a series of positive outcomes. Therefore, an individual's basic psychological needs satisfaction is postulated to enhance their self-determined motivation.

To measure this construct, Gillet, Rosnet and Vallerand (2008) developed in French the *Échelle de Satisfaction des Besoins Psychologiques* (original French for Basic Psychological Needs Satisfaction Scale) specifically oriented at the sport context. This is a 15-item instrument divided in 3 subscales (autonomy, competence and relatedness) and presented in a 7-point Likert scale (ranging from not at all true to very true). Scores of different items are averaged on the relevant subscale, and a higher score represents a higher degree of satisfaction on a particular need. The construct validity was assessed through good fit indices in confirmatory factor analysis and through the positive and significant correlations in-between the three subscales (basics need of autonomy, competence and relatedness). Additionally, the authors reported Cronbach alpha scores of .71 for competence satisfaction, .82 for autonomy satisfaction and .81 for relatedness satisfaction. The *Échelle de Satisfaction des Besoins Psychologiques* is presented in appendix XVI.

Subsequently, León et al. (2011) validated a Spanish version of the aforementioned scale in the context of education. The resulting instrument has 15 positive voice items presented in a 5-point Likert scale (ranging from totally disagree to totally agree). Correlations between the three subscales were medium-to-strong, positive and significant. Confirmatory factor analyses revealed good fit indices and Cronbach alpha scores were .77 for the autonomy satisfaction subscale, .87 for the competence satisfaction subscale and .88 for the relatedness subscale. Additionally, concurrent validity was assessed by testing a structural equation model where motivational climate had positive and significant regressions weights with the basic psychological needs, which in turn had also positive and significant regressions weights with intrinsic motivation. The model explained 19% of the variance of intrinsic motivation. The Spanish version of the Basic Psychological needs satisfaction is presented in appendix XVII. Written permission to use this instrument was requested and granted by the corresponding author (Appendix XIII).

4.2.3.6 Deep and surface study strategies

Students' approach to learning is a perspective aiming at understanding how students set about the task of learning. This comprises both a motive (why students learn) and a related learning strategy (what students do) (Biggs, 1987), which are sensitive to contextual and intrapersonal factors and generally influence learning outcomes (Biggs, 2001). The constructs of study strategies (deep and surface), as outlined in section 2.3.2.4, have been considered as a behavioural outcome of students' motivation, where autonomous motivation has been associated with higher levels of deep study strategies and controlled motivation has been associated with higher levels of surface study strategies.

To measure these constructs, Biggs, Kember and Leung (2001) developed the Revised Study Process Questionnaire (R-SPQ-2F) that contains 20 items in four subscales (Deep Motive; Deep Strategy; Surface Motive and Surface Strategy) aiming to measure two dimensions: deep and surface approaches. It is assessed on a 5-point Likert scale ranging from 1 ('rarely true of me') to 5 ('always true of me') in which scores are averaged to compute the four subscales. A high score represents a high endorsement towards one of the specific approaches to learning. The instrument's validation study reported good fit indices in confirmatory factor analysis and the four-factor structure was confirmed by means of exploratory factor analysis. Cronbach alpha scores ranged from .57 to .72. The original full English version containing the deep and surface study strategies subscales is presented in appendix XVIII.

The subscales of deep and surface study strategies of the Spanish version of the R-SPQ-2F, validated by Justicia et al. (2008), were used in this study. It has the same presentation as the original English version. Exploratory factor analysis resulted in the same four-factor structure as the original instrument and confirmatory factor analysis showed better fit indices of this structure over competing models. The Spanish version of the instrument is presented in appendix XIX. Written permission to use this instrument was requested and granted by the corresponding author (appendix XX).

4.2.3.7 Academic performance

The second behavioural outcome variable integrated in the hypothesised model corresponded to academic performance. As it was reported in section 2.3.2.4, previous research has informed that medical and psychology students engaging in academic activities out of autonomous motivation exhibited a higher academic performance, and that

this diminishes when behaviour is initiated out of controlled motivation or when students experience amotivation. A previous study conducted by our research group involving the same dental student population as the current study, yield inconclusive results and associations between motivation and academic performance in the form of cumulative GPA (Orsini et al., 2015a). As motivation, however, is a dynamic variable, one of our learning points was that further research should focus on testing the association of concurrent academic performance instead of cumulative. As such, this study aims at testing students' GPA results from the current semester when the research took place.

As mentioned above, the university's administrative department provided these data after all participating students granted permission to access. Despite Vallerand et al. (1993) reported a positive and significant association between self-reported GPA and autonomous motivation, we opted for a more objective measure of students' GPA in order to enhance the reliability of our results. Several authors have supported this approach (Cokley, et al, 2001; Fairchild, et al., 2005; Baker, 2004).

4.2.3.8 Academic self-esteem

Self-esteem has been considered as an important component of self-concept and it has been defined as an individual's set of thoughts and feelings about one's own worth and importance, that is, a global positive or negative attitude towards oneself (Rosenberg, 1965). Overall, the benefits of high self-esteem are mostly related to enhanced initiative and pleasant feelings (Baumeister, et al., 2003). As such, teachers, parents, therapists, and others have focused efforts on boosting self-esteem as a way to promote positive outcomes and benefits.

Previous research on SDT has reported a positive correlation between autonomous motivation and self-concept (Orsini et al., 2015a), therefore, we hypothesised that higher self-determination levels will be positively associated with higher self-esteem.

The Rosenberg Self-esteem Scale (RSES) (Rosenberg, 1965), which is one of the most extensively used instruments to assess this construct, was used to measure self-esteem as an affective outcomes of motivation. This is a unidimensional instrument elaborated from a phenomenological conception of self-esteem that captures subjects' global perception of their own worth by means of a 10-item scale, 5 positively worded items and 5 negatively worded items rated on a 4-point Likert scale, ranging from 1 (totally disagree) to 4 (totally

agree). The total self-esteem level is calculated by summing the scores for all ten items on a continuous scale. Higher scores indicate higher self-esteem. The original English version of the RSES is presented in appendix XXI.

Martin-Albo, et al., (2007) translated and validated a Spanish version of the RSES in the higher education context. The Spanish-RSES has the same presentation and structure as the original instrument, which was assessed by means of confirmatory factor analysis. Reliability was assessed with Cronbach's alpha and by a 4-week test-retest correlation. The values obtained in the first and the second administration were .85 and .88, respectively, with a test-retest correlation of .84. Concurrent criterion validity was assessed by means of Pearson's correlation between self-esteem and five self-concept dimensions (academic, social, emotional, family, and physical). These correlations were all positive and medium-high, with values between .28 and .50. The Spanish version of the instrument is presented in appendix XXII. Written permission to use this instrument was requested and granted by the corresponding author (Appendix XXIII).

4.2.3.9 Vitality

The concept of subjective vitality refers to the state of feeling alive, alert and to having energy available to the self. Vitality is considered an aspect of eudemonic well-being, as being vital and energetic is part of what it means to be fully functioning and psychologically well (Ryan and Deci, 2001).

As outlined in section 1.2.1.3, self-determined motivation has been considered an important predictor of students' affective outcomes. As such, vitality was chosen as one of the variables to represent affective outcomes considering that previous research has found that autonomous motivation leads to higher levels of vitality when compared to controlled motivation (Nix, et al., 1999). Additionally, in educational settings, Nunez, et al., (2015) reported that teachers autonomy support predicted students' autonomy, which in turn, predicted positive changes in vitality.

To measure this construct, Ryan and Frederick (1997) developed the subjective vitality scale, in which vitality is understood as an individual difference and it has been found to positively relate to self-actualization and self-esteem and to negatively relate to depression and anxiety. A second version of this instrument assesses the state of subjective vitality rather than its enduring aspect. At the state level, vitality has been found to relate negatively

to physical pain and positively to the amount of autonomy support in a particular situation (Nix et al., 1999). In this research we were interested in measuring vitality as an individual difference and at the educational contextual level rather than involving a particular situation.

The original scale has 7 items, 6 positively worded and 1 negatively worded presented on a 7-point Likert scale ranging from 1 (not true at all) to 7 (very true). In a subsequent validation study, Bostic, Rubio and Hood (2000) used confirmatory factor analysis and indicated that a 6-item version (deleting the 1-item negatively worded) worked even better than the 7-item version. The scale score is calculated by averaging the individual items scores, where a higher score represents a higher vitality level. The original subjective vitality scale is presented in appendix XXIV.

Balaguer, et al., (2005) validated a Spanish version of the subjective vitality scale. This version has the same presentation based on the aforementioned 6-item version. Subsequent studies have reported acceptable levels of the instrument's internal consistency and have also tested models where an autonomy supportive climate predicts higher levels of vitality (Alpha Cronbach ranging from .75 to .84) (Alvarez, et al., 2012; Balaguer, et al., 2011). The Spanish version of the instrument is presented in appendix XXV. Written permission to use this instrument was requested and granted by the corresponding author (Appendix XXVI).

4.2.4 Instruments' Face-Validity

In spite having access to use the Spanish versions of the aforementioned instruments, previous researchers have suggested the importance of face-validating Spanish-developed instruments when the intention is to use them in Latin American contexts, mainly due to the inherent linguistic differences (Nunez, Martin-Albo and Navarro, 2004; Stover et al., 2012). The concept of face-validity refers to whether the questions asked look as if they are measuring what they claim to measure (Cohen, Manion and Morrison, 2013). Therefore, previous to their application, the Spanish-versions of all the instruments were revised by a panel of three faculty native Chilean-Spanish speaker to assess their cultural equivalence to the original instruments. Minor changes were made and the resulting instruments were subsequently presented to a group of ten recently graduated students who expressed no observations or misunderstandings. This process resulted in face-valid Chilean-Spanish instruments. The one exception to this process was the AMS, which had

been previously validated specifically to the Chilean higher education context. Additionally, all instruments were adapted so they specifically refer to the university context.

4.2.5 Data collection process

After permission to access the students was granted by the leadership of the dental school and ethics approval was obtained, the classrooms were selected and one faculty from year one to year six was contacted to apply for permission to survey the students at the end of one lecture. For each year of study, students were invited to voluntarily participate in a confidential paper-based survey. As explained above, this paper-based survey contained an informed consent form, a participant information sheet and the aforementioned self-reported instruments. Students were informed that we were interested in better understanding the reasons why they go to the university and how this influenced educational outcomes. We requested their cooperation and, to avoid possible social desirability effects, we urged them to respond the questionnaires as honestly as possible with no time limitations. It took them approximately 20 minutes to complete the survey package.

One faculty staff member of the dental school, who was previously trained by the research team, was present during the administration of the instruments and provided students with the help needed to successfully complete the questionnaire package.

Despite the research team being based in Glasgow and the study taking place in Chile, a face-to-face survey was opted instead of an online survey mainly because of the support and collaboration from the leadership and faculty staff of the dental school of the University San Sebastian, which allowed the successful administration of the questionnaire package through a paper-based questionnaire. Additionally, Cohen, Manion and Morrison (2013) have argued that face-to-face surveys should be favoured over electronic ones when resources permit, as online survey response rates in educational research can be as low as 20-30%.

Once the students answered the questionnaire package, these were sent to the research team for coding and data analysis purposes. As it was mentioned in section 4.2.2, students who agreed to participate provided the first six digits of their ID numbers. A list of these was sent to the University's administrative department so it could be matched with the students' GPA of the concurrent semester at the time the study took place.

4.2.6 Data Analysis

Data were analysed with the PASW Statistic (v 22.00; SPSS® Inc., Chicago, IL) and AMOS® (v 20.0; SPSS Inc.) software and the alpha level was set at ≤ 0.05 . The author undertook specific training in order to use these software, provided by the '*Research Training Programme and Personal Development Planning for Postgraduate and Postdoctoral Researchers*' from the College of Medical, Veterinary and Life Sciences of the University of Glasgow. The data analysis procedures outlined below were discussed with a statistician from the Medical School, who provided support and guidance in reaching the final statistical analysis plan.

4.2.6.1 Data Screening

After coding the data and reversing scores in the quality and quantity of feedback and self-esteem scales, the first step in the statistical analysis plan was to ensure that data were reliable and valid for testing the proposed model. This stage was conducted following the suggestions by Field (2013) and Lynch (2007) for data screening. It involved three steps: case screening, variable screening and meeting the assumptions of the general linear model. We started from the base that, in case of having missing values, we would only delete data under 10% of the total sample, so to avoid sample bias. If more than 10% of the sample was deleted, the risk of not being able to calculate the estimated model increased, as structural equation modelling requires a certain number of data points in order to compute estimates. Additionally, greater model complexity (number of items and number of paths) and improved power require large samples.

4.2.6.1.1 Case Screening

The case screening was aimed to analyse three aspects of the collected data: missing values, unengaged responses and outliers. First, missing data by cases were identified and it was considered acceptable to have a maximum of 10% of missing values per total variables in the data set. Our data contained 82 variables; therefore a case was listwise-deleted if having more than 8 missing values.

Secondly, unengaged responses were analysed. This corresponds to subjects that answered with the exact response value or with a defined pattern to every single question. In order to identify unengaged responses, the standard deviation for all variables (excluding

demographic variables and GPA) on each case was calculated. If a case had a standard deviation of less than 0.5 it meant that there was very small variance in their responses, so they were inspected one-by-one to evaluate their engagement level. If no or little engagement was evidenced (e.g., answering with a 4 to every Likert scale), the case was deleted.

The third step was to test for outliers that might have influenced the results, pulling the mean away from the median. Outliers, however, were neither considered in the Likert scale-type responses nor in the data of gender, year of curriculum or GPA, as answers at any extremes were not considered as representative outlier behaviour. Concerning the variable of age, we did not inspect for outliers, as we were interested in all subjects independent of their age.

4.2.6.1.2 Variable Screening

This phase was aimed on the one hand, at identifying missing values by variables and on the other hand, to impute data. The goal of imputation is to estimate what the missing value might have been, often considering values for other variables that have been collected. Amongst the simpler of these techniques are single imputation methods, in which each missing value is filled in with one plausible value. For instance, there is mean or median substitution, in which the average or middle value of a variable across the sample is imputed for missing observations of that variable, or regression imputation, where the missing observation is imputed using the prediction taken from a multiple regression analysis (Finch, 2016). A more complex form is multiple imputation, in which each missing value is replaced with multiple plausible values. This creates multiple possible datasets. Then, these datasets are 'pooled' together to arise with one result (Finch, 2016).

Missing 10% or less of a variable is not considered to be problematic, therefore all variables missing less than 94 values (out of a total of 941 data) were moved forward to single data imputation instead of pairwise deletion. If a variable was identified as having more than 10% of missing data, more complex imputation techniques would be required. If this was the case, we planned to check if these data were missing completely at random, at random or not missing at random and to run models with and without multiple imputations of those missing values to evaluate how sensitive the results were. The screening, however, identified a maximum of 36 (3.8%) missing values per variable, and thus all of these underwent single imputation. Missing values were identified in the Likert scale-type, age and GPA variables. All Likert scale-type variables were replaced by the median and the age and GPA missing values were replaced by their mean. Compared to pairwise deletion, this

method has the advantage of retaining sample size. The downside is that it may potentially decrease standard deviation and standard errors and could create smaller confidence intervals, however, this is much more likely when it is used to replaced large quantities of missing values and in which case, multiple imputation techniques should be favoured (Scheffer, 2002).

4.2.6.1.3 Assumptions of the general linear model

The final step in the data-screening phase was to assess the assumptions of the general linear model and multivariate data analysis. Most sources of bias come in the form of violations of these assumptions, therefore the objective was that we could be sure that these assumptions were true and know that we could take the test statistic associated with a model at face value and interpret it accordingly (Field, 2013). These assumptions correspond to linearity; homoscedasticity; non-multicollinearity; independent errors and normality. We proceed to describe and test them following the recommendations from Field (2013).

In first place, the assumption of linearity means that the outcome variable is, in reality, linearly related to any predictors, and if there are several predictors then their combined effect is best described by adding their effects together. This assumption is the most important because if it is not true then even if all other assumptions are met, the model would be invalid because it has been described incorrectly (Kline, 2010).

Secondly, homoscedasticity means that the variance of the residual terms at each level of the predictor variables should be constant. In other words, the residuals at each level of the predictors should have the same variance; if unequal, there is said to be heteroscedasticity. Violating this assumption invalidates confidence intervals and significance tests (Kline, 2010).

As linearity and homoscedasticity are both related to the errors (residuals) in the model we fit to the data, these assumptions can be tested by creating a scatterplot of the values of the residuals against the values of the outcome variables predicted by the model (Field, 2013). In these graphs we assessed whether there was a systematic relationship between what comes out of the model (the predicted values) and the errors in the model. If linearity and homoscedasticity hold true then there should be no systematic relationship between the errors in the model and what the model predicts. If the graph funnels out, chances are that there is heteroscedasticity and if there is any sort of curve, then there are chances that the

data has violate the assumption of linearity. The graphs between the independent variables (quantity and quality of feedback, autonomy support and academic motivation) and the five outcome variables (GPA, Deep and surface study strategies, self-esteem and vitality) are presented in appendix XXVII, where all of them show points randomly and evenly distributed throughout the plot indicating a situation in which the assumptions have been met.

Thirdly, multicollinearity means that the variance that independent variables explain in the dependent variables are overlapping with each other, not explaining each a unique variance in the dependent variables. The best situation occurs when independent variables have high correlations with the dependent variable but not with one another. Having high inter correlated independent variables is called multicollinearity, in which case, these variables are measuring the same thing (Dancy and Reidy, 2007). In other words, perfect collinearity exists when there is a strong correlation between predictors. This is not desirable as it makes the results from regression analyses untrustworthy, it limits the size of correlations and it makes it difficult to assess the individual importance of a predictor (O'Brien, 2007). One way to check this is to calculate a Variable Inflation Factor (VIF), which indicates whether a predictor has a strong linear relationship with another predictor, and through the VIF's reciprocal that is the Tolerance. If the largest VIF is greater than 10 then there is a cause of concern (Bowerman and O'Connell, 1990), and if the tolerance values are less than 0.10 it indicates a serious multicollinearity problem (Menard, 1995). Results are reported in appendix XXVII, where all predictors (i.e., all variables but the outcome ones) showed VIF values below 10 and tolerance values above 0.10.

Fourth, the assumption of independent errors means that the errors in the model are not related to each other. In other words, for any observations the residual terms should be uncorrelated. If they were not independent, the equation to estimate the standard errors would be invalid and so would be the confidence intervals and significance tests (Field, 2013). The assumption can be tested with the Durbin-Watson statistic, which tests whether adjacent residuals are correlated. Values less than 1 or greater than 3 are cause of concern, with a value of 2 meaning that residuals are uncorrelated (Durbin and Watson, 1951). Durbin-Watson test results for each outcome variable are reported in appendix XXVII, where all scores were above 1 and below 3.

Finally, the assumption of normality refers to the normal distribution of the data for the outcome variables. It is characterised by the bell-shaped curve, implying that the majority of the scores lie around the centre of the distribution (Field, 2013). If this assumption is violated

it may bias the parameter estimates, invalidate confidence intervals and derive inaccurate significance testing.

Normality was assessed by shape and by skewness and kurtosis scores. First, frequencies of the outcome variables were plotted in histograms (frequencies of the variables compared to the normal curve) and p-plots (cumulative probability of a variable against the cumulative probability of the normal distribution). These graphs are presented in appendix XXVII and showed that the frequency distribution of the outcome variables followed the normal distribution with minor skewness deviations. A second approach was to assess the skewness (Lack of symmetry) and kurtosis (Pointiness) scores of the outcome variables. Authors such as Curran, West and Finch (1996) and Finney and DiStefano (2013) have suggested that univariate normality should be considered when values are below 2 and 7 for skewness and kurtosis, respectively.

As can be seen from Table 8, all outcome variable values of skewness and kurtosis are below 1. While the data collected was considered to be normally distributed, it is important to say that normality issues affect small sample sizes (<50) much more than large sample sizes (>200). This is mainly because of the central limit theorem (Lumley, et al., 2002), which postulates that regardless of the shape of the population, parameter estimates of that population will have a normal distribution provided the samples are big enough. As such, when estimating parameter of a model, constructing confidence intervals or computing significance tests in large samples, normality can be assumed regardless of the shape of the sample data (Field, 2013)

4.2.6.2 Reliability analysis

Before conducting descriptive and inferential analyses, we assessed the reliability of all face-validated questionnaires. Reliability means that a measure or questionnaire should consistently reflect the construct that it is measuring (Field, 2013). In other words: all being equal, a person should get the same score on a questionnaire if they complete it at two different points in time. Another way to look at reliability is to say that two people who are the same in terms of the construct being measured should get the same score. In statistical terms, the usual way to look at reliability is based on the idea that individual items should produce results consistent with the overall subscale or questionnaire (Field, 2013).

Amongst the different ways by which reliability has been reported in the literature, the coefficient alpha is the most common (Kline, 2010). This measure, also called Cronbach's

alpha, measures internal consistency reliability as the degree to which responses are consistent across items within a measure (Cronbach, 1951). If internal consistency is low, then the content of the items may be so heterogeneous that the total score is not the best possible unit of analysis for the measurement. Internal consistency is greater as the mean inter-item correlation is increasingly positive.

Generally, reliability coefficients around .90 are considered “excellent”, values around .80 are “very good”, and values around .70 are “adequate”. When dealing with psychological constructs, however, values between .50 and .70 can, realistically, be expected because of the diversity of the constructs being measured. Notwithstanding, if internal consistency is less than .50, most of the observed score variance would be due to random error, which is an unacceptable amount of imprecision in most research (Kline, 2013). Consequently, if a measure was found to be less than .50 it was considered unacceptable and it was further analysed to assess conflicting items. This was done by means of correlations between items and by evaluating the Cronbach’s alpha if the conflicting item was deleted.

4.2.6.3 Descriptive analysis and group comparison

After assessing the internal consistency of all scales, we conducted descriptive statistics and group comparison to explore and assess differences in all constructs regarding gender and year of curriculum so as to include them in our hypothesised model.

First, based on the scale items, we calculated the continuous scores for all variables and computed means, standard deviations, skewness and kurtosis. As discussed in section 4.2.6.1.3, we considered univariate normality when skewness and kurtosis scores were below 2 and 7, respectively (Curran, West and Finch, 1996; Finney and DiStefano, 2013).

Second, in order to assess gender differences between the studied variables, we conducted a series of independent-samples t-tests, which are used when there are two conditions and different participants are assigned to each condition (i.e., females and males). Additionally, we calculated a confidence interval for each test, which is a range of scores constructed such that the population mean will fall within this range in 95% of samples. In other words, rather than fixating on the single value from the t-test in the sample, we used these confidence intervals to set a lower and upper limit in which the population is believed to fall. If the interval is small, the sample mean must be very close to the true mean. Conversely, if the confidence interval is very wide then the sample mean could be very different from the

true mean, indicating that this is a poor representation of the population (Field, 2013). To reduce potential bias in the data, we used bootstrapping (allowing estimation of the sampling distribution) to generate robust confidence intervals for the difference between means.

Finally, in order to report if the effects were important, we computed effect sizes based on Cohen's *d*, which is an objective and standardised measure of the magnitude of the observed effect. A "d" of 0.2, 0.5 and 0.8 are considered small, medium and large effect sizes, respectively (Cohen, 1992).

Third, to assess year-of-curriculum differences between all variables, we conducted a multivariate analysis of variance (MANOVA). This test is used to assess the differences between groups across several dependent variables simultaneously. We opted for MANOVA instead of conducting separate univariate analysis of variance tests (ANOVA) for each dependent variable, as it has been shown that when carrying multiple ANOVA tests on the same data this might inflate the Type I error (Field, 2013). Additionally, when conducting separate ANOVAs, any relationship between the dependent variables is ignored, which is overcome and taken into account by MANOVA.

The MANOVA test statistic informs about the overall effect of year of curriculum on the studied variables, and subsequently it informs the specific significance and effect size for year-of-curriculum and each dependent variables. The effect size statistic corresponded to the eta-squared, in which a small effect is considered when scores are between 0.01-0.06, a medium effect is considered with results between 0.06-0.138, and a large effect is when scores are above 0.138 (Pallant, 2007). The eta-squared results are equivalent to the percentage of explained variance in the dependent variables (e.g., an eta-squared of 0.356 is equivalent to a 35,6% of explained variance).

Finally, post-hoc tests were conducted to assess significant differences within different years of curriculum and each dependent variable. The post-hoc Hochberg's GT2 test was used because of its robustness when sample sizes are different between groups. Additionally, the Games-Howell test was also conducted to assess differences in situations in which population variances differ (Toothaker, 1993).

4.2.6.4 Bivariate Correlations

A complete study of motivation and its determinants and outcomes should not come without a full correlational analysis of the different measures. As suggested in section 1.2.2, testing the aforementioned model relying on the RAM index (in our case) reduces the number of latent variables, however, its exclusive use may lead to incomplete information concerning the different types of motivation and regulations and their specific correlation to other relevant variables within the study. As such, we calculated the bivariate correlations amongst all studied constructs by means of Pearson's correlation coefficient (Miles and Banyard, 2007). This measure standardises the covariances and provides a value that lies between -1 and +1. A coefficient of +1 indicates that two variables are perfectly positively correlated, whereas a value of -1 indicated a perfectly negative relationship. A coefficient of zero indicates no linear relationship at all, and so if one variables changes the other stays the same. The correlation coefficient has been commonly used as a measure of the size of an effect, with values of ± 0.1 representing a small effect, ± 0.3 a medium effect and ± 0.5 a large effect (Field, 2013).

4.2.6.5 Mediation

The mediating role of the basic psychological needs was tested as this has been referred to by the SDT model (Fig. 1 and 3) as fundamental to facilitate and maintain optimal forms of motivation in students. Therefore we focused on mediation instead of a moderator analysis, aiming to explain the association between predictors and students' motivation. This leaves room for future research to test moderators that could strength this association, such as gender, age and year or study, which were used as controlling variables in this research.

Mediation refers to a situation when the relationship between a predictor variable and an outcome variable can be explained by their relationship to a third variable (the mediator). SDT postulates that motivation is determined by social factors, which are mediated by perceptions of the satisfaction of the needs of autonomy, competence, and relatedness (See section 1.2.2). As such, we aimed to assess the influence that autonomy-support and quantity and quality of feedback have on students' motivation and to test the mediating effect of the satisfaction of the three basic psychological needs.

Mediation is said to have occurred if the strength of the relationship between the predictor and the outcome is reduced by including the mediator and by assessing the significance and effect size of the indirect effect, i.e., the effect of the predictor on the outcome through the mediator (Field, 2013). Consequently, and according to the Barron and Kenny (1986) approach, we tested two regression models for each predictor:

1. A regression model predicting RAM from autonomy-support/ quantity and quality of feedback, without including the mediator.
2. A regression model predicting RAM from the predictor variables, including the mediator. Here, the three basic psychological needs were merged into one variable by summing and averaging their scores. In this model the path between the predictor and mediator was assessed, as well as the path predicting RAM from both- predictor and mediator.

These regressions test four conditions of mediation. First, the predictor variable must significantly predict the outcome variable in regression 1. Second, the predictor variable must significantly predict the mediator in regression 2. Third, the mediator must significantly predict the outcome variable in regression 2. And finally, the predictor variable must predict the outcome variable less strongly in model 2 than in model 1 (Baron and Kenny, 1986).

One limitation of the Baron and Kenny (1986) approach is the importance given to the all-or-nothing thinking that p-values encourage (Field, 2013), which can be biased by factors such as sample size. Therefore, an additional approach to assess mediation, proposed by Preacher and Hayes (2004), was used to estimate the indirect effect with its significance, confidence interval and effect size.

The indirect effect is the combined effect of the paths between predictor-mediator and mediator-outcome. The significance of this effect was assessed using the Sobel test (Sobel, 1982), which if significant, means that the predictor significantly affects the outcome via the mediator. To increase the robustness, however, we also computed confidence intervals for the indirect effect using bootstrap methods. If the confidence interval contained zero then we could not be confident that a genuine mediation effect exists, whereas if it did not contain zero we could conclude that the mediation has occurred. Finally, the effect size was assessed using the kappa-squared measure (k^2), which expresses the indirect effect as a ratio to the maximum possible effect that you could have found given the design of the study (Preacher and Kelley, 2011). A value close to 0 means that the indirect effect was very small relative to its maximum possible value, and values close to 1 mean that it was as large as it

could possibly be given the research design. A value of .01 was considered as a small effect and a value around .09 corresponded to a medium effect, while values in the region of .25 were considered as a large effect (Preacher and Kelley, 2011).

By applying these two approaches to test mediation to each of the predictor variables, we were able to assess significant relationships as well as to estimate the indirect effect and its confidence interval to report the degree of mediation observed in the data.

4.2.6.6 Structural equation modelling

After testing the mediating effect of basic psychological needs and in order to assess the model depicted in figure 9 as a whole, we conducted a structural equation model analysis to test the overall relations in the entire sample and compare them by gender and year of study. Structural equation modelling is a family of statistical techniques used for the systematic analysis of multivariate data to measure observable and underlying hypothetical constructs (latent variables) and their interrelationships (Violato and Hecker, 2007). As such, we chose structural equation modelling as it allows the translation of the proposed theory into a testable model.

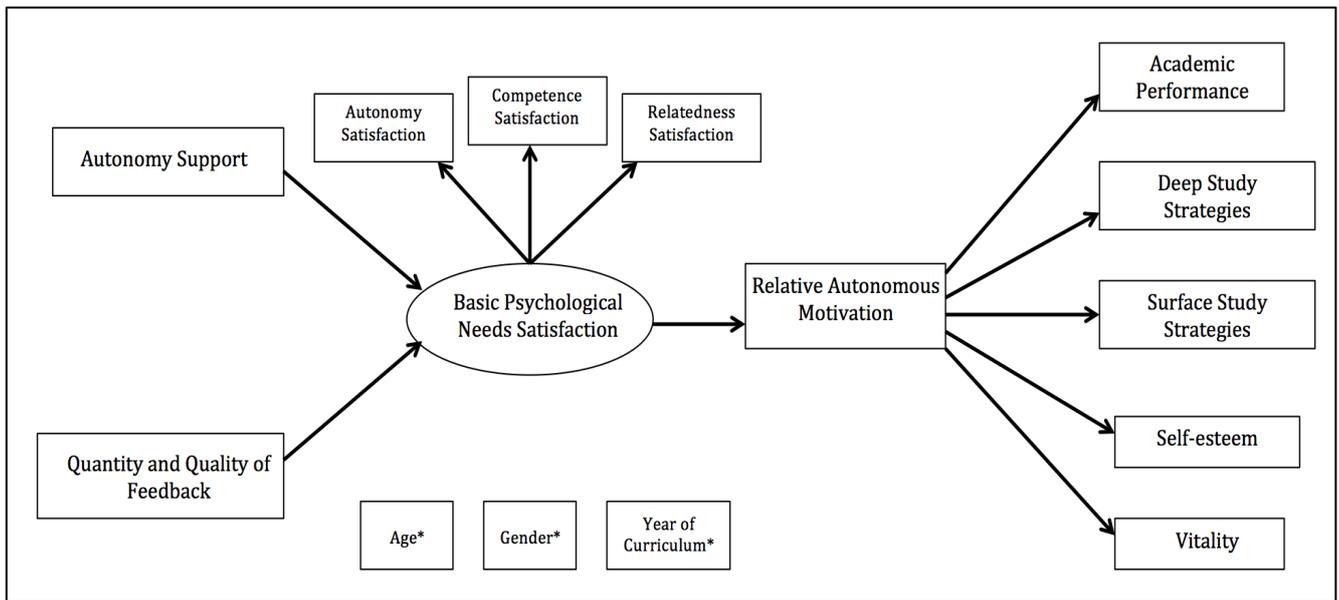
Structural equation modelling builds on statistical techniques such as correlation, multiple regression, and ANOVA and combines the strength of confirmatory factor analysis (CFA) to assess model fit, with the multi-regression techniques of path analysis to explicate the relationships between variables (Bollen, 1989). Additionally, Violato and Hecker (2007) have highlighted structural equation modelling as a useful research and statistical method for medical education research and refer to it as having the potential for advances in the field, however, at present it has not been used extensively in the biomedical literature.

We followed the steps suggested by Kline (2010), which stipulate (1) model specification, (2) evaluation of model identification, (3) selecting the measures and (4) estimating the model – evaluating model fit and interpreting parameter estimates.

The first step, specification, refers to representing the hypothesis in the form of a structural equation model. In other words, it is the act of formally stating a model. The specified model is presented in Figure 11, in which its structure and directionality was based on the postulates of SDT. This model expands the scheme presented in Figure 9 by adding the latent variable of basic psychological needs satisfaction (with its the three indicators of

autonomy, competence and relatedness), the measure of RAM to represent self-determined motivation and the controls of age, gender and year of study. The models testing gender and year-of-study differences did not include the controls of gender and year-of-study, respectively.

Figure 11. Specified model for structural equation modelling analysis. Note: Residuals, covariances and regression paths of control variables have been omitted to simplify the model visualization. Observable variables are represented with rectangles and latent variables with an ellipse. *Control variables. Source: Own work.



We decided to control for the effects of the latter variables as previous literature has argued their potential confounding effects in the study of academic motivation (see section 2.3.2). Moreover, based on the above-mentioned mean comparison and correlation analyses, this was taken a step forward as we specifically controlled these confounding variables on the constructs in which we found significant results.

Secondly, identification, refers to the relationship between what will be estimated (the parameters) and the information used to derive these estimates (observations) (Kline, 2010). Therefore, a model is identified if it is possible to find unique values for the parameters of the specified model (Violato and Hecker, 2007). As a rule of thumb, a model must meet two conditions to be identified: (1) the degrees of freedom must be at least zero ($df \geq 0$), meaning that the information in the data is equal to or exceeds the information being estimated (unknown values such as parameters estimations), and (2) the data should contain multiple indicators of each latent variable, in which models with one latent construct should have three indicators for identification, while models with two or more latent variables should have

two or more indicators for identification. The model presented in Figure 11 was considered identified as it met both latter conditions: the one latent construct included (basic psychological needs) has three indicators, and the model for the overall sample and the comparison by gender and year-of-study had 44, 68, and 216 degrees of freedom, respectively (detailed in the next chapter).

The third step, selecting the measures and screening them, was covered in sections 4.2.3 and 4.2.6.1. All measures were selected based on theory and assessing previous validation studies with acceptable internal consistency, which involved independent samples derived from similar populations. Moreover, we tested each measure's internal consistency and, by means of correlation and group differences analysis, construct and criterion validity was assessed specifically in the context of this study, contrasted to SDT and the results from previous studies.

Finally, the model was estimated to assess the goodness-of-fit of the model to the data and to derive parameter estimates through the maximum likelihood method. The latter is a normal theory method in which the estimates are the ones that maximise the likelihood that the data were drawn from the population. It is the default method in most SEM analyses and the most widely used for continuous outcomes (Kline, 2010).

First, the goodness-of-fit answers the questions on how well does the model fit the observed data (Violato and Hecker, 2007). As there is no statistical "gold standard" in structural equation modelling that automatically and objectively leads to the decision on whether to reject or retain a model, no set of fit statistics is considered as definitive. As such, Kline (2010) recommends to combine several fit statistics as a rigorous approach to hypothesis testing. The two main classes of fit statistics correspond to (1) model test statistics and (2) approximate fit statistics.

On the one hand, model tests statistics assess whether the model covariance matrix is equivalent to the data covariance matrix, in which differences might reasonably be considered as being due to sampling error. The chi-square test (χ^2) is the most commonly used model test statistic, which is scaled as a "badness-of-fit" statistic because the higher the value, the worst the model's correspondence with the data. This means that a statistically significant result (e.g., $p < .05$) indicates problematic model-data correspondence (Kline, 2010; Violato and Hecker, 2007). The chi-square statistic, however, should not be used as the sole criterion for fit because it has a number of technical problems (sensitivity to sample size, not interpretable in a standardized way, inflated Type I error rate for model rejection) as used in SEM (Violato and Hecker, 2007). In the context of this study, and

considering the aimed large sample, the sensitivity to sample size becomes a relevant limitation, where significant X^2 results should not come as surprise.

On the other hand, approximate fit indexes do not distinguish between what may be sampling error and what may be real covariance evidence against the model. These indexes are intended as continuous measures of model-data correspondence, where some measures are scaled as “badness-of-fit” statistics, but most are scaled as goodness-of-fit statistics because the higher their values, the closer the model-data correspondence. Of these, the most widely reported in the structural equation modelling literature correspond to the Goodness of Fit Index (GFI), the Comparative Fit Index (CFI) and the root mean square error of approximation (RMSEA) (Kline, 2010).

The GFI estimates the proportion of covariances in the sample data matrix explained by the model. In other words, it estimates how much better the researcher’s model fits compared with no model at all (Jöreskog, 2004). The CFI measures the relative improvement in the fit of the researcher’s model over that of a baseline model, typically the independence model (Bentler, 1990). The range of values for both- GFI and CFI is generally 0-1.0, where values of .90 or higher indicate an adequate fit (Bentler, 2006; Byrne, 2001). The RMSEA with its 90% confidence interval is used to compare the fit of two or more different models of the same data, favouring the simpler model. It is scaled as a “badness-of-fit” index, where a value of zero indicates the best fit and values less than .08 are considered acceptable (Browne and Cudeck, 1992).

Finally, estimates of the relationships between variables were estimated. The path coefficients, both unstandardized and standardised, were interpreted as regression coefficients in multiple regression. Unstandardized regression coefficients reflect the scales of their respective predictors, therefore values from predictors with different raw score metrics are not directly comparable. Thus we reported the standardised regression coefficients (associated with the unstandardized significance), which can be directly compared across predictors and which also reflect the effect sizes.

This chapter has described the methods adopted in this investigation so as to answer the research questions and cover the principles of the research. The next chapter moves on to report the results of such methods.

5. Results

*Two modified versions of this chapter have been presented at international conferences, one has been published, and one has been submitted for publication:

- Poster presentation: Orsini C, Binnie VI. **The Mediating Role of Basic Psychological Needs Satisfaction between Autonomy-Support and Self-determined Motivation in Dental Education.** In: Annual Conference of the Association for Medical Education in Europe (AMEE). Barcelona. August 2016.

- Selected oral presentation: Orsini C, Binnie VI. **The Mediating Role of Basic Psychological Needs Satisfaction between Quality-Quantity of Feedback and Self-determined Motivation in Dental Education.** In: Annual Conference of the Association for Dental Education in Europe (ADEE). Barcelona. August 2016.

- Orsini C, Binnie VI, Fuentes F, Ledezma P, Jerez O. **Implications of motivation differences in dental students' preclinical-clinical transition: A one-year follow-up study.** *Educ Med.* 2016;17(4):193-196. <http://dx.doi.org/10.1016/j.edumed.2016.06.007>

- Orsini C, Binnie VI, Wilson S, Villegas MJ. **Learning climate and feedback as predictors of dental students' self-determined motivation: The mediating role of basic psychological needs satisfaction.** (Submitted for publication). 2017.

The results from the systematic review (Chapter 2) guided the formulation of the research questions and the selection of the included variables. An autonomy-supportive learning climate and feedback were referred by previous research as important predictors of students' motivation, and in turn behavioural and affective outcomes (such as performance, learning strategies, self-esteem and vitality) have been suggested as being influenced by students' motivation. The identified gap on the mediating effect of basic psychological needs was also transferred to the aims of the present research. Moreover, the identified methods and suggestions for future research informed the data analyses phases and how the results are reported.

Out of 1,024 students, a total of 941 completed and returned the questionnaires. When screening by case, 17 students presented more than 10% of missing data (more than 8 variables missing) and were therefore deleted. No unengaged responses or outliers were identified. When screening by variables, no data presented more than 10% of missing values. Consequently, after single imputation of missing values, the final sample was of 924 students, with an average age of 22.8 (SD= 3.36). This was above all the sample calculations conducted in section 4.2.1 and represented a 90.2% response rate. There were 583 (63%) women and 341 (37%) men. The distribution per year of study was as follows: 137 (15%) first year, 166 (18%) second year, 242 (26%) third year, 170 (18%) fourth year, 139 (15%) fifth year, and 70 (8%) sixth year. These frequencies broadly correspond to the percentage of students in the total dental student population, so we therefore considered the sample to be representative.

5.1 Reliability of measures

As shown in table 7, the reliabilities of the scales used, i.e., Cronbach's alpha values, ranged from .641 to .912, which were in line with those found in previous studies described in section 4.2.3. Four out of the nineteen used scales showed values under .70.

Firstly, the identified regulation subscale of the AMS showed a value of .687, which is consistent with previous studies conducted in medical (Kusurkar et al., 2013a), dental (Orsini et al., 2015a) and general higher education (Nunez, Martín-Albo and Navarro, 2004; Nunez, Martín-Albo, Navarro and Grijalvo, 2006). As Núñez, Martín-Albo and Navarro (2004) posit, a possible explanation might be that because identified regulation is the most self-determined type of extrinsic motivation in the AMS, it tends to overlap and generate ambiguity with the intrinsic motivation constructs and yields less but still acceptable values of internal consistency.

Secondly, the construct of quantity and quality of feedback showed a score of .655. Lower internal consistency values were expected for this measure taking into account, on the one hand, that it is composed by the least amount of items of all the scales used (Internal consistency decreases as there are few items) and on the other hand, that it measures more than one construct, both quantity and quality of feedback.

Thirdly, when measuring learning strategies, deep and surface study strategies yielded .650 and .641, respectively. These results mirror those from previous studies in medical (Kusurkar et al., 2013a) and dental education (Orsini et al., 2015a) that have also used the R-SPQ-2F.

Taken together, these results provide support for the measures used as being reliable instruments within the context of this study.

Table 7. Internal Consistency of instruments. Source: Own work.

Questionnaires Used	Variables	Cronbach's Alpha
<i>Academic Motivation Scale</i>	Intrinsic Motivation	.897
	Intrinsic Motivation To Know	.804
	Intrinsic Motivation Towards Accomplishment	.815
	Intrinsic Motivation To Experience Stimulation	.785
	Extrinsic Motivation Identified Regulation	.687
	Extrinsic Motivation Introjected Regulation	.826
	Extrinsic Motivation External Regulation	.724
	Amotivation	.831
	Autonomous Motivation	.905
	Controlled Motivation	.827
<i>Learning Climate Questionnaire</i>	Autonomy Support	.891
<i>Assessment Experience Questionnaire</i>	Quantity and Quality of Feedback	.655
<i>Basic Psychological Needs Satisfaction in Education Scale</i>	Autonomy Satisfaction	.820
	Relatedness Satisfaction	.848
	Competence Satisfaction	.840
<i>Revised 2-Factor Study Process Questionnaire</i>	Deep Study Strategy	.650
	Surface Study Strategy	.641
<i>Subjective Vitality Scale</i>	Vitality	.912
<i>Rosenberg Self-Esteem Scale</i>	Self-Esteem	.772

5.2 Means and group comparison

Table 8 presents means, standard deviations, skewness and kurtosis for all variables for the total student sample. In terms of reasons for attending university, students' endorsed identified regulation with the highest score, followed by intrinsic motivation to know and

towards accomplishment, then came external regulation, overall intrinsic motivation, introjected regulation, the subtype of intrinsic motivation to experience stimulation and finally the least endorsed regulation type was amotivation. Summing up, students' autonomous motivation for attending university was higher than controlled motivation, which was confirmed by a positive RAM, implying an overall self-determined profile. While identified regulation, which is considered an autonomous form of regulation that can lead to positive outcomes, was the highest endorsed regulation-type, it is still a form of extrinsic motivation as it comes from outside the individual. In this sense, external motivators and controlled motivation still play a somehow important role in students' intentions to act, shown by the mix of internal-external regulation scores in table 8.

Students' perceptions of teachers' autonomy-support and the quantity and quality of feedback received were both satisfactory, as the scores were above the mean point of each scale. Concerning the satisfaction of their basic psychological needs, the feeling of competence appears to be the most satisfied by the learning environment, followed by relatedness and autonomy. In terms of behavioural outcomes, students reported higher deep rather than surface study strategies, however, the latter was still above the scale mean, as well as for GPA scores. Regarding affective outcomes, both vitality and self-esteem showed adequate scores, as they were also above the scale mean value.

All scores were below the normality cut-off point of 2 and 7, respectively, for skewness and kurtosis. The one exception was amotivation that showed a skewness value above 2, implying that the majority of students' scores were concentrated below the mean. This result, however, does not come as a surprise considering that previous research has found that dental and health professions students generally exhibit low scores for amotivation (see section 2.3.2.1) and consequently it was not considered to be a cause of concern.

Comparing the results from females and males, it can be seen in table 9 that there were significant gender differences in the majority of the motivation variables, where females showed higher scores for both autonomous and controlled motivation and for the majority of the regulation types. These significant differences, however, were associated to small and small-to-medium effect sizes and should therefore be interpreted with caution. The two motivation-variables that showed non-significant results were amotivation and RAM. As RAM is an index of autonomous motivation vs. controlled motivation, and considering that females scored higher in both autonomous and controlled regulation-types, it is not surprising that there were no significant gender differences in this construct.

Table 8. Descriptive statistics of all measured variables (n= 924). Source: Own work.

Variable	Mean (SD)	Maximum Scale Score	Skewness	Kurtosis
Age	22.8 (3.36)	-	1.31	3.77
Intrinsic Motivation	21.9 (3.49)	28	- 0.81	0.83
Intrinsic Motivation To Know	23.6 (3.59)	28	- 1.10	1.71
Intrinsic Motivation Towards Accomplishment	23.2 (4.05)	28	- 1.13	1.69
Intrinsic Motivation To Experience Stimulation	18.8 (4.40)	28	- 0.54	0.35
Extrinsic Motivation Identified Regulation	24.6 (3.37)	28	- 1.80	5.53
Extrinsic Motivation Introjected Regulation	21.1 (5.49)	28	- 0.94	0.54
Extrinsic Motivation External Regulation	22.7 (4.61)	28	- 1.16	1.54
Amotivation	6.71 (4.41)	28	2.20	5.12
Autonomous Motivation	23.2 (3.10)	28	- 1.25	2.66
Controlled Motivation	21.87 (4.37)	28	- 0.94	0.97
Relative Autonomous Motivation	1.90 (12.28)	-	0.69	1.22
Autonomy Support	4.92 (1.21)	7	- 0.43	- 0.19
Quantity and Quality of Feedback	3.26 (0.81)	5	- 0.02	- 0.23
Autonomy Satisfaction	3.03 (0.96)	5	0.08	- 0.71
Relatedness Satisfaction	4.16 (0.72)	5	- 0.81	0.29
Competence Satisfaction	4.20 (0.65)	5	- 0.66	- 0.03
Deep Study Strategy	16.41 (3.50)	25	- 0.07	- 0.28
Surface Study Strategy	13.31 (3.81)	25	0.34	- 0.29
Vitality	4.85 (1.36)	7	- 0.50	- 0.37
Self-Esteem	32.52 (4.60)	40	- 0.63	- 0.20
GPA	4.72 (0.54)	7	- 0.10	1.71

On the other hand, all determinant, mediator and outcome variables showed non-significant gender differences. The two exceptions in which males and females showed significantly higher results respectively, corresponded to vitality and GPA, though they both represented small effect sizes.

Together, gender difference results indicate that females endorse higher than men both autonomous and controlled motivations as reasons to attend university and initiate action. Nevertheless, the overall motivation profile does not show significant gender differences.

Turning now to differences in year-of-study, and based on Pillai's Trace test statistic, MANOVA showed general significant differences between year-of-study and the studied variables, $V = 0.54$, $F(85,4530) = 6.44$, $p = <.0001$, $\eta^2 = 0.11$. From this result we conclude that different years of study significantly differ amongst the different variables, however, it does not inform neither on which specific constructs there were differences nor between which specific years. To determine this, table 10 shows specific F-ratios, their significance levels and effect sizes for each variable and the results from post-hoc tests to assess the differences between each year of study for each variable. Additionally, box-plots for all years of study per variable are presented in appendix XXVIII.

There were significant differences amongst year-of-study and autonomous motivation (and the regulation types that compose it), with the exception of intrinsic motivation to experience stimulation. The aforementioned differences, however, were associated with small-to-medium effect sizes. It is interesting to note that these results tended to be higher in first year students, then gradually decreased when transitioning to the preclinical cycle (i.e., third year) with the lowest scores being in the clinical fourth and fifth year, for then to rise again in the sixth year.

Likewise, results for year-of-study showed significant differences with controlled motivation, introjected regulation and external regulation, yet they were small-sized. For these constructs, scores were also higher in the first year, which then tended to decrease and stay relatively constant during the fourth, fifth and sixth year.

On the other hand, the significant but small-sized differences for amotivation showed the reversed pattern compared to autonomous motivation and its regulation types. As such, scores were lower in first year which tended to increase reaching the highest score in the fourth year, to then decrease until the sixth year, were results were similar to first year.

As far as the overall motivation profile is concerned, RAM was shown to be positive from year one to year six, and while the index gradually increased until the sixth year, this increment was non-significant. The latter did not come as a surprise, as the effects from the above-mentioned differences were all small and hence did not impact the overall motivation profile.

Table 9. Means (SD) for females and males and mean gender differences [T-test]. BCa Bootstrap 95% CIs reported. Source: Own work.

Variable	Females	Males	Mean Difference	95% Difference BCa CI	t	p value	Effect Size (Cohen's d)
Intrinsic Motivation	22.22 (3.30)	21.27 (3.71)	0.95	[0.45,1.48]	3.90	.001	0.27
Intrinsic Motivation To Know	23.94 (3.42)	23.14 (3.81)	0.80	[0.27,1.35]	3.19	.003	0.22
Intrinsic Motivation Towards Accomplishment	23.66 (3.75)	22.42 (4.43)	1.24	[0.69,1.82]	4.35	.001	0.30
Intrinsic Motivation To Experience Stimulation	19.06 (4.24)	18.26 (4.61)	0.80	[0.19,1.41]	2.69	.011	0.18
Extrinsic Motivation Identified Regulation	24.81 (3.22)	24.13 (3.57)	0.66	[0.22,1.15]	2.87	.007	0.20
Extrinsic Motivation Introjected Regulation	21.66 (5.17)	20.07 (5.87)	1.58	[0.84,2.28]	4.13	.001	0.29
Extrinsic Motivation External Regulation	23.06 (4.24)	21.99 (5.11)	1.07	[0.45,1.65]	3.27	.002	0.23
Amotivation	6.51 (4.40)	7.04 (4.41)	-0.53	[-1.15,0.58]	-1.76	.088	0.12
Autonomous Motivation	23.51 (2.93)	22.70 (3.29)	0.81	[0.36,1.25]	3.76	.001	0.26
Controlled Motivation	22.36 (4.02)	21.03 (4.81)	1.33	[0.76,1.87]	4.30	.001	0.30
Relative Autonomous Motivation	1.47 (11.46)	2.63 (13.56)	-1.16	[-3.01,0.79]	-1.33	.179	0.09
Autonomy Support	4.90 (1.20)	4.96 (1.23)	-0.07	[-0.23,0.10]	-0.81	.435	0.05
Quantity and Quality of Feedback	3.27 (0.81)	3.24 (0.80)	0.03	[-0.08,0.14]	0.56	.562	0.04
Autonomy Satisfaction	3.01 (0.97)	3.06 (0.94)	-0.05	[-0.18,0.10]	-0.70	.474	0.05
Relatedness Satisfaction	4.18 (0.73)	4.11 (0.69)	0.07	[-0.03,0.17]	1.52	.111	0.10
Competence Satisfaction	4.18 (0.66)	4.22 (0.63)	-0.04	[-0.13,0.05]	0.27	.427	0.06
Deep Study Strategy	16.32 (3.55)	16.57 (3.40)	-0.26	[-0.71,0.20]	-1.08	.256	0.07
Surface Study Strategy	13.12 (3.66)	13.62 (4.05)	-0.50	[-1.03,0.03]	-1.88	.056	0.13
Vitality	4.78 (1.36)	4.97 (1.34)	-0.19	[-0.38,0.01]	-2.05	.038	0.14
Self-Esteem	32.36 (4.91)	32.77 (5.03)	-0.41	[-1.04,0.32]	-1.22	.250	0.08
GPA	4.75 (0.53)	4.67 (0.56)	0.08	[0.01,1.48]	2.11	.044	0.15

The motivation-determinant-variables of autonomy-support and quantity and quality of feedback showed different results. While differences for quantity and quality of feedback were found to be non-significant and remained constant throughout the six years, perceptions of autonomy-support were significantly different with scores being fairly similar during the first three years, to then drop in the fourth and fifth year and slightly rise in the sixth year.

Scores for the satisfaction of the three basic psychological needs showed significant differences per year of study, of which all followed a trend of higher scores in the first two years gradually dropping through the third year and showing the lowest scores in the fourth and fifth years, to then rise again in the final sixth year. While differences in satisfaction of competence and relatedness showed both small effect sizes, satisfaction of autonomy on the other hand showed a medium-to-large effect.

With respect to behavioural outcomes both deep and surface learning strategies showed significant differences per year of curriculum. On the one hand, deep study strategies showed a slight decline from the first year to the fourth year, where it then increased in the fifth and sixth year, yet these differences represented a small-sized effect. On the other hand, surface study strategies showed a steady decline from year one to six, which represented a medium effect size. As concurrent GPA is concerned, a significant and large effect-size difference was shown, where grades were lower in first year, then remained somehow constant between the second and the fifth year, to finally show a marked increase in the sixth year. These results suggest that as students advance throughout the curriculum, their study strategies become more deep and less surface, with an increase in their academic performance.

Finally, the affective outcomes of vitality and self-esteem showed both significant year-of-study differences. For vitality, the first three years presented a constant above-the-mean score, which sharply dropped in the fourth year, increasing once again in the fifth year to reach its highest score in the sixth year, representing a medium-sized effect. Self-esteem, on the other hand, showed a quite steady pattern from year one to five, with a marked growth in the sixth year.

Table 10. Means (SD) and differences per year of study [MANOVA]. Note: From Post-Hoc analysis, the means with different subscripts are significantly different from each other, e.g. a mean with subscript “a” is significantly different from a mean with subscript “b” or “c”. Source: Own work.

Variable	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	F-Test	p value	Effect Size (Eta-Squared)
Intrinsic Motivation	22.99 _a (2.76)	22.08 _{a,b} (3.48)	21.81 _b (3.38)	21.12 _b (3.88)	21.76 _b (3.38)	21.42 _b (3.87)	4.87	<.0001	.026
Intrinsic Motivation To Know	25.10 _a (2.52)	23.94 _b (3.69)	23.67 _b (3.42)	22.52 _c (4.14)	23.23 _{b,c} (3.28)	23.53 _{b,c} (3.85)	8.86	<.0001	.046
Intrinsic Motivation Towards Accomplishment	24.36 _a (3.28)	23.55 _{a,b} (3.91)	23.17 _b (3.91)	22.58 _b (4.47)	23.00 _b (3.96)	22.13 _b (4.81)	4.45	.001	.024
Intrinsic Motivation To Experience Stimulation	19.50 _a (4.09)	18.73 _a (4.49)	18.60 _a (4.43)	18.27 _a (4.39)	19.05 _a (4.41)	18.60 _a (4.56)	1.40	.222	.008
Extrinsic Motivation Identified Regulation	25.63 _a (2.46)	24.59 _{a,b,c} (4.17)	24.83 _b (2.76)	23.66 _c (3.90)	24.27 _{b,c} (3.07)	24.23 _{b,c} (3.24)	5.96	<.0001	.031
Extrinsic Motivation Introjected Regulation	22.93 _a (5.22)	22.01 _a (5.01)	21.38 _{a,c} (5.03)	19.68 _b (5.93)	20.29 _{b,c} (5.08)	19.10 _{b,c} (6.63)	9.22	<.0001	.048
Extrinsic Motivation External Regulation	23.93 _a (4.18)	23.01 _{a,c} (4.46)	22.79 _{a,c} (4.32)	22.30 _{b,c} (4.47)	21.81 _{b,c} (5.34)	21.49 _{b,c} (4.95)	4.43	.001	.024
Amotivation	5.99 _{a,b} (3.93)	6.42 _a (4.51)	7.24 _a (4.67)	7.29 _a (4.66)	6.97 _a (4.45)	5.01 _b (2.42)	4.40	.001	.023
Autonomous Motivation	24.31 _a (2.29)	23.33 _b (3.45)	23.32 _b (2.82)	22.39 _b (3.58)	23.02 _b (2.75)	22.82 _b (3.23)	6.46	<.0001	.034
Controlled Motivation	23.43 _a (4.12)	22.51 _{a,c} (4.02)	22.09 _{b,c} (3.99)	20.99 _{b,d} (4.43)	21.05 _{b,d} (4.57)	21.29 _d (5.15)	8.84	<.0001	.046
Relative Autonomous Motivation	0.82 _a (11.45)	0.72 _a (10.82)	1.49 _a (11.36)	1.63 _a (13.83)	3.87 _a (13.54)	5.00 _a (12.94)	2.21	.051	.012
Autonomy Support	4.93 _{a,b,c} (1.21)	5.08 _b (1.16)	5.07 _{a,b} (1.19)	4.72 _{a,b,c} (1.15)	4.64 _c (1.31)	5.04 _{a,b,c} (1.22)	3.98	.001	.021
Quantity and Quality of Feedback	3.26 _a (0.79)	3.29 _a (0.87)	3.21 _a (0.85)	3.19 _a (0.72)	3.28 _a (0.81)	3.46 _a (0.73)	1.39	.227	.007
Autonomy Satisfaction	3.60 _a (0.87)	3.35 _a (0.93)	2.98 _c (0.89)	2.67 _b (0.85)	2.71 _{b,c} (0.99)	2.85 _{b,c} (0.91)	24.53	<.0001	.118
Relatedness Satisfaction	4.31 _a (0.64)	4.33 _a (0.73)	4.18 _{a,c} (0.69)	3.95 _{b,d} (0.77)	3.98 _{b,c,e} (0.72)	4.14 _{a,d,e} (0.62)	7.99	<.0001	.042
Competence Satisfaction	4.27 _{a,b,c} (0.64)	4.35 _{a,b} (0.57)	4.20 _{b,c,d} (0.63)	3.99 _e (0.71)	4.06 _{c,e} (0.63)	4.49 _a (0.53)	10.54	<.0001	.054
Deep Study Strategy	17.12 _a (3.19)	16.51 _{a,c} (3.58)	16.02 _{b,c,d} (3.46)	15.56 _{b,c} (3.50)	16.90 _{a,d} (3.48)	17.24 _{a,d} (3.55)	5.21	<.0001	.028
Surface Study Strategy	14.85 _a (3.93)	14.19 _{a,c} (3.99)	13.50 _{b,c} (3.61)	12.74 _{b,e} (3.37)	12.09 _{d,e} (3.59)	11.31 _{d,e} (3.51)	14.81	<.0001	.075
Vitality	5.01 _a (1.30)	5.12 _a (1.24)	4.98 _a (1.19)	4.22 _b (1.47)	4.53 _{b,c} (1.46)	5.57 _c (1.03)	16.32	<.0001	.082
Self-Esteem	32.14 _a (5.05)	32.70 _a (5.23)	32.49 _a (4.80)	31.92 _a (5.34)	32.31 _a (4.63)	34.76 _b (3.69)	3.66	.003	.020
GPA	4.44 _a (0.55)	4.74 _{b,c} (0.46)	4.77 _b (0.53)	4.63 _c (0.44)	4.67 _{b,c} (0.53)	5.35 _d (0.47)	32.63	<.0001	.151

In summary, these results suggest that across the six years students show an overall self-determined profile, in which autonomous motivation decreases when transitioning to the clinical years, to rise again in the final year. These results mirror the trend followed by students' perception of teachers' autonomy-support, how they perceive that the learning environment satisfies their three basic psychological needs, deep study strategies, vitality and academic performance. The contrary was found for students' amotivation scores, which were higher when transitioning to the preclinical and clinical years and dropped by the final year. As for students' controlled forms of motivation, they decline as entering the clinical-based years, as well as did their surface study strategies. Finally, students' perceptions of the quantity and quality of feedback were maintained constant throughout the curriculum and so did students' self-esteem that additionally showed a sharp rise in the final year. A note of caution is due here since some of the above-mentioned differences showed small effect sizes.

5.3 Correlations

We turn now to the results from the correlational analysis between all variables. It can be seen from the data in table 11 that these serve two purposes. On the one hand, it confirms the construct validity of the motivation variables derived from SDT and on the other hand it shows the associations between determinant, mediator, motivation, and outcome variables.

In first place, the construct validity of motivation variables is shown by the three subtypes of intrinsic motivation presenting the strongest significant correlations amongst them and with the overall intrinsic motivation construct (i.e., from .56 to .89, $p < .01$). Moreover, these results support the continuum of SDT, where correlations between adjacent subscales showed strongest, positive and significant coefficients (e.g. between intrinsic motivation to know and extrinsic motivation identified regulation, $r = .64$, $p < .01$) than subscales farther apart, which showed weaker positive or stronger negative correlations (e.g. between intrinsic motivation to know and amotivation, $r = -.44$, $p < .01$). It is also interesting to note that the construct of amotivation showed negative correlations with all other motivation variables (including autonomous/controlled motivation and RAM). This makes sense, as all of these constructs 'represent intention to act' (despite coming from internal or external sources), whereas amotivation reflects the lack there of it.

These results also show support for the validity of the autonomous/controlled motivation and RAM scores. Autonomous motivation showed strong correlations with the type of regulations that compose it (i.e., Intrinsic motivation and identified regulation), which became weaker when correlated with the constructs that compose controlled motivation (i.e., Introjected regulation and external regulation). The opposite results were shown for controlled motivation. Furthermore, RAM, showed positive correlations with autonomous motivation (and its regulation types) and negative associations with controlled motivation (and its regulation types).

In terms of the associations between determinant variables- autonomy-support and quantity/quality of feedback- and motivation, the former both showed the strongest positive correlations with the most autonomous forms of regulation, which then became weaker and negative when correlated with controlled forms of motivation and amotivation. This suggests that as teacher's support students' autonomy and as quantity/quality of feedback received increases, students' autonomous forms of motivation increase as well, whereas controlled forms of motivation experience small changes and amotivation decreases. These results are consistent with the correlations found between the satisfaction of the three basic psychological needs and motivational variables. Therefore, suggesting that as students' perception of the satisfaction of their needs of feeling autonomous, competent and related to important others increase, so does their autonomous forms of motivation, while controlled forms of motivation experience small changes and amotivation decreases.

Turning now to the results shown by correlates between motivational variables and behavioural and affective outcomes, the above-mentioned trend was once again repeated. Consequently, as students' motivation became more autonomous so did their actions and emotions, and as controlled motivation and amotivation increased, these positive actions and emotions decreased. These results suggest that as dental students' self-determination increases so does their deep study strategies, GPA, vitality and self-esteem, experiencing less positive and decreasing surface study strategy scores.

Finally, amotivation and both autonomous and controlled forms of motivation were negatively associated with age. Controlled forms of motivation, however, showed stronger correlations than autonomous forms of motivation, which resulted in a significant positive association between RAM and age.

Together these results provide important support for postulate 2 (see section 1.2.1.2) and 3 (see section 1.2.1.3), which claim that educational social factors influence motivation, which in turn is suggested to lead to important outcomes at both- the affective and behavioural dimensions, decreasingly positive from autonomous motivation to amotivation.

Table 11. Bivariate correlations (Pearson's r). Note: IM: Intrinsic Motivation, IMTK: Intrinsic Motivation to Know, IMTA: Intrinsic Motivation Towards Accomplishment, IMES: Intrinsic Motivation to Experience Stimulation, EMID: Extrinsic Motivation Identified Regulation, EMIN: Extrinsic Motivation Introjected Regulation, EMER: Extrinsic Motivation External Regulation, Amot: Amotivation, AM: Autonomous Motivation, CM: Controlled Motivation, RAM: Relative Autonomous Motivation, Aut-Sup: Autonomy-Support, QQF: Quantity-Quality of Feedback, AS: Autonomy Satisfaction, RS: Relatedness Satisfaction, CS: Competence Satisfaction, DSS: Deep Study Strategy, SSS: Surface Study Strategy, Vit: Vitality, S-E: Self-Esteem, GPA: Grade Point Average (Concurrent). * p < .05 (two-tailed), ** p < .01 (two-tailed). Source: Own work.

	IM	IMTK	IMTA	IMES	EMID	EMIN	EMER	Amot	AM	CM	RAM	Aut-Sup	QQF	AS	RS	CS	DSS	SSS	Vit	S-E	GPA	Age
IM	-	.89**	.88**	.85**	.62**	.49**	.20**	-.37**	.91**	.42**	.37**	.33**	.11**	.28**	.32**	.40**	.45**	-.12**	.29**	.17**	.10**	-.10**
IMTK		-	.74**	.61**	.64**	.38**	.19**	-.44**	.89**	.34**	.36**	.29**	.10**	.21**	.30**	.38**	.38**	-.12**	.26**	.16**	.11*	-.11**
IMTA			-	.56**	.58**	.55*	.25**	-.42**	.81**	.48**	.22**	.28**	.12**	.24**	.31**	.40**	.33**	-.10**	.25**	.17**	.09**	-.11**
IMES				-	.44**	.36**	.09**	-.14**	.72**	.28**	.37**	.29**	.08*	.27**	.24**	.29**	.47**	-.10**	.26**	.11**	.06	-.04
EMID					-	.42**	.40**	-.42**	.90**	.47**	.14**	.24**	.03	.20**	.26**	.32**	.22**	-.01	.15**	.13**	.03	-.16**
EMIN						-	.50**	-.10**	.51**	.89**	-.42**	.17**	-.05	.22**	.22**	.20**	.08*	.14**	.10**	-.03	.01	-.21**
EMER							-	-.06	.33**	.84**	-.75**	.09**	-.04	.06	.09**	.05	-.04	.21**	.01	-.03	-.03	-.18**
Amot								-	-.44**	-.10**	-.24**	-.15**	-.23**	-.12**	-.25**	-.32**	-.14**	.23**	-.22**	-.31**	-.12**	-.01
AM									-	.49**	.29**	.32**	.08*	.26**	.32**	.40**	.38**	-.08*	.25**	.16**	.07*	-.14**
CM										-	-.66**	.16**	-.05	.17**	.19**	.15**	.03	.20**	.07*	-.03	-.01	-.22**
RAM											-	.11**	.12**	.07*	.09**	.19**	.31**	-.29**	.16**	.16**	.08*	.13**
Aut-Sup												-	.32**	.45**	.35**	.38**	.26**	-.04	.31**	.14**	.06	-.06
QQF													-	.16**	.14**	.20**	.15**	-.23**	.12**	.15**	.07*	.01
AS														-	.44**	.41**	.28**	.13**	.35**	.12**	-.02	-.24**
RS															-	.56**	.25**	.04	.36**	.26**	.10**	-.14**
CS																-	.37**	-.08*	.47**	.48**	.20**	-.08**
DSS																	-	-.03	.31**	.22**	.09**	.01
SSS																		-	-.04	-.20**	-.20**	-.22**
Vit																			-	.42**	.04	-.02
S-E																				-	.11**	.07**
GPA																					-	.05
Age																						-

5.4 Mediation

A set of regression analyses were used to assess the influence of autonomy-support and quantity and quality of feedback on dental students' motivation, and the mediating effect of the satisfaction of their basic psychological needs over this relationship. As can be seen in Figure 12 and 13, first, simple regression tests showed a significant positive influence of both predictor variables over motivation, implying that as autonomy-support and quantity and quality of feedback increases so does students' RAM.

In the second set of regression analyses, when integrating the mediating variable, positive and significant relationships resulted between both predictor variables and the satisfaction of the basic psychological needs, as well as between this mediator and students' RAM. This means that as autonomy-support and quantity and quality of feedback increases so does students' perceptions of the satisfaction of their basic psychological needs, which in turn is related to an increment in students' RAM. What is interesting in this mediating regression is that both direct effects from predictor to outcome variable, when the mediator variable was integrated, became less strong than when the relationship was tested without the mediator. Indeed, the direct effect in the mediating relationship between autonomy-support and RAM resulted to be non-significant, while the relationship between quantity and quality of feedback and RAM became less strong and less significant. These relationships meet the criteria postulated by Baron and Kenny (1986) to assess mediation.

Moreover, when assessing the indirect effects of both predictors, it can be seen that they were significant with regression coefficients that fell within the confidence intervals, which did not include 0. Finally, the kappa-squared (k^2) test showed that these significant mediating effects represented small-to-medium effect sizes, which lied within the confidence intervals and did not include 0. These results meet the second approach to test mediation proposed by Preacher and Hayes (2004).

Overall, these results indicate that teachers' autonomy-support and quantity and quality of feedback predict dental students' RAM, however, this relationship is not direct, it is mediated by students' perceptions of the satisfaction of their basic psychological needs of feeling autonomous, competent and related to significant others.

Figure 12. Model of Autonomy-Support as predictor of Relative Autonomous Motivation (RAM), mediated by Basic Psychological Needs. The confidence intervals are BCa Bootstrapped CI based on 1000 samples. Note: k^2 : kappa-squared. Source: Own work.

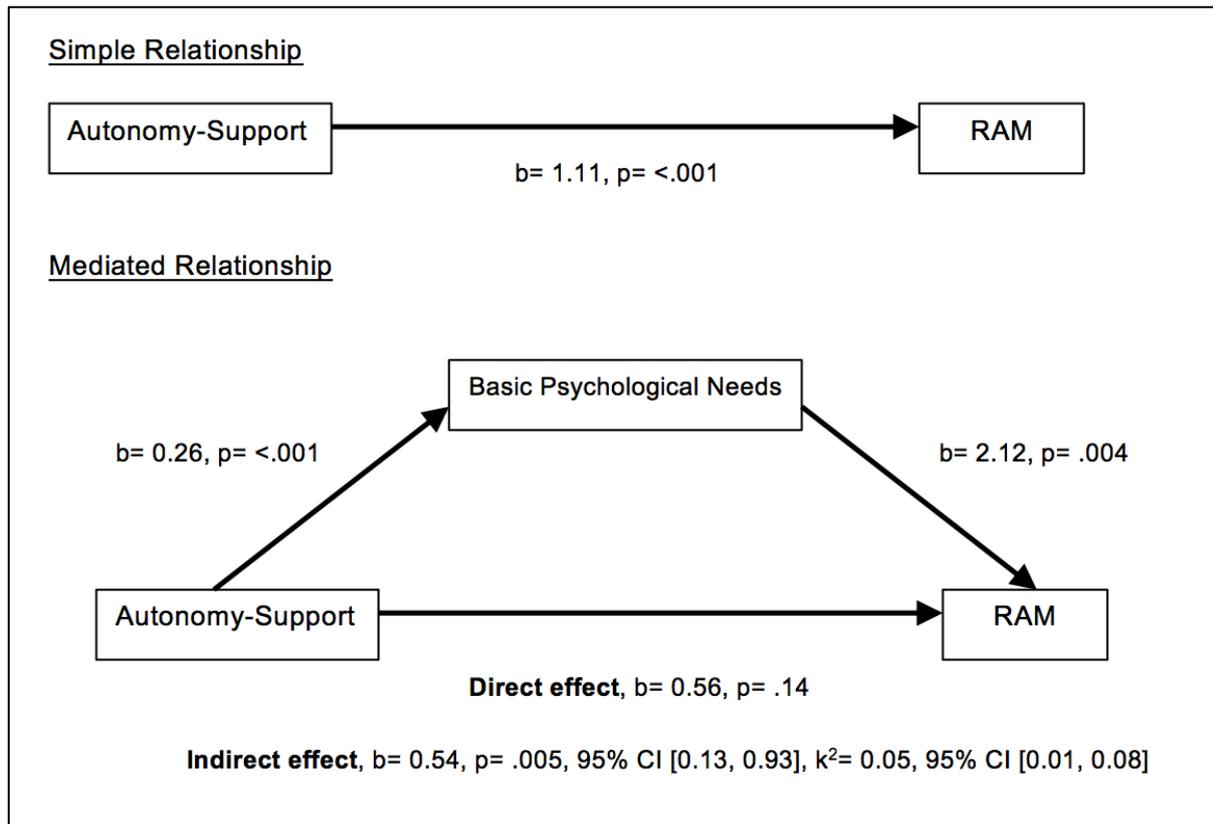
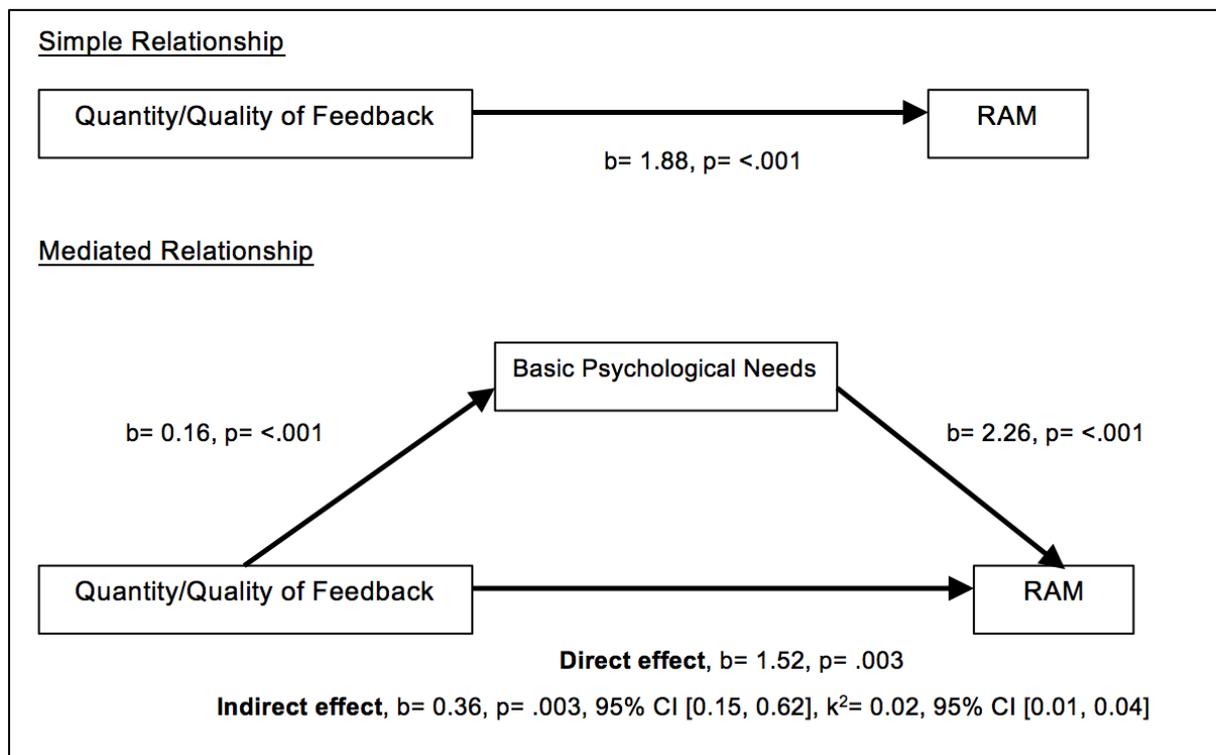


Figure 13. Model of Quantity/Quality of Feedback as predictor of Relative Autonomous Motivation (RAM), mediated by Basic Psychological Needs. The confidence intervals are BCa Bootstrapped CI based on 1000 samples. Note: k^2 : kappa-squared. Source: Own work.



5.5 Structural equation modelling

Finally, to test the entire hypothesised model we conducted a series of structural equation modelling analyses. These were intended to test the model for all students and to compare the relationships by gender and by year of curriculum.

A first step was to assess if the proposed model fitted the observed data. Fit statistics for the three models are shown in table 12. As expected, the X^2 test was significant for the three models, suggesting a poor fit. Nevertheless, as it was mentioned in section 4.2.6.6, this test is sensitive to large samples and thus slight model-data discrepancies can be large enough to trigger a significant result. Therefore we conducted additional approximate fit indexes, which are less sensitive to sample sizes. These showed, for the three models, an adequate model-data fit with one exception. This referred to the CFI score in the model that compared year of study, which was slightly under the standard for acceptance. Taking into account that both GFI and RMSEA with its confidence interval suggested an adequate fit and that the CFI score was near the cut-off point of .90, we interpreted these three models as having adequate fit and were therefore retained for parameter estimates.

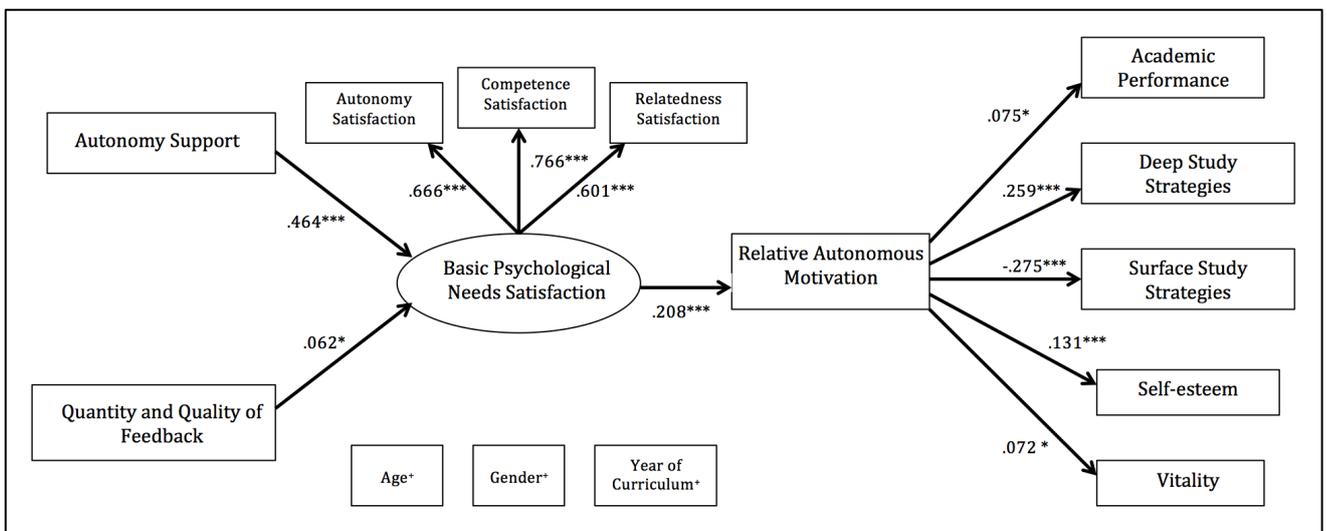
Figure 14 shows the structural model and the standardised regression coefficients (along with their unstandardised significance) between variables for all students, in which the control variables of age, gender and year-of-study were added. Therefore, it is important to stress that the below-reported associations were over and above the effect of age, gender and year of study.

Table 12. Values of fit statistics for the structural equation models. Note: X^2 : model chi-square, df: degrees of freedom, CFI: comparative fit index, GFI: goodness-of-fit index, RMSEA: root mean square error of approximation. Source: Own work.

Index	Model			Standards for Acceptance
	Total Sample	Comparison by Gender	Comparison by Year of Curriculum	
X^2	289.61	336.85	625.91	NA
df	44	68	216	NA
p-value	<.001	<.001	<.001	>.05
CFI	.91	.90	.81	≥.90
GFI	.96	.95	.92	≥.90
RMSEA [90% CI]	.078 [.069, .086]	.065 [.059, .073]	.045 [.041, .050]	≤.08

Based on the results from the correlation analysis and its significance, the effect of age was controlled over the variables of RAM, basic psychological needs, surface study strategies and self-esteem. Based on the above-reported mean comparisons, the effect of gender was controlled over RAM (considering the effect gender on its indicators), vitality and GPA, while the effect of year-of-study was controlled over RAM (considering the effect year-of-curriculum on its indicators), autonomy-support, basic psychological needs, deep and surface study strategy, vitality, self-esteem and GPA. The controlling variables of gender and year-or-study were removed when comparing the models by gender and year-of-study, respectively.

Figure 14. Structural equation model showing standardised regression coefficients amongst the hypothesised model for all students. Note: Residuals, covariances and regression paths of control variables have been omitted to simplify the model visualization. Observable variables are represented with rectangles and latent variables with an ellipse. Significant differences are based on unstandardized regression coefficients. + Control variables. * $p < .05$, *** $p < .001$. Source: Own work.



Regression weights for the total dental student sample (Figure 14 and Table 12) show that all relationships were significant and in the hypothesised direction. Both interpersonal academic social factors- autonomy-support and quantity and quality of feedback- were found to be significant positive predictors of the satisfaction of students' basic psychological needs. This means that, as students perceive that the learning environment supports their autonomy and as the quantity and quality of feedback increases so does the satisfaction of their needs of feeling autonomous, competent and related to significant others. This influence, however, was stronger for autonomy-support, when controlling for the effect of quantity and quality of feedback, than vice versa.

The basic psychological needs, on the other hand, showed a positive and significant influence over RAM, implying that, as students perceive that their needs are being satisfied, their motivation becomes more autonomous. Moreover, the three indicators of this latent variable showed high standardised factor loadings ($>.50$), which adds additional convergent validity to the model (Kline, 2010).

As for the influence of RAM over educational outcomes variables, it showed a positive association with the two affective outcomes. Thus, as students' motivation became more autonomous, the degree of vitality experienced in the educational setting and academic self-esteem increased, being the relationship stronger for self-esteem than for vitality. Likewise, RAM showed the hypothesised associations with behavioural outcomes, positively predicting deep study strategies and academic performance and negatively predicting surface study strategies. Consequently, as students' motivation gradually shifts from controlled to autonomous, their study strategies change, becoming deeper- and less surface-type with an increase in their concurrent academic performance.

When comparing the model by gender (Table 13), the different associations were in agreement with the total student sample model showing regression weights of similar strength. There were, however, two minor deviations. First, the relation between quantity and quality of feedback and basic psychological needs was positive but non-significant for both- females and males, and the relation between RAM and academic performance was also positive and non-significant, but only for females. Overall, the model fits both female and male subgroups very well, showing the hypothesised directionality of relationships.

Table 13 presents the results from the model's year-of-study comparison. Despite the model fit the different year of study very well and the directionality of paths were, overall, following the hypothesised associations, the regression weights for the different years of study showed differences. When controlling for the effect of quantity and quality of feedback, autonomy-support showed to be a positive and significant predictor of students' basic psychological needs satisfaction, being increasingly stronger from year one to year six. Quantity and quality of feedback, when controlling for the effect of autonomy-support, showed a positive influence over students' basic psychological needs with scores of similar strength as to the overall sample and the gender subgroups, however, these associations showed to be significant only for third-year students. The one exception was reported in the fourth year, where quantity and quality of feedback showed a negative influence over students' basic psychological needs when controlling for the effect of autonomy-support and age, thus contradicting our hypothesis and indicating a negative suppression effect when

taking into account the positive and significant bivariate correlations between quantity and quality of feedback and the three basic psychological needs (Table 11).

Table 13. Differences in maximum likelihood standardised regression coefficients of variables between total sample, gender and years of curriculum. Note: Significant differences are based on unstandardized regression coefficients. Aut-Sup: Autonomy-Support, QQF: Quantity-Quality of Feedback RAM: Relative Autonomous Motivation, AS: Autonomy Satisfaction, RS: Relatedness Satisfaction, CS: Competence Satisfaction, DSS: Deep Study Strategy, SSS: Surface Study Strategy, Vit: Vitality, S-E: Self-Esteem, GPA: Grade Point Average (Concurrent). * p < .05, ** p < .01, *** p < .001 Source: Own work.

Parameter	Model								
	Total Sample	Females	Males	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year
Aut-Sup → BPN	.464***	.491***	.533***	.546***	.564***	.515***	.640***	.709***	.756***
QQF → BPN	.062*	.049	.069	.114	.119	.168*	-.118	.053	.172
BPN → AS	.666***	.856***	.720***	.692***	.578***	.637***	.605***	.772***	.780***
BPN → RS	.601***	.714***	.651***	.680***	.554***	.423***	.485***	.630***	.725**
BPN → CS	.766***	.694***	.685***	.850***	.594***	.644***	.573***	.582***	.470***
BPN → RAM	.208***	.199***	.158*	.018	.305**	.298***	.338**	.026	.187
RAM → GPA	.075*	.044	.117*	.063	.109	.065	.042	.099	.064
RAM → DSS	.259***	.284***	.289***	.306***	.301***	.242***	.287***	.265***	.477***
RAM → SSS	-.275***	-.203***	-.309***	-.215**	-.157*	-.294***	-.329***	-.267**	-.309**
RAM → S-E	.131***	.093*	.133**	.013	.207*	.167**	.273***	.020	.219
RAM → Vit	.072*	.084*	.139**	-.060	.052	.156*	.268***	.051	.273*

The influence of students' basic psychological needs satisfaction over RAM was positive for all six years, however this association was stronger and significant in the case of second, third and fourth-year students.

The associations reported between RAM and the affective outcomes were overall positive. In the case of RAM and self-esteem, all regression weights were positive showing that as students' motivation becomes autonomous their academic self-esteem increases. This, however, was stronger and significant for second, third and fourth-year students. The associations between RAM and vitality were all positive, being stronger and significant for third, fourth and sixth-year students. The one exception was reported for first-year students, where a negative association is shown between RAM and vitality suggesting a negative suppression effect when controlling for the effect of gender, similar to the above-mentioned

relationship between fourth-year quantity and quality of feedback and basic psychological needs.

Finally, the influence of RAM over students' behavioural outcomes followed the hypothesised relationships. RAM was shown to be a positive predictor of deep study strategies and a negative predictor of surface study strategies across all years of study with similar association strengths. Similarly, RAM positively predicted academic performance; nevertheless, this was a non-significant and small-to-medium association across all year of study.

In summary, these results show that both predictors- autonomy-support and quantity and quality of feedback positively predict students satisfaction of their basic psychological needs, which positively influences autonomous motivation over controlled motivation. In turn, the gradual shift from controlled to autonomous motivation seems to positively predict affective outcomes such as academic self-esteem and vitality, and behavioural outcomes such as deep study strategies and academic performance, showing a negative influence over surface study strategies. The relative associations followed a similar pattern in females, males and over the six year of study, with minor deviations.

This chapter began presenting the descriptive results of the investigation, followed by the assessment of the measures' internal consistencies. It went on to show the results from the inferential analyses including means and group comparisons, correlational and mediation analyses, and finally the results from the structural equation modelling analyses. The next chapter moves on to discuss, synthesize and interpret the most important findings with reference to previous research conducted in similar fields, along with describing implications and contributions for practice and for the field of knowledge, the study's limitations and suggestions for future research.

6. Discussion

The present investigation was designed to study academic motivation, from the SDT perspective, in the context of dental education. As mentioned in the literature review, several studies in health professions education have found evidence that shows the benefits of supporting autonomous forms of motivation in future practitioners. These findings, however, are limited in the context of dentistry, where little is known about motivation of dental students (Orsini et al., 2015a). As such, our study adds to the literature with regard to this and contributes also by expanding the study of motivation to the field of dental education. The latter, by testing the influence of educational social factors- i.e., autonomy-support and quantity and quality of feedback- over motivation, and the mediating role of students' basic psychological needs satisfaction in this relationship, and in turn, testing the influence that motivation has over several educational outcomes, at the behavioural and affective level.

Overall, students reported a more autonomous than controlled motivational profile as reasons to attend university. This profile, however, was characterised by a mixture of autonomous and controlled forms of motivation, and by amotivation being the least endorsed type of regulation, all of which are in agreement with previous research conducted in dental, medical and psychology education (Williams and Deci, 1996a; Stoeber et al., 2011; Kusurkar et al., 2013b; Baker, 2004; Orsini et al., 2015a; Sobral, 2004).

Moreover, RAM, autonomous and controlled motivation and amotivation demonstrated the expected relationships to each other, thus confirming they are inter-related constructs. It is interesting to note that autonomous and controlled motivation showed a significant, positive and medium-to-strong correlation, which might seem contradictory to a certain point. Nevertheless, it is important to bear in mind that they both represent reasons to act (despite their different locus of causality and consequences) and that behaviour may be stimulated by a controlled or by an autonomous source of initiation. These are opposed to amotivation, which represents the lack of intention to act. As such, autonomous motivation, RAM and controlled motivation showed significant but decreasingly negative associations with amotivation, which is consistent with the data obtained in other health professions education contexts (Orsini et al., 2015a; Kusurkar et al., 2013b; Bailey and Phillips, 2016; Baker, 2004).

This stresses the relevance for students of both autonomous and controlled motivation, and despite the literature referring to health professions students as exhibiting a more

autonomous profile than students pursuing other careers (Williams, Saizow and Ryan, 1999). This is not always the case, due to the frequent and mutual interaction of internal and external factors (Misch, 2002). An implication of this is the importance of the educational environment in the internalisation process, from a controlled to an autonomous locus of causality. SDT proposes that if students autonomously engage with their environment, they will tend to internalise and integrate the values and other learning contents they encounter within that environment. Thus, the process of internalisation and the inputs received are relevant to behavioural regulation and also to values, attitudes and other learning contents (Niemic and Ryan, 2009).

6.1 Autonomy-support and feedback as predictors of motivation and the mediating role of students' basic psychological needs satisfaction

Considering the important role that educational social factors play on students' adoption of an autonomous or controlled type of motivation, the first research question that this study sought to address was whether the above-mentioned educational social factors acted as determinants and positively influenced dental students' self-determined motivation, and if so, to assess if this influence was direct or mediated by students' perceptions of the satisfaction of their basic psychological needs. Both predictors were found to positively and significantly influence students' self-determined motivation; however, this was mediated by the satisfaction of students' basic psychological needs. Indeed, in correlational analyses, both predictors were positively and significantly correlated with the three basic psychological needs, which in turn showed decreasingly positive associations from the most autonomous to the most controlled forms of motivation. This supports the claims of Deci, Ryan and Williams (1996), who argue that students must feel these needs satisfied in order to act out of and maintain their autonomous motivation.

These results were corroborated when analysing the associations integrated in the structural equation model; nevertheless, one unanticipated finding was that autonomy-support was a stronger and more significant predictor of the basic psychological needs than quantity and quality of feedback (Figure 14). This may be explained by the fact that both predictors were controlled for one and the other when predicting students' needs. Thus, autonomy-support is suggested as a confounder between feedback and students' needs and therefore reduces the regression coefficient compared to it being tested as a sole predictor. Additionally, these results were over and above the effects of age and year of study. Moreover, autonomy-

support being a stronger predictor than feedback seems to be consistent with the claims of Williams and Deci (1998), who suggest that an autonomy-supportive learning climate is one of the most important ways in which students' needs might be satisfied, thus leading to autonomous motivation. Another possible explanation is that feedback itself should come with an autonomy-supportive compound, in which the needs of feeling autonomous, competent and related are satisfied (Ten Cate, 2013), and as such, controlling for a somehow integral part of feedback might lead to a reduced but still significant result.

From these data, we can infer that dental students in this study were autonomously motivated, however this was not a direct effect of teachers' autonomy-support and by the quantity and quality of the feedback received, but because of the impact these predictors had on students' feelings of autonomy, competence and relatedness, which then positively influenced their self-determined motivation.

These results are consistent with data obtained in medical education, where an autonomy supportive learning climate was found to encourage students' autonomous motivation (Williams and Deci, 1996a; Williams et al., 1997, 1994). In dentistry, while faculty have referred to autonomy-support and constructive feedback as a means to encourage students' motivation, this association is still understudied (Orsini, et al., 2015b). Additionally, as stated in the literature review, we did not find any articles studying the mediating effect of basic psychological needs on motivation in health professions education, which has been successfully tested in other fields of education (Nunez et al., 2011; Deci, Ryan and Williams, 1996). Our study therefore adds to the dental education literature on both aspects.

6.2 Motivation as a predictor of behavioural and affective educational outcomes

With respect to the second research question, it was found in the structural equation modelling and correlational analyses that RAM positively predicted behavioural and affective educational outcomes in dental students, and that the specific autonomous forms of motivation (i.e., including identified regulation and intrinsic regulation) were positively associated with the latter outcomes. This was found to decrease as motivation became controlled and turned negative when students endorsed amotivation for attending university. Specifically, concerning behavioural outcomes, autonomously motivated dental students seem to use more effective and deep learning strategies and rely less on surface strategies;

this pattern tended to reverse as motivation became controlled and students became amotivated. These results support previous research in dental education, which linked intrinsic and identified regulation with deep study motives, and introjected and external regulation and amotivation with surface study motives (Orsini et al., 2015a). This is also in agreement with Kusrkar et al., (2013b; a) findings which showed that, as Dutch medical students' autonomous motivation increased, so did their deep study strategies. These observations, added to the findings from our systematic review, provide support to the hypothesis that motivation drives behaviour and effort towards success (Grolnick and Ryan, 1987; Maslow, 1943) and that autonomously motivated students use more effective learning strategies and show sustained involvement (Ames and Archer, 1988).

With regards to academic performance, our findings are both supported and unsupported by previous research. The observation that RAM predicts concurrent GPA over and above the effects of gender and year of study, and that motivation shows a decreasingly positive correlation pattern, from autonomous to controlled forms of motivation, is consistent with data obtained from Australian psychology students (Bailey and Phillips, 2016), and with Dutch (Kusrkar, et al., 2013a; b), Korean (Park, et al., 2012) and Brazilian (Sobral, 2004) medical students. These results, however, differ from those obtained with British psychology students (Baker, 2004) and with a previous study conducted with Chilean dental students (Orsini, et al., 2015a), where the self-determination continuum showed inconclusive and non-significant correlations with academic performance. That said, it is important to clarify that the latter study included cumulative instead of concurrent academic performance of dental students, which might be a less precise construct due to the dynamic and likely-to-change nature of motivation. Future research should confirm or refute our results in dental education, taking into account concurrent rather than cumulative academic performance.

The association between motivation and academic performance, therefore, needs to be interpreted with caution, as it has not been strongly corroborated, either in dental or in the broad health professions education field. The reason for these inconsistencies may have something to do with differences in how academic performance is measured (i.e., type of assessments) depending on the university, the course or area of study, and on how the authors have reported it (i.e., cumulative or concurrent).

With respect to affective outcomes, high scores on both vitality and self-esteem were predicted by a positive RAM and were associated with students endorsing autonomous forms of motivation, being decreasingly positive when associated with controlled forms of

motivation and negative when correlated with amotivation. According to these data, we can infer that autonomous motivation is of paramount importance when supporting students' wellbeing. This is supported by the findings of Ryan and Deci (2008) who consider vitality and self-esteem as being silent and functional indicators of health. Moreover, Skinner, Furrer, Marchand and Kindermann (2008) indicated vitality (along with interest, enjoyment and enthusiasm) as an essential indicator of students' emotional engagement in academic activities.

Despite a lack of studies that had previously tested the association between motivation (from the SDT perspective) and these two constructs in health professions education, our results do show consistency with research conducted in other fields of higher education (Nunez et al., 2015; Ryan and Frederick, 1997; Nix et al., 1999). There is one study that provides evidence of a positive association between motivation of dental students and another construct that also deals with the self, i.e., academic self-concept (Orsini et al., 2015a), thus supporting our results specifically in the dental education field. Additionally these results are also in line with those of previous studies conducted in health professions education, where autonomous motivation has been positively associated with affective outcomes such as adaptation to university and satisfaction with life (Bailey and Phillips, 2016), harmonious passion (Stoeber et al., 2011), positive emotions (Orsini, et al., 2015a) and negatively associated with burnout (Stoeber, et al., 2011), negative emotions (Bailey and Phillips, 2016), psychological distress (Baker, 2004), and depression and anxiety (Bailey and Phillips, 2016; Park et al., 2012).

6.3 Differences in gender and year of study

The third research question concerned whether there were gender or year-of-study differences.

First, as shown by mean group comparisons, females and males showed significant differences on the majority of the motivational constructs, where females seem to show, at the same time, a more autonomous and controlled profile than men. Although these results differ from some published studies in medical education, where female students have shown a more autonomous profile and men a more controlled and amotivational profile (Kusurkar et al., 2013a; Williams and Deci, 1996a; Kusurkar, Croiset and ten Cate, 2013; Kusurkar et al., 2013b), they are consistent with those of a previous study in dental education (Orsini et al.,

2015a). In the latter study, females endorsed both autonomous and controlled motivation types more than males.

This would preliminarily indicate that for dental students, there is not a clear gender difference with regards to the autonomous/controlled motivation types and while females do exhibit a higher autonomous locus of causality, their actions are also initiated in large due to external demands, such as following instructions from a controlling tutor, the rewards of obtaining a passing grade, or to avoid feelings of guilt. Men, however, seem more passive in their intentions to act, with both lower autonomous and controlled loci of causality and higher amotivation scores. These findings have important implications for the mentorship-style of male students, who might need more support to engage in academic activities. Students' endorsement of amotivation has been associated, in health professions education, with greater stress, depression, anxiety and poor adjustment (Baker, 2004; Park et al., 2012; Bailey and Phillips, 2016). Hence, a student's lack of motivation at university appears to have detrimental effects over their general mental health and pose a higher dropout risk (James, Krause and Jennings, 2010). Our results, however, maybe somewhat limited by the small-to-medium effect sizes and therefore need to be interpreted with caution.

It would be interesting for future research in dental education to replicate the study of Kusrkar et al. (2013b), where medical students were clustered by their motivational profiles, showing that males reported a higher status-motivated profile (i.e., lower intrinsic motivation and higher controlled motivation), and females showed a higher interest-motivated profile (i.e., higher intrinsic motivation and lower controlled motivation).

With regards to the model tested in the structural equation modelling analysis, both females and males produced similar predictive values compared to the overall student model, suggesting that these relationships seem to be well substantiated. This adds validity to the SDT principles across genders in dental students. One unanticipated finding was that the relationship between quantity and quality of feedback and basic psychological needs was non-significant in both subgroups. These non-significant relationships, that were still positive, may partly be explained by the controlling effect of autonomy support over basic psychological needs, as suggested in section 6.1. Another unanticipated finding was that RAM showed a positive but non-significant prediction of academic performance in female students, which was positive and significant in males. This result is difficult to explain, but it might be related to the nature of the assessments informing academic performance (see section 6.2) and also because academic performance is not only influenced by the degree of

autonomous motivation, being there other variables that should be taken into account to explain its variance, specially in the case of female students (Baker, 2004).

In summary and contrasting earlier findings from different domains of education where females have displayed a more self-determined profile than males and consequently have derived more positive outcomes (Vallerand and Bissonnette, 1992; Vallerand et al., 1989; Vallerand et al., 1993), no evidence of this was detected for dental education in the context of this research. Further work is required to establish the nature of the psychological processes underlying motivational gender differences (if there are any) in dental education.

Second, the MANOVA analysis revealed differences between years of curriculum regarding motivational types. While the RAM index showed an overall self-determined profile across all years, there were differences regarding the specific motivation types. The pattern of a decreasing level of autonomous motivation from the first to the fourth year and then a rise moving towards the sixth year, with the reverse pattern for amotivation, is consistent with the results of a recent study conducted with dental students (Orsini, et al., 2015a). These results, however, differ from those of Kusurkar et al. (2013a), where year of curriculum was found to have an inconsistent relationship with autonomous motivation of medical students. This in-between health professions difference supports the needs to study motivation with a discipline-specific approach.

These differences can be explained in part by the way in which dentistry is generally taught in Chile and in many other universities across the globe, where students begin with a basic science cycle followed by a preclinical and a clinical-based cycle. Therefore, the way students transition from one cycle to another may be an important variable influencing motivation. The respective high and low autonomous and amotivation scores in the first year maybe reflecting a 'halo effect' with students showing a positive predisposition and excitement towards this new academic environment, which then tends to fluctuate when transitioning to the more clinical-oriented cycles, where students start treating their own patients under supervision. Consequently, as students enter the clinical environment, autonomous motivation seems to decline, controlled motivation stays somehow stable and amotivation rises. It is also interesting to note that as students start transitioning they also perceive their teachers as being less autonomy supportive, feel that the learning environments' satisfaction of their psychological needs decreases, approach their studies with less deep strategies and their academic performance and vitality decreases as well. This trend, however, tends to stabilise and increase towards the fifth and sixth year, when students appear to adapt to this demanding clinical environment.

Another interesting finding is that, when taking autonomous and controlled motivation together expressed by RAM, the index rises when transitioning from basic science/preclinical to the clinical environment. This was also the case for amotivation, which might seem contradictory at first, but SDT postulates that amotivation is neither an autonomous nor a controlled form of motivation; it is the lack of it (Deci and Ryan, 2008b). Therefore, a possible explanation for the increase in RAM and amotivation at the same time, might be that, despite reporting an overall self-determined profile, students seem to be uncertain where to put their efforts because of unsubstantiated feelings or inadequacy within the clinical context (Legault, Green-Demers and Pelletier, 2006). This context also becomes less autonomy-supportive and perhaps more controlling, which reduces fulfilment of students' needs with regards to feeling of autonomy, competence and relatedness. In other words, students appear to be self-determined when engaging in activities in this new, challenging and exciting clinical environment, but at the same time the abrupt transition might be making them not know what to expect and therefore to feel maladjusted and experience anxiety, uncertainty and lack of confidence (Whitford and Hubail, 2014). Moreover, as previously mentioned, research in dental education has correlated amotivation with negative emotions and behaviours (Orsini et al., 2015a).

These findings have important implications for the Chilean context, as they may explain the high dropout rates in the third/fourth year in medicine and dentistry (University of Chile, 2008) supporting the introduction of curricular changes that may lead to a more self-determined student profile, such as horizontal and vertical integration, problem-based learning, small groups tutorials, and an early and gradual clinical contact experience. The latter has been previously associated with improvement and quicker development of interpersonal and clinical skills, better understanding of basic sciences, improvement of confidence, and the alleviation of feelings of inadequacy, uncertainty and anxiety (Littlewood et al., 2005; Whitford and Hubail, 2014; Lalumandier, Victoroff and Thuernagle, 2004).

With regards to the year-of-study model differences compared to the overall student model, from year one to year six the relationships seem to be well-sustained with minor deviations. These deviations are reflected in that some variables have stronger associations in some subgroups and weaker associations in others.

It is interesting to note that for all years of study autonomy-support has shown to be a stronger predictor of the satisfaction of students' basic psychological needs than quantity and quality of feedback. This supports the claims from several authors that postulate that making students feel more competent, with strategies such as constructive feedback, are

important but not enough to satisfy students' psychological needs and result in autonomous motivation. What is indeed is to support students' autonomy so that behaviour can become internalised and self-endorsed (Williams and Deci, 1998; Guay, Ratelle and Chanal, 2008; Deci et al., 1991).

It is somewhat surprising that two unexpected negative regression weights resulted from the associations between quantity and quality of feedback in fourth year students and between RAM and vitality in first year students. These negative suppression effects, however, should be interpreted with caution and the relations replicated in further research given the small subgroup sample size (< 200), considering the results from the bivariate correlations (both positive and significant correlations, see table 10) and taking into account that these represented non-significant regression coefficients.

One unanticipated finding was that the associations between RAM and GPA, although being positive, were non-significant across all years of study. This contrasts the results from students' study strategies, where across all years RAM was a significant strong positive and negative predictor of deep and surface strategies, respectively. This observation may support the hypothesis that self-determined motivation does enhance dental students learning orientation, however, the fact that this is not clearly reflected across all years of study in the relation between students' motivation and academic performance may suggest that GPA or the type of assessment may not be a good indicator of students motivation. Further research should be conducted to investigate the results of different types of assessments (Written vs. workplace-based assessment) and their association to motivation.

Regarding affective outcomes of motivation, and with the exception of the aforementioned negative suppression relationship, all regression coefficients were in the expected directions, where some were stronger and more significant than others.

In summary, these results show that gender and year of curriculum, although having some differences when analysing the specific types of motivation, did not show major variations in the tested model. This adds to the study of motivation in dental education and provides acceptable evidence for our proposed model, which was based on a priori hypothesis derived from SDT.

6.4 Implications and recommendations for educational practice and policy

The results of this research provide strong support for the SDT of motivation in dental education and provide acceptable evidence that the quality of motivation and satisfying students' psychological needs is important in determining positive educational outcomes amongst dental students. These findings have a number of practical implications for dental educational practice and policy (Table 14), as successes and failures in many elements of dental and health professions education can be understood from the SDT perspective. As such, efforts should be made in various aspects of dental education to support learners' sense of autonomy, competence and relatedness.

As far as curriculum is concerned, dental education has been traditionally centred on structured and careful designs where students must follow a defined path based on well-chosen teaching methods. As Ten Cate, Kusurkar and Williams (2011) point out, not allowing students to choose how they learn (or providing options) would lead to less identification and integration of the contents being taught and it will also be less likely for the students to remember these contents and apply them in their future practice. Health professions students have been described as having a natural tendency to develop autonomous motivation to learn and to take on challenges (Williams, Saizow and Ryan, 1999), however, by imposing a structured and rigid curriculum, schools might be unintentionally encouraging students to act out of controlled motivation. Moreover, there is no strong evidence of the superiority of any educational approach or specific teaching method over the other (Albanese, 2000; Colliver, 2000), therefore excessive rules and regulations may be preventing educational progress.

Previous research findings indicate that health profession' students from different countries taught under different curricula designs showed differing progress, but surprisingly, showed similar knowledge and practical scores at the end of their training (Albano et al., 1996). This supports the claims of Ten Cate (2001), who postulates that the 'power of motivation to become a practitioner' and the natural tendency to acquire knowledge could be the major cause of variance in measured outcomes of education, no matter what education students receive.

As such, a key policy priority for curriculum developers should therefore be to prioritise ways to satisfy students' psychological needs and stimulate autonomous motivation, rather than trying to determine the best moment to transfer content or the best method to teach it. Indeed, many of the positive outcomes of recent changes in health professions curricula, such as the implementation of Problem-based Learning, core and options-based curriculum, small-group teaching, early patient contact and horizontal and vertical integration could be

understood from the SDT perspective, as they increase feelings of autonomy, competence and relatedness compared to traditional curricula (Ten Cate, Kusurkar and Williams, 2011).

Up to now, most of the Chilean dental schools (and many others worldwide) still focus on traditional learning, in which there is solitary study with subsequent exhibition of knowledge in written exams resulting in an acquired score which is without interaction or feedback and represents a controlled source of motivation. Therefore, continued efforts are needed in dental education to understand the social factors that satisfy students' basic psychological needs, which may encourage autonomous motivation and enable students to thrive. It has been suggested that adopting autonomy-supportive curricular changes may help to reduce the rates of academic discontinuation (Williams and Deci, 1998), which is of paramount importance to the Chilean higher education context. In this investigation we have focused on two social factors- autonomy-support and quantity and quality of feedback- both of which resulted in positively predicting self-determined motivation through the mediating effect of satisfying students' needs. However, there is abundant room for future research to test other variables that may favourably influence students' autonomous motivation. This will lead to the implementation of evidence-based strategies to support students, which would likely lead to enhanced educational cognitive, behavioural and affective outcomes.

Given the links that have been found amongst the variables in this and related studies in dental education (Orsini et al., 2015a; b), there is a need to ensure the development of autonomy in dental students. This is in line with the current trends towards competency- and entrustable professional activity (EPAs)-based education (Ten Cate et al., 2015), both of which stress the relevance of autonomy and transference of responsibility as fundamental for students academic success. In this sense, compared to other health professions, dentistry is one step ahead, as students receive clinical teaching in a more structured way where all students follow a similar learning path, as opposed for instance to the experiential and 'along the way' clinical learning that some students experience in medical education (Orsini and Binnie, 2016). In the dental clinical setting students begin their clinical training treating their own patients, under supervision of faculty, with increasing complexity of procedures as progressing to senior years and where each student is required to meet certain competencies and perform pre-defined procedures in order to progress to the following courses. The final objective is for students to meet the outcomes required for registration as 'safe beginners'. As declared by the U.K. General Dental Council (General Dental Council, 2015, p.5), learning outcomes "must be set to prepare all potential registrants for safe and independent practice".

While the latter is somehow in line with the principles of EPA-based education, the transfer of responsibility, however, is frequently made on an informal and individual scenario, relying on ad hoc or non-systematic judgements. As Ten Cate (2015) argues, these informal and context-based entrustments come without long-term consequences, whereas a summative transference of responsibility represents formal declarations that support students' perception of autonomy and are validated by more observers, supporting students' feelings of relatedness as well. Despite the literature reporting dental faculty's awareness of the relevance of a gradual transference of responsibility and autonomy (Orsini et al., 2015b), greater efforts are needed to formalise how students are entrusted in the clinical setting, so as to support students' psychological needs and to ensure what students learn does not solely depend on their own behaviour, attitude and concept of learning.

Besides the implications directly related to the formal curriculum, which represents what is stated, these findings also strengthen the relevance of the informal curriculum, understood as the social interactions between students, teachers, clinical environments, personal interests and goals (Hafferty and Franks, 1994; Kaufman and Mann, 2010). As such, an implication of this is the possibility that these informal interactions can support or diminish students' perceptions of the psychological needs. That said, it is certainly more difficult to intervene over student-student relationships than over the student-teacher informal interactions. Therefore, dental faculty who do not understand SDT may inadvertently support those strategies and attitudes that induce control, pressure and coercion. If faculty, however, can recognise low or maladaptive forms of motivation amongst students, several courses of action may be undertaken, such as closer learner support, additional course review, enhancement of learning strategies, or even teaching renewal.

This emphasizes the relevance that SDT has for those who teach dental students and the important practical implications related to teaching, learning and clinical training. Given that supporting autonomy and providing feedback were found to be relevant predictors of students' autonomous motivation, it is critical to consider how clinical teachers and the clinical context can support this. This may well mean a move towards more interactive teaching methods that promote student involvement and autonomy. It also suggests that faculty should be trained to be autonomy-supportive.

The autonomy-supportive training involves faculty encouraging students to explore new ways and to be self-initiators rather than pressure them to behave. It also involves providing choice, volition and agency so that students are involved in the decision-making process of their education, as well as developing empathy from the students' perspective. It includes

providing meaningful rationale so that students can internalise the reasons to engage in academic activities, and above all, the aim is to create the conditions for students to become self-motivated rather than trying to control their behaviour (Williams and Deci, 1996a; Kusurkar, Croiset and Ten Cate, 2011). These ideas are supported by early SDT-related publications that argued for the use of more measures that stimulate autonomous motivation in medical students and fewer measures such as regulations and requirements, derived from behaviourist theories, that stress the usefulness of external rewards for motivation building (Williams et al., 1994; Williams, Saizow and Ryan, 1999).

The results of this research have significant implications for the understanding of how dental clinical teaching, in the way it is currently conducted, may enhance students' autonomous motivation by satisfying their relatedness needs. Clinical training in dentistry is usually conducted by students having a close and maintained professional relationship with their patients, faculty and fellow students. The responsibility students have for their patients grows as they progress throughout the curriculum, leading them to senior years in which they attend their outreach programmes and fully develop a sense of belongingness within the dental community (Orsini et al., 2015b).

Moreover, in a recent publication in the *British Dental Journal*, Radford and Hellyer (2016) highlighted the relevance that relatedness has for students' development and argued that, by the nature of dental education, belongingness can be engendered in student groups if it is positively encouraged and opportunities are facilitated. They suggest a number of key strategies by which the learning environment can foster students' relatedness, such as an initial welcoming and warm atmosphere, continuous interest in students as individuals, the development of collegiality by encouraging team work, the continuous transfer of clinical responsibility, respect for students as members of the dental team, foster leadership skills and encouraging students to become reflective independent practitioners. The latter provides an opportunity to become an autonomous and self-directed professional, facilitating the development of good quality care by stimulating personal and professional growth (Brindley, 2016). Indeed, becoming a reflective practitioner and providing a lifelong learning experience is pointed out as one of the fundamental graduate attributes in the dental school where this research took place (University San Sebastian, 2016). Additionally, Radford and Hellyer (2016) took a step forward and defined relatedness and belongingness in dental education as "a deeply personal and contextually mediated experience in which a student becomes an essential and respected part of the dental educational environment where all are accepted and equally valued by each other and which allows each individual student to develop autonomy, self-reflection and self-actualisation as a clinician". The benefits of such

belongingness in enhancing educational outcomes might be explained through the principles of SDT.

The latter constitutes another important difference between dental education and education in other health professions, where in the case of dentistry a greater feeling of responsibility through a continuous relationship with patients can increase learning effects. This is, in contrast, for instance, to the re-examination of already admitted patients described in medical education (Ten Cate, Kusrkar and Williams, 2011). As Irby (2007) points out, the lack of sustained relationships amongst students, faculty and patients is a major problem in medical education and a threat to the development of autonomous motivation in medical students. This might be explained by the recent developments in academic health care, comprising working-hour restrictions, the short stay of patients in hospitals, fragmentation of health care over specialties and health care providers, and the increased pressures upon clinical teachers, all which lead faculty to create controlling learning environments (Ten Cate, Kusrkar and Williams, 2011). This, however, is not the case for dental education, where the encouragement for participating in a professional community, for either major or minor tasks, and the well-established relationships may well stimulate feelings of relatedness.

The present study should also prove to be particularly valuable as to the frequency with which dental schools give students opportunities to engage in academic responsibilities. For instance, the act of peer-assisted learning (PAL) has been shown to have specific benefits for those students who teach, without necessarily compromising the learning of their younger peers (Ross and Cameron, 2007). The principles of SDT could explain the recent positive findings that PAL interventions have had in dental education (Cameron, et al., 2015; Sheridan, et al., 2016; Ali, et al., 2014), as they can foster students feelings of competence and relatedness (Ten Cate, Kusrkar and Williams, 2011). By acting as a relative expert one feels like such when interacting with fellow students and being taken as a contributing member of the academic staff by more senior faculty. As pointed out by Ten Cate and Durning (2007), successfully teaching fellow and younger students generates feelings of competence, relative autonomy to determine what and how to teach and esteem before others, which in turn can motivate the peer-teacher to spend further energy in studying. This does not only hold for teaching, it can also mean students being involved in research electives conducting their own research projects or contributing to faculty's investigations, which can energise them to autonomously work out a project and be responsible for its disseminations, either speaking at conferences or being part of the co-authors of a journal publication (van Eyk et al., 2010).

Another important aspect deals with assessment, the overall student group showed that autonomous motivation significantly predicted higher academic performance in concurrent examinations, however, this result did remain positive but not significant when observing specific subgroups (gender and year of study). While autonomous motivation did strongly predict other behavioural outcomes, such as higher deep and lower surface study strategies, the weaker results of academic performance might suggest a controlling and pressure nature of assessments, which could benefit from SDT-based modifications. For instance, written and workplace-based assessments could be applied according to SDT if they are planned to be centred on individualised learning for mastery (Amirault and Branson, 2006), rather than representing large scale events of controlled stimuli where marks typically represent external reward. This change would allow students to plan their own moments of assessment, whenever they feel ready to be tested, therefore stimulating students' autonomy by creating their own learning paths. Creating this flexibility, in which students would proceed at different speed, would represent a major challenge that not every dental school might be ready to undertake, however, taking into account its agreement with the current thoughts on competency-based education (Frank et al., 2010) it is an area worth of exploring for future research.

In the context of this study, the benefits of satisfying students' psychological needs and promoting autonomous motivation are its influence on students' behaviour, e.g., on how they approach their learning activities, as well as on their emotions, both of which contribute to enhance students' well being and learning experience. The implications of the latter may well positively affect the student–patient relationship and how patients approach their oral health care. Williams and Deci (1996a) reported that medical students being taught in an autonomy-supportive learning climate did not only become more autonomously motivated towards their learning, but they also became more autonomy supportive in their interactions with simulated patients. There is, therefore, a definite need for further research to investigate the impact that an SDT-based education has for patients and for the patient-centredness and psychosocial approach it might encourage in dental students. This is stressed by the American Dental Education Association (2011) definition of competencies for the dental practitioner, where 'applying psychosocial and behavioural principles' in patient-centred health care is mentioned as a core aspect.

Indeed, behaviour change is more effective and lasting when patients are autonomously motivated and when health carers approach their practice in an autonomy-supportive way. This, shown in a recent systematic review (Ng et al., 2012), has derived in enhanced mental health (e.g., less, depression, less somatization, less anxiety, higher quality of life) and

physical health outcomes for patients (e.g., not smoking, exercise, weight loss, glycaemic control, medication use, healthier diet, oral health care). In terms of specific oral health outcomes, recent research shows an increased perception of competence and autonomous motivation of patients, showing improvements in brushing and flossing and reduction in dental plaque, gingivitis and dental anxiety. (Halvari et al., 2013; Halvari and Halvari, 2006; Halvari et al., 2012a, 2010). Moreover, as Judson, Volpp and Detsky (2015) claim in a recent publication in the *Journal of the American Medical Association*, motivated practitioners are a key component of high-quality health care delivery and as such health policy makers (and health professions curricula developers) should have special care on how motivators are used to optimise students/practitioners' behaviour. As such, ensuring appropriate curricula, learning environments, services and support for students and practitioners should be a priority, in which the SDT principles may have a fundamental role.

6.5 Limitations and suggestions for future research

Several relevant findings emerged from this investigation; however, there are a number of important limitations and suggestions for future research that need to be considered, which are summarised in table 14.

A limitation of this study is that it was conducted in one dental school in Chile, and while we had access to the entire student population and were able to generalise the results to the specific context of this dental school, we could not generalise our findings neither to the entire Chilean dental education system nor to other dental education contexts. That said, we have presented the context, applied and described robust methods so other authors can judge the transferability of our findings and perhaps replicate our study in different dental academic contexts aiming at confirming or refuting our results with different samples. Nevertheless, as Cleland (2015) argues, much of the research conducted in health professions education has been single-centred, thus we do not consider this to be a particular limitation of our research but at the same time it poses a challenge for future research to include multi-centred designs and to increase, when feasible, the rigour of the research conducted in health professions education.

Despite the latter limitation, the positive and incremental single-centred investigations conducted on SDT in health professions education have the potential to contribute to enhance the theory's external validity, adding to its continuous non-refutation, which

supports its generalisability (Cohen, Manion and Morrison, 2013). This also has implications for the cross-cultural validity of SDT in the context of health professions education. SDT proposes that, while there might be differences at the mean level concerning gender, race or culture, it is expected that the model should take place for all individuals (Deci and Ryan, 2008b). This has been supported by research in other fields conducted simultaneously across adolescent samples in Belgium, China, USA and Peru (Vansteenkiste et al., 2005; Chen et al., 2014). As pointed out by Gobat, Bogle and Lane (2011) however, the cross-cultural validity of the SDT postulates has been questioned. This is particularly related to its emphasis on autonomy, mainly because not all cultures have an emphasis on the self as an individual. As such, our study contributes to the SDT's cross-cultural validity, though further studies need to be carried out in different cultural settings, as most of the current research in health professions education involves western cultures.

Being limited by time constraints and resources prevented us from conducting a longitudinal or experimental design. Hence our study relied on a correlational and cross sectional method, which prevented us of making direct cause-and-effect relations. Nevertheless, we feel confident in the interpretation of the emerged data. This is mainly because of the use of structural equation analyses as a statistical technique, which is highly conservative, and also because the observed relationships are in agreement with a vast amount of SDT-based experimental research. This provides important support for the soundness of the direction of causality of the tested model. Yet, if feasible, it is recommended that further research moves from correlation and associations to causality and therefore it should be undertaken from prospective and experimental perspectives. The latter would help to provide more definitive evidence and to clarify the mechanisms of students' academic motivation, its maintenance and sustainability, and to develop ways for students to obtain more favourable outcomes.

The scope of this study was also limited in terms of its level of generality (Figure 3), as it was restricted to the educational contextual level. Thus, a natural progression of this work is to analyse the hierarchical model of motivation described by Vallerand (1997) including the global and situational level, and to analyse their bottom-up and top-down effects in dental education. It would be interesting, for instance, to assess the effects of situational motivation for given tasks or activities on a longitudinal basis and its recursive effects on the students' educational contextual level, which in turn may affect their broad personality level.

There is also a limitation concerning how data were collected. All instruments involved self-reported measures, which can introduce response bias due to lack of corroboration from other sources that could lead to desirable answers and inflated scores (Cohen, Manion and

Morrison, 2013). Recent research (Pelletier and Vallerand, 1996), however, has shown that students' perceptions of their social agents (instead of actual behaviour) are roughly equivalent to objective contextual variables and therefore would pose minor threats to the validity of our results, considering that the study did not involve any sensitive issues.

Another source of limitation concerning data collection is related to the use of Likert scales. Although they are widely used in educational research offering the opportunity to combine flexible responses with the ability to determine frequencies, correlations and other forms of quantitative analysis, there needs to be awareness of their limitations. These include issues such as numbers having different meanings for different respondents, possible bias towards the left-hand side of the scale or respondents tendencies to avoid extreme poles and opt for mid-point choices (Cohen, Manion and Morrison, 2013). It is suggested that future research triangulates and combines the use of Likert scales with other sources of data collection.

An issue that was not addressed in this study was whether self-determined motivation led to positive cognitive educational outcomes, this being limited by the lack of Spanish validated instruments to assess this type of outcome. Therefore further studies regarding the validation of such instruments would be worthwhile for researchers to test the three levels of outcomes, cognitive, behavioural and affective.

The variables tested in this investigation were mostly focused on general education constructs applied to the context of dental education and there were not specifically intended for the health professions contexts. As Sobral (2004) claims, the development of health professions-specific instruments (in this case dental education-specific instruments) would seem worthy.

A final limitation concerns the linearity of the proposed model and how social factors and outcomes are depicted. We have presented two social factors focusing on how they affect motivation and on how the latter affects outcomes, however we neither tested nor discussed how other elements in the model (e.g., satisfaction of needs, motivation or outcomes) may also have an impact on these social factors. In other words, this linear presentation has not considered a more dynamic display amongst the variables.

For instance, how teachers perceive students' motivation or how they perceive that a student acts may perhaps influence the teacher's behaviour towards students (e.g., how autonomy-supportive they are or how they give feedback). Thus, students' own behaviour or

how they engage in academic activities and relate to the learning environment may bring upon themselves different social factors that may influence their motivation and behaviour.

This has been tested in others fields showing that teachers' beliefs (e.g., of students' motivation, behaviour or emotions) actually creates reality (Pelletier and Vallerand, 1996). In this laboratory study, supervisors that perceived their students to be acting out of autonomous motivation were more autonomy-supportive than teachers who perceived their students acting out of controlled motivation, who acted in a more controlling way. Thus, teachers that perceived their students as autonomously motivated seem to realise that the students want to do the task, however, when they perceive their students acting out of controlled motivation, their own behaviour was more controlling in order to ensure that behaviours were emitted as expected.

The issue of how elements in the model may have a recursive influence on social factors and influence motivation and its educational outcomes is an intriguing one, which could be usefully explored in further research. This may provide insights that the process of motivation is actually more complex and dynamic in nature than what is actually posited in the tested model.

Table 14. Recommendations for supporting students' basic psychological needs and suggestions for future research. Source: Own work.

The formal curriculum	<ul style="list-style-type: none"> ▪ Provide students with options and choice on their learning paths. ▪ Reduce excessive rules and regulations. ▪ Introduce autonomy-supportive curricular changes (e.g., PBL, Vertical and horizontal integration, core and options curriculum). ▪ Support competency- and entrustable professions activity-based education.
The informal curriculum	<ul style="list-style-type: none"> ▪ Support and guide student-student interactions. ▪ Support and guide faculty-student interactions.
Learning climate and teaching style	<ul style="list-style-type: none"> ▪ Provide SDT faculty development instances. ▪ Provide interactive teaching methods. ▪ Support students' involvement. ▪ Encourage students to explore new ways and to be self-initiators. ▪ Provide choice, volition and agency. ▪ Consider the students' perspective. ▪ Provide meaningful rationale for activities. ▪ Provide informative feedback and structure. ▪ Provide a warmth atmosphere and show interest in students. ▪ Encourage teamwork.
Academic responsibilities	<ul style="list-style-type: none"> ▪ Encourage participation in peer-assisted learning programmes. ▪ Provide research electives. ▪ Consider students participating in active research projects and in their dissemination. ▪ Encourage students to participate in national and international conferences.
Assessment	<ul style="list-style-type: none"> ▪ Centre assessments on individualised learning for mastery. ▪ Let students plan their own moments for assessment. ▪ Encourage workplace-based assessment over fully written assessments.
Suggestions for future research	<ul style="list-style-type: none"> ▪ Emphasis on multi-centric studies. ▪ Expand research to other HPE areas and to eastern cultures. ▪ Include longitudinal and experimental designs. ▪ Test the relations between the global, contextual and situational levels of generality. ▪ Triangulate data collection techniques with qualitative approaches. ▪ Test the model including cognitive outcomes. ▪ Design HPE-oriented instruments. ▪ Analyse the dynamic display of the model.

7. Conclusion

This thesis was designed to test a model of the influence of educational social factors on students' motivation mediated by perceptions of the satisfaction of their basic psychological needs, and in turn to test the influence that motivation has on behavioural and affective outcomes. The research was undertaken to contribute to the study of dental students' academic motivation through the lens of SDT.

Returning to the questions posed in chapter 3, the following conclusions can be drawn from the present study. On the one hand, in the context of this research, dental students perceiving high autonomy-support and feedback from faculty showed a more self-determined motivation profile mediated by their basic psychological needs satisfaction, i.e., their autonomous motivation increased. As this perception of autonomy-support and quantity and quality of feedback decreased so did students' basic psychological needs satisfaction and therefore motivation became less self-determined, i.e., controlled motivation and amotivation increased. Thus, our study provides acceptable evidence, in dental education, for SDT's postulate claiming that motivation is determined by social educational factors, which are mediated by the students' perceptions of autonomy, competence and relatedness.

On the other hand, students presenting a more self-determined profile showed enhanced deep study strategies and better academic performance, experienced higher vitality and self-esteem, and showed lower surface study strategies. In other words, students acting out of autonomous motivation resulted in enhanced behavioural and affective educational outcomes, which became less positive and negative as students' acted out of controlled motivation or were amotivated towards academic activities. Consequently, our study provides acceptable evidence, in the context of dental education, for SDT's principle stating that motivation leads to important outcomes, decreasingly positive from autonomous motivation to amotivation.

Considering subgroups, the above-mentioned results were also in line with females and males, and for different years of study. While females showed higher autonomous and controlled motivation, these differences did not result in females or males exhibiting a more self-determined profile. Whilst students in different year of study showed a self-determined profile, there were important differences that showed that students' transition from basic/preclinical to clinical years influences their motivation and should therefore be taken into account when planning interventions to enhance student motivation.

The findings from this research make several contributions to the current literature. This study should prove to be particularly valuable, as it informs the delivery of dental education via the study of motivation based on an empirically verified psychological theory, i.e., from the SDT perspective. It also makes several noteworthy contributions to the overall HPE literature by being, to the extent of our knowledge, the first study to test the full picture of the hierarchical model at the educational contextual level, i.e., including determinants, mediators, motivation and outcomes.

By testing the influence on students' motivation that teachers' autonomy-support and quantity and quality of feedback received have, this research provides a framework for the exploration of other factors influencing dental students motivation, which may provide educators with concrete means to enhance students' autonomous motivation. Providing an educational experience that satisfies students' needs of feeling autonomous, competent and related to important people in the clinical environment may lead students to become more autonomously motivated and to value academic activities, thus having an extensive influence on dental education and on students' wellbeing.

The study has gone some way towards enhancing the understanding of motivation by stressing that quality of motivation is of key relevance in determining students positive educational experience. The desired type of motivation in dental students is autonomous motivation, which was associated with positive outcomes when compared with controlled motivation and amotivation. Therefore, students may exhibit high levels of motivation, however, this may not always lead to positive outcomes and, therefore, it is more important to assess which type of motivation is driving students' actions or emotions than to just quantifying it. Doing so may explain many successes and failures in dental education.

Consequently, we should specifically question ourselves on how to target the enhancement of dental students' autonomous motivation. This study suggests that an answer to this might be enhancing our teaching and learning activities by satisfying students' basic psychological needs and, above all, by creating the conditions for students to become self-determined rather than attempting to control their behaviour.

8. References

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Appendix I- The STORIES Statement (Gordon and Gibbs, 2014)

STORIES statement: Publication standards for healthcare education evidence synthesis

Title and abstract

Use a title that includes a description of the aims of the piece and method of evidence synthesis

Provide a structured summary

Introduction

Describe the rationale for the review in the context of what is already known

Provide a statement of the questions being addressed by the study

State why this method of evidence synthesis was selected within the context of the questions being asked

Methodology

State and provide a rationale for how the searching was done

Provide details on all the sources of information and dates searched

Electronic databases - provide full search terms for at least one database, with details of deviations in subsequent searches

Describe the process of data extraction and any process of contacting authors for more data

Explain the method for judging inclusion / exclusion

If quality appraisal tools are used, please describe and justify their choice

Describe qualitative methods for synthesising primary evidence (where appropriate) and the goal of these methods, such as thematic analysis; meta-ethnography, and realist synthesis

Describe quantitative methods for synthesising primary evidence (where appropriate), such as meta-analysis and how issues of heterogeneity will be considered

Results

Give a flow diagram summarising study selection

If individuals familiar with the relevant literature and/or topic area were contacted, provide a summary of the contact and information obtained

Provide summarised details of included works, considering elements such as methodology, key results and conclusions

Describe methods of quality assessment of education reported, including all parameters considered (e.g. Details of study theoretical underpinning, pedagogical strategies and details of teaching activities to allow replication or dissemination)

Describe quality assessment of the research methods of included studies

Present the results of qualitative and/or quantitative evidence synthesis

Discussion

Present the main findings in light of the review objectives

Discuss strengths and limitations of the review and its findings, commenting on the strength of the evidence

Discuss how the findings of the evidence synthesis impact future primary research

Describe possible implications of the findings for educators.

Appendix II – List of experts in the field whose research profiles were reviewed.

Researcher	Affiliation	No. of publications reviewed and source (Research Gate-SDT Website- or both)
1. Dr Richard Ryan	Australian Catholic University, Australia, and University of Rochester, USA	258- http://www.selfdeterminationtheory.org/authors/richard-ryan/ 238- https://www.researchgate.net/profile/Richard_Ryan2/publications
2. Dr Edward Deci	University of Rochester, USA	171- http://www.selfdeterminationtheory.org/authors/edward-deci/ 190- https://www.researchgate.net/profile/Edward_Deci/publications
3. Dr Avi Assor	Ben-Gurion University, Israel	24- http://www.selfdeterminationtheory.org/authors/avi-assor/
4. Dr Paul Baard	Fordham University, USA	3- http://www.selfdeterminationtheory.org/authors/paul-baard/
5. Dr Marc Blais	Université du Québec à Montréal, Canada	12- http://www.selfdeterminationtheory.org/authors/marc-blais/
6. Dr Celine Blanchard	University of Ottawa, Canada	12- http://www.selfdeterminationtheory.org/authors/celine-blanchard/
7. Dr Kirk Warren Brown	Virginia Commonwealth University, USA	24- http://www.selfdeterminationtheory.org/authors/kirk-warren-brown/ 53- https://www.researchgate.net/profile/Kirk_Brown/publications
8. Dr Nikos Chatzisarantis	Curtin University, Australia	45- http://www.selfdeterminationtheory.org/authors/nikos-chatzisarantis/
9. Dr Cicilia Chettiar	Maniben Nanavati Women's College, India	1- http://www.selfdeterminationtheory.org/authors/cicilia-chettiar/
10. Dr Valery Chirkov	University of Saskatchewan, Canada	17- http://www.selfdeterminationtheory.org/authors/valery-chirkov/ 22- https://www.researchgate.net/profile/Valery_Chirkov/publications
11. Dr Joan Duda	University of Birmingham, U.K	38- http://www.selfdeterminationtheory.org/authors/joan-duda/
12. Dr Claude Fernet	Université du Québec à Trois-Rivières, Canada	15- http://www.selfdeterminationtheory.org/authors/claude-fernet/ 35- https://www.researchgate.net/profile/Claude_Fernet/publications
13. Dr Jacques Forest	Université du Québec à Montréal, Canada	14- http://www.selfdeterminationtheory.org/authors/jacques-forest/
14. Dr Michelle Fortier	University of Ottawa, Canada	15- http://www.selfdeterminationtheory.org/authors/michelle-fortier/
15. Dr Christina Frederick-Recascino	Embry-Riddle Aeronautical University, USA	9- http://www.selfdeterminationtheory.org/authors/michelle-fortier/
16. Dr Marylène Gagné	University of Western Australia, Australia	38- http://www.selfdeterminationtheory.org/authors/marylène-gagné/ 53- https://www.researchgate.net/profile/Marylène_Gagné/publications
17. Dr Nicolas Gillet	François Rabelais University, France	24- http://www.selfdeterminationtheory.org/authors/nicolas-gillet/
18. Dr Adam M. Grant	University of Pennsylvania, USA	5- http://www.selfdeterminationtheory.org/authors/adam-m-grant/
19. Dr Isabelle Green-Demers	Université du Québec en Outaouais, Canada	15- http://www.selfdeterminationtheory.org/authors/isabelle-green-demers/

Researcher	Affiliation	No. of publications reviewed and source (Research Gate-SDT Website- or both)
20. Dr Wendy Grolnick	Clark University, USA	37- http://www.selfdeterminationtheory.org/authors/wendy-grolnick/
21. Dr Fred Grouzet	University of Victoria, Canada	7- http://www.selfdeterminationtheory.org/authors/fred-grouzet/
22. Dr Frédéric Guay	Université Laval, Canada	27- http://www.selfdeterminationtheory.org/authors/frederic-guay/ 69- https://www.researchgate.net/profile/Frederic_Guay/publications
23. Dr Leen Haerens	Ghent University, Belgium	12- http://www.selfdeterminationtheory.org/authors/leen-haerens/
24. Dr Martin Hagger	Curtin University, Australia	53- http://www.selfdeterminationtheory.org/authors/martin-hagger/
25. Dr Anne Halvari	University of Oslo, Norway	5- http://www.selfdeterminationtheory.org/authors/anne-halvari/
26. Dr Hallgeir Halvari	Buskerud University College, Norway	6- http://www.selfdeterminationtheory.org/authors/hallgeir-halvari/
27. Martin Hammershøj Olesen	Aarhus University, Denmark	4- http://www.selfdeterminationtheory.org/authors/martin-hammershoj-olesen/
28. Dr Sam Hardy	Brigham Young University, USA	1- http://www.selfdeterminationtheory.org/authors/sam-hardy/
29. Dr Ken Hodge	University of Otago, New Zealand	10- http://www.selfdeterminationtheory.org/authors/ken-hodge/
30. Dr Holley Hodgins	Skidmore College, USA	11- http://www.selfdeterminationtheory.org/authors/holley-hodgins/
31. Dr Hyungshim Jang	Hanyang University, South Korea	7- http://www.selfdeterminationtheory.org/authors/hyungshim-jang/
32. Dr Yaniv Kanat-Maymon	Interdisciplinary Center (IDC) Herzliya, Israel	9- http://www.selfdeterminationtheory.org/authors/3031/
33. Dr Haya Kaplan	Kaye Academic College of Education, Israel	11- http://www.selfdeterminationtheory.org/authors/haya-kaplan/
34. Dr Tim Kasser	Knox College, USA	34- http://www.selfdeterminationtheory.org/authors/tim-kasser/
35. Dr Idit Katz	Ben-Gurion University, Israel	8- http://www.selfdeterminationtheory.org/authors/idit-katz/
36. Dr Youngmee Kim	University of Miami, USA	8- http://www.selfdeterminationtheory.org/authors/youngmee-kim/
37. Dr C. Raymond Knee	University of Houston, USA	19- http://www.selfdeterminationtheory.org/authors/c-raymond-knee/
38. Dr Richard Koestner	McGill University, Canada	69- http://www.selfdeterminationtheory.org/authors/richard-koestner/
39. Dr Rashmi Kusrkar	VU University Medical Center Amsterdam, The Netherlands	8- http://www.selfdeterminationtheory.org/authors/rashmi-kusrkar/ 25- https://www.researchgate.net/profile/Rashmi_Kusrkar/publications
40. Dr Jennifer La Guardia	University of California, Santa Barbara, USA	16- http://www.selfdeterminationtheory.org/authors/jennifer-la-guardia/ 13- https://www.researchgate.net/profile/Jennifer_La_Guardia/publications
41. Dr Woogul Lee	Korea National University of Education, South Korea	4- http://www.selfdeterminationtheory.org/authors/woogul-lee/
42. Dr Nicole Legate	Illinois Institute of Technology, USA	3- http://www.selfdeterminationtheory.org/authors/nicole-legate/

Researcher	Affiliation	No. of publications reviewed and source (Research Gate-SDT Website- or both)
43. Dr Lisa Legault	Clarkson University, USA	9- http://www.selfdeterminationtheory.org/authors/lisa-legault/
44. Dr Chantal Levesque-Bristol	Purdue University, USA	21- http://www.selfdeterminationtheory.org/authors/chantal-levesque-bristol/
45. Dr Todd Little	Texas Tech University, USA	7- http://www.selfdeterminationtheory.org/authors/todd-little/
46. Dr Chris Lonsdale	Australian Catholic University, Australia	17- http://www.selfdeterminationtheory.org/authors/chris-lonsdale/
47. Dr Gaëtan F. Losier	Université de Moncton, Canada	10- http://www.selfdeterminationtheory.org/authors/gaetan-f-losier/
48. Dr Martin Lynch	University of Rochester, USA	17- http://www.selfdeterminationtheory.org/authors/martin-lynch/
49. Dr Genevieve Mageau	University of Montreal, Canada	39- http://www.selfdeterminationtheory.org/authors/genevieve-mageau/ 43- https://www.researchgate.net/profile/Genevieve_Mageau/publications
50. Dr David Markland	University of Wales, Bangor, UK	22- http://www.selfdeterminationtheory.org/authors/david-markland/
51. Dr Lisa Mask	Bishop's University, Canada	3- http://www.selfdeterminationtheory.org/authors/lisa-mask/
52. Dr Lennia Matos	Pontifical Catholic University of Peru, Peru	6- http://www.selfdeterminationtheory.org/authors/lennia-matos/
53. Dr Marina Milyavskaya	McGill University, Canada	9- http://www.selfdeterminationtheory.org/authors/marina-milyavskaya/
54. Dr Arlen Moller	Illinois Institute of Technology, USA	10- http://www.selfdeterminationtheory.org/authors/arlen-moller/
55. Dr Marcus Mueller	Sacred Heart University, Luxembourg	3- http://www.selfdeterminationtheory.org/authors/marcus-muller/
56. Dr Kou Murayama	University of Reading, UK	5- http://www.selfdeterminationtheory.org/authors/kou-murayama/
57. Dr Clayton Neighbors	University of Houston, USA	15- http://www.selfdeterminationtheory.org/authors/clayton-neighbors/
58. Dr Christopher Niemiec	University of Rochester, USA	29- http://www.selfdeterminationtheory.org/authors/christopher-niemiec/ 24- https://www.researchgate.net/profile/Christopher_Niemiec
59. Dr Nikos Ntoumanis	Curtin University, Australia	76- http://www.selfdeterminationtheory.org/authors/nikos-ntoumanis/
60. Dr Heather Patrick	Nurtur-LiveHealthier, USA	21- http://www.selfdeterminationtheory.org/authors/heather-patrick/
61. Dr Luc Pelletier	University of Ottawa, Canada	70- http://www.selfdeterminationtheory.org/authors/luc-pelletier/
62. Dr Anne Poulsen	The University of Queensland, Australia	10- http://www.selfdeterminationtheory.org/authors/anne-poulsen/
63. Dr Andrew Przybylski	Oxford Internet Institute, University of Oxford, UK	10- http://www.selfdeterminationtheory.org/authors/andrew-przybylski/
64. Dr Catherine Ratelle	Universite Laval, Canada	3- http://www.selfdeterminationtheory.org/authors/catherine-ratelle/
65. Dr Johnmarshall Reeve	Korea University, South Korea	27- http://www.selfdeterminationtheory.org/authors/johnmarshall-reeve/ 56- https://www.researchgate.net/profile/Johnmarshall_Reeve/publications

Researcher	Affiliation	No. of publications reviewed and source (Research Gate-SDT Website- or both)
66. Dr C. Scott Rigby	Immersyve, Inc, USA	13- http://www.selfdeterminationtheory.org/authors/2523/
67. Dr Guy Roth	Ben-Gurion University of the Negev, Israel	20- http://www.selfdeterminationtheory.org/authors/guy-roth/
68. Dr Simon Sebire	University of Bristol, UK	7- http://www.selfdeterminationtheory.org/authors/simon-sebire/
69. Dr Michelle Segar	University of Michigan, USA	2- http://www.selfdeterminationtheory.org/authors/michelle-segar/
70. Dr Caroline Sénécal	Université Laval, Canada	20- http://www.selfdeterminationtheory.org/authors/caroline-senecal/
71. Dr Kennon Sheldon	University of Missouri, Columbia, USA	60- http://www.selfdeterminationtheory.org/authors/kennon-sheldon/
72. Dr Marlene N. Silva	University of Lisbon, Portugal	13- http://www.selfdeterminationtheory.org/authors/marlene-silva/
73. Dr Omer Faruk Simsek	Izmir University of Economics, Turkey	1- http://www.selfdeterminationtheory.org/authors/omer-faruk-simsek/
74. Dr Ellen Skinner	Portland State University, USA	7- http://www.selfdeterminationtheory.org/authors/ellen-skinner/
75. Dr Bart Soenens	Ghent University, Belgium	59- http://www.selfdeterminationtheory.org/authors/bart-soenens/ 115- https://www.researchgate.net/profile/Bart_Soenens
76. Dr Martyn Standage	University of Bath, UK	33- http://www.selfdeterminationtheory.org/authors/martyn-standage/
77. Dr Dan Stone	University of Kentucky, USA	4- http://www.selfdeterminationtheory.org/authors/dan-stone/
78. Dr Krzysztof Szadejko	Research Institute & Coaching 'Progetto Uomo' Ceis Formazione, Italy	2- http://www.selfdeterminationtheory.org/authors/krzysztof-szadejko/
79. Dr Pedro Teixeira	Technical University of Lisbon, Portugal	24- http://www.selfdeterminationtheory.org/authors/pedro-teixeira/
80. Dr Cecilie Thogersen-Ntoumani	Curtin University, Australia	19- http://www.selfdeterminationtheory.org/authors/cecilie-thogersen-ntoumani/
81. Dr Ahmet Uysal	Middle East Technical University, Turkey	5- http://www.selfdeterminationtheory.org/authors/ahment-uysal/
82. Dr Robert Vallerand	McGill University, Canada	77- http://www.selfdeterminationtheory.org/authors/robert-vallerand/ 210- https://www.researchgate.net/profile/Robert_Vallerand
83. Dr Maarten Vansteenkiste	University of Gent, Belgium	112- http://www.selfdeterminationtheory.org/authors/maarten-vansteenkiste/ 170- https://www.researchgate.net/profile/Maarten_Vansteenkiste/publications
84. Dr John Wang	National Institute of Education, Singapore	37- http://www.selfdeterminationtheory.org/authors/john-wang/
85. Dr Netta Weinstein	University of Essex, UK	21- http://www.selfdeterminationtheory.org/authors/netta-weinstein/
86. Dr T. Cameron Wild	University of Alberta, Canada	7- http://www.selfdeterminationtheory.org/authors/t-tyler-wild/

Researcher	Affiliation	No. of publications reviewed and source (Research Gate-SDT Website- or both)
87. Dr Geoffrey Williams	Healthy Living Center, Center for Community Health, USA	60- http://www.selfdeterminationtheory.org/authors/geoffrey-williams/ 121- https://www.researchgate.net/profile/Geoffrey_Williams
88. Dr Philip Wilson	Brock University, Canada	34- http://www.selfdeterminationtheory.org/authors/philip-wilson/
89. Dr Jenny Ziviani	The University of Queensland, Australia	9- http://www.selfdeterminationtheory.org/authors/jenny-ziviani/
90. Dr Jaime León	Universidad de Las Palmas de Gran Canaria, Spain	16- https://www.researchgate.net/profile/Jaime_Leon/publications
91. Dr Christoph Ramseier	University of Bern, Switzerland	21- https://www.researchgate.net/profile/Christoph_Ramseier2/publications
92. Dr José Martín-Albo	Universidad de Zaragoza, Spain	42- https://www.researchgate.net/profile/Jose_Martin-Albo/publications
93. Dr Juan L. Núñez	Universidad de Las Palmas de Gran Canaria, Spain	46- Universidad de Las Palmas de Gran Canaria, Spain
94. Dr Olle ten Cate	University Medical Center Utrecht, The Netherlands	347- https://www.researchgate.net/profile/Olle_Ten_Cate/publications

Total number of publications reviewed: **4079**

Appendix III – Quality appraisal of the 17 selected papers based on the ‘Questions to ask of research or evaluation evidence’.(Harden et al., 1999)

Area	Questions	Bailey & Phillips, 2015	Baker, 2004	Kusurkar et al, 2011	Kusurkar et al, 2013a	Kusurkar et al, 2013b	Kusurkar et al, 2013c	Orsini et al, 2015a	Orsini et al, 2015b	Park et al, 2012	Sobral, 2004	Stoeber et al, 2011	Tanaka et al, 2009	Tanaka et al, 2011	Williams & Deci, 1996	Williams et al, 1994	Williams et al, 1997	Wouters et al, 2014
Background	Is the research free of theoretical views already held by the authors?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	If the evidence is based on cited papers, are those papers researched based rather than theory only?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Are the researchers independent?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sample	Is it large enough for the purpose?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Is it pertinent enough for the purpose?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Is there a reasonable response rate?	✓	✓	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓
	Is the sample unbiased?	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓
Data collection	Do you know how the data were collected?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Is the data collection instrument properly described?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Was the data collection instrument properly developed and piloted or tested?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Data analysis	Is the way the data were analysed properly described so that you could do it in the same way?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Validity and reliability	Did the study try to establish the validity of the data and findings?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Did the study try to establish the reliability of the data and findings?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Is the likely generalizability of the study discussed?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Conclusions	Are the conclusions reached actually borne out by the data?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Do the recommendations actually follow on from the findings?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Does the research justify the conclusions? E.g., small numbers in a qualitative study should not merit general conclusions for action.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: ✓: YES, ✗: NO

Appendix IV – STROBE Statement: Checklist of items that should be included in reports of cross-sectional studies (von Elm et al., 2008)

	Item No.	Recommendation
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any pre specified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding
		(b) Describe any methods used to examine subgroups and interactions
		(c) Explain how missing data were addressed
		(d) If applicable, describe analytical methods taking account of sampling strategy
		(e) Describe any sensitivity analyses
Results		
Participants	13	(a) Report numbers of individuals at each stage of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15	Report numbers of outcome events or summary measures
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(b) Report category boundaries when continuous variables were categorized
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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Appendix V- University of Glasgow, MVLS College Ethics Committee approval letter.



9 April 2015

Dr Vivian Binnie
Clinical Senior University Teacher
Dental School, MVLS College
University of Glasgow

Dear Dr Binnie

MVLS College Ethics Committee

Project Title: The Self-Determination Theory of Motivation in Dental Education: Testing a Model of Social Factors, Psychological Mediators, Academic Motivation, and Educational Outcomes

Project No: 200140106

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project, subject to the following conditions:

- Project end date: 31 December 2015.
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research:
http://www.gla.ac.uk/media/media_227599_en.pdf
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

A handwritten signature in black ink, appearing to read 'William Martin'.

Professor William Martin
College Ethics Officer

Approval200140106.docx

Professor William Martin
Professor of Cardiovascular Pharmacology

R507B Level 5
School of Life Sciences
West Medical Building
Glasgow G12 8QQ Tel: 0141 330 4489
E-mail: William.Martin@glasgow.ac.uk

Appendix VI- University San Sebastian, Dental School Ethics Committee approval letter.



**UNIVERSIDAD
SAN SEBASTIAN**

Informe Final N° 2015-03

Universidad San Sebastián

Facultad de Odontología

Comité de ética de investigación biomédica

Santiago 28 de Enero, 2015.

Dear Dr. César Orsini S.

PRESENT

This letter is to inform the decision of the ethics committee of the Dental School of the San Sebastian University concerning your project:

Project Title: THE SELF-DETERMINATION THEORY OF MOTIVATION IN DENTAL EDUCATION: TESTING A MODEL OF SOCIAL FACTORS, PSYCHOLOGICAL MEDIATORS, ACADEMIC MOTIVATION, AND EDUCATIONAL OUTCOMES.

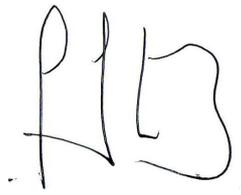
Protocol Reference Number: 2015-03-08/03

Project Status: Approved.

Approved to: 31 September 2015

If you have any queries please do not hesitate to contact the Dental School Ethics Committee of the San Sebastian University as listed below.

Yours Sincerely,



Dr. Fernando Fuentes Barría, PhD.

Presidente comité de ética de investigación biomédica

Facultad de Odontología, USS.

Appendix VIII- Participants information sheet (an exact Spanish translation was provided to the participants).



Medical School – Health Professions Education Department



INFORMATION SHEET

1. Study title

The Self-Determination Theory of Motivation in Dental Education: Testing a Model of Social Factors, Psychological Mediators, Academic Motivation, and Educational Outcomes.

2. Invitation paragraph

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

3. What is the purpose of the study?

The purpose of this Project is to study the process of motivation in dental education. Specifically, we intend to analyse the relationships between several social factors considered as determinants of motivation, how they impact academic motivation through a series of basic psychological needs, and in turn, how different quality types of motivation impact different educational outcomes, such as behavioural and affective outcomes. Therefore we are interested in studying motivation in the undergraduate dental context so to better understand the reasons why you go to the university, what impacts those reasons, and the consequences of the motivation experienced when attending university. The focus of the project is to study motivation in dental education within the Chilean higher educational environment. Motivation has been studied in several educational fields, such as psychology, business, and medicine, but the lack of studies conducted in dental education represents a knowledge gap in the literature.

The overall relevance in conducting this research relies on the importance that previous research has suggested towards motivation as a key variable in academic outcomes. Therefore, the present study would add knowledge to the study of academic motivation, promote future research, and benefit dental education. The study is expected to last from the 1st of April until the 31th of September 2015.

4. Why have I been chosen?

Participants for this study are all the undergraduate dental students from the University San Sebastian in Santiago. You have been invited to participate in this survey, as you are currently an undergraduate dental student of the University San Sebastian.

5. Do I have to take part?

No, It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

6. What will happen to me if I take part?

If you agree to participate in this research, you will be able to answer a survey containing several instruments, including an academic motivation scale and other instruments related to determinants, mediators, and outcomes of motivation in dental education. Answering them will help us to understand better the process of motivation in dental education.

The questionnaire will take approximately 20 minutes to be answered. Additionally, the study intends to have access to you concurrent GPA, only for research purposes. You will be asked to enter your university ID number and not your name. This will enable the researcher to match your questionnaires answers to your GPA.

7. What do I have to do?

You will be asked to answer a paper-based questionnaire package, one time, at the end of one class. This should take only 20 minutes of your time.

8. What are the possible disadvantages and risks of taking part?

This study represents no risks or any physical or psychological harm to the participants.

9. What are the possible benefits of taking part?

You will receive no direct benefit from taking part in this study. The information that is collected during this study will give us a better understanding and add knowledge to the study of motivation in higher education, specifically in the Chilean undergraduate dental context. The benefits will be to current and future students, as the study of academic motivation intends to benefit undergraduate dental education outcomes.

10. Will my taking part in this study be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential. You will be identified only by an ID number and not by your name, so that you cannot be recognised. Only the principal researcher will have access to your responses and GPA.

11. What will happen to the results of the research study?

The results of the study will be disseminated as a research project of the University of Glasgow and University San Sebastian, and through publications in peer reviewed journals. If you would like a copy of the results, you are welcome to contact the author. You will not be identified in any report/publication.

12. Who is organising and funding the research?

This research is being organised by the Medical School of the University of Glasgow and by the Dental School of the University San Sebastian.

13. Who has reviewed the study?

The project has been reviewed by the Ethics Committee of the College of Medical, Veterinary and Life Science of the University of Glasgow and by the Ethics Committee of the Dental School of the University San Sebastian.

14. Contacts for Further Information

You can contact Dr Cesar Orsini, principal researcher, in the telephone number +447799485024 or at the email cesar.orsini@gmail.com, who will answer any questions related to the investigation objectives, procedures, and results.

Thank you for considering taking part in this research.

Appendix IX- English Version of the Academic Motivation Scale.

Scale Description

This scale assesses 7 types of constructs: intrinsic motivation towards knowledge, accomplishments, and stimulation, as well as external, introjected and identified regulations, and finally amotivation. It contains 28 items (4 items per subscale) assessed on a 7-point scale.

References

Vallerand, R.J., Blais, M.R., Brière, N.M., & Pelletier, L.G. (1989). Construction et validation de l'Échelle de Motivation en Éducation (EME). Revue canadienne des sciences du comportement, 21, 323-349.

ACADEMIC MOTIVATION SCALE (AMS-C 28)

UNIVERSITY VERSION

*Robert J. Vallerand, Luc G. Pelletier, Marc R. Blais, Nathalie M. Brière,
Caroline B. Sénécal, Évelyne F. Vallières, 1992-1993*

Educational and Psychological Measurement, vols. 52 and 53

WHY DO YOU GO TO UNIVERSITY ?

Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons why you go to university.

Does not correspond at all	Corresponds a little	Corresponds moderately	Corresponds a lot	Corresponds exactly			
1	2	3	4	5	6	7	
WHY DO YOU GO TO UNIVERSITY ?							
1. Because with only a high-school degree I would not find a high-paying job later on.	1	2	3	4	5	6	7
2. Because I experience pleasure and satisfaction while learning new things.	1	2	3	4	5	6	7
3. Because I think that a university education will help me better prepare for the career I have chosen.	1	2	3	4	5	6	7
4. For the intense feelings I experience when I am communicating my own ideas to others.	1	2	3	4	5	6	7
5. Honestly, I don't know; I really feel that I am wasting my time in school.	1	2	3	4	5	6	7
6. For the pleasure I experience while surpassing myself in my studies.	1	2	3	4	5	6	7
7. To prove to myself that I am capable of completing my University degree.	1	2	3	4	5	6	7
8. In order to obtain a more prestigious job later on.	1	2	3	4	5	6	7
9. For the pleasure I experience when I discover new things never seen before.	1	2	3	4	5	6	7
10. Because eventually it will enable me to enter the job market in a field that I like.	1	2	3	4	5	6	7

11. For the pleasure that I experience when I read interesting authors.	1	2	3	4	5	6	7
12. I once had good reasons for going to university; however, now I wonder whether I should continue.	1	2	3	4	5	6	7
13. For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments.	1	2	3	4	5	6	7
14. Because of the fact that when I succeed in university I feel important.	1	2	3	4	5	6	7
15. Because I want to have "the good life" later on.	1	2	3	4	5	6	7
16. For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.	1	2	3	4	5	6	7
17. Because this will help me make a better choice regarding my career orientation.	1	2	3	4	5	6	7
18. For the pleasure that I experience when I feel completely absorbed by what certain authors have written.	1	2	3	4	5	6	7
19. I can't see why I go to university and frankly, I couldn't care less.	1	2	3	4	5	6	7
20. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.	1	2	3	4	5	6	7
21. To show myself that I am an intelligent person.	1	2	3	4	5	6	7
22. In order to have a better salary later on.	1	2	3	4	5	6	7
23. Because my studies allow me to continue to learn about many things that interest me.	1	2	3	4	5	6	7
24. Because I believe that a few additional years of education will improve my competence as a worker.	1	2	3	4	5	6	7
25. For the "high" feeling that I experience while reading about various interesting subjects.	1	2	3	4	5	6	7
26. I don't know; I can't understand what I am doing in school.	1	2	3	4	5	6	7
27. Because university allows me to experience a personal satisfaction in my quest for excellence in my studies.	1	2	3	4	5	6	7
28. Because I want to show myself that I can succeed in my studies.	1	2	3	4	5	6	7

© *Robert J. Vallerand, Luc G. Pelletier, Marc R. Blais, Nathalie M. Brière, Caroline B. Sénécal, Évelyne F. Vallières, 1992*

KEY FOR AMS-28

- # 2, 9, 16, 23 Intrinsic motivation - to know**
 - # 6, 13, 20, 27 Intrinsic motivation - toward accomplishment**
 - # 4, 11, 18, 25 Intrinsic motivation - to experience stimulation**
 - # 3, 10, 17, 24 Extrinsic motivation - identified**
 - # 7, 14, 21, 28 Extrinsic motivation - introjected**
 - # 1, 8, 15, 22 Extrinsic motivation - external regulation**
 - # 5, 12, 19, 26 Amotivation**
-

Note: To use this scale you require only to mention the complete reference data.

Thank you for your interest.

Good luck in your research.

Appendix X- Chilean-Spanish Version of the Academic Motivation Scale.

Descripción del Instrumento

Este instrumento evalúa 7 tipos de constructos: motivación intrínseca hacia el conocimiento, hacia el logro, y hacia las experiencias estimulantes, al igual que regulación externa, introyectada, e identificada, y finalmente amotivación. Contiene 28 ítems (4 ítems por constructo) evaluados en una escala tipo Likert de 7 puntuaciones.

Referencia Bibliográfica

Orsini C, Binnie V, Evans P, Ledezma P, Fuentes F, & Villegas MJ.
Psychometric Validation of the Academic Motivation Scale in a Dental Student Sample. J Dent Educ. 2015 79:971-981.

Escala de Motivación Educativa (EME-Ch)

Versión Adaptada al contexto Universitario Chileno

César Orsini, Vivian Binnie, Phillip Evans, Priscilla Ledezma, Fernando Fuentes, María J. Villegas, 2015

Journal of Dental Education, Vol 79

¿PORQUE VAS A LA UNIVERSIDAD?

Utilizando la siguiente escala:

Muy en desacuerdo	En desacuerdo	Ni de acuerdo Ni en desacuerdo	De acuerdo	Muy de acuerdo		
1	2	3	4	5	6	7

indica, marcando con una X, en qué medida los siguientes elementos representan las razones por las que asistes a la Universidad.

Para contestar, lee la frase planteada y, a continuación marca en la casilla en blanco la opción que mejor refleje tu postura. Sólo se debe marcar una casilla por enunciado.

¿PORQUE VA USTED A LA UNIVERSIDAD?

1. Porque sólo con el 4to medio no podría encontrar un empleo bien pagado	1	2	3	4	5	6	7
2. Porque para mí es un placer y una satisfacción aprender cosas nuevas.	1	2	3	4	5	6	7
3. Porque pienso que los estudios universitarios me ayudarán a preparar mejor la carrera que he elegido	1	2	3	4	5	6	7
4. Por los intensos momentos que vivo cuando comunico mis propias ideas a los demás	1	2	3	4	5	6	7
5. Sinceramente no lo sé; verdaderamente, tengo la impresión de perder el tiempo en la Universidad	1	2	3	4	5	6	7

6. Por la satisfacción que siento cuando me supero en mis estudios	1	2	3	4	5	6	7
7. Para demostrarme que soy capaz de terminar una carrera universitaria	1	2	3	4	5	6	7
8. Para poder conseguir en el futuro un trabajo más prestigioso	1	2	3	4	5	6	7
9. Por el placer de descubrir cosas nuevas y desconocidas para mí	1	2	3	4	5	6	7
10. Porque posiblemente me permitirá entrar en el mercado laboral dentro del campo que a mí me guste	1	2	3	4	5	6	7
11. Por el placer de leer autores interesantes	1	2	3	4	5	6	7
12. En su momento, tuve buenas razones para ir a la Universidad; pero, ahora me pregunto si debería continuar o no	1	2	3	4	5	6	7
13. Por la satisfacción que siento al superar cada uno de mis objetivos personales	1	2	3	4	5	6	7
14. Porque aprobar en la Universidad me hace sentir importante	1	2	3	4	5	6	7
15. Porque en el futuro quiero tener una «buena vida»	1	2	3	4	5	6	7
16. Por el placer de saber más sobre las asignaturas que me atraen	1	2	3	4	5	6	7
17. Porque me ayudará a elegir mejor mi orientación profesional	1	2	3	4	5	6	7
18. Por el placer que experimento al sentirme completamente absorbido por lo que ciertos autores han escrito	1	2	3	4	5	6	7
19. No sé porqué voy a la Universidad y francamente, me trae sin cuidado	1	2	3	4	5	6	7

20. Por la satisfacción que siento cuando logro realizar actividades académicas difíciles.	1	2	3	4	5	6	7
21. Para demostrarme que soy una persona inteligente	1	2	3	4	5	6	7
22. Para tener un sueldo mejor en el futuro.	1	2	3	4	5	6	7
23. Porque mis estudios me permiten continuar aprendiendo un montón de cosas que me interesan	1	2	3	4	5	6	7
24. Porque creo que unos pocos años más de estudios van a mejorar mi competencia como profesional	1	2	3	4	5	6	7
25. Porque me gusta «meterme de lleno» cuando leo diferentes temas interesantes	1	2	3	4	5	6	7
26. No lo sé; no consigo entender qué hago en la Universidad	1	2	3	4	5	6	7
27. Porque la Universidad me permite sentir la satisfacción personal en la búsqueda de la perfección dentro de mis estudios	1	2	3	4	5	6	7
28. Porque quiero demostrarme que soy capaz de tener éxito en mis estudios	1	2	3	4	5	6	7

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Clave de Puntuación

2, 9, 16, 23 Motivación Intrínseca – Hacia el Conocimiento

6, 13, 20, 27 Motivación Intrínseca – Hacia el Logro

4, 11, 18, 25 Motivación Intrínseca – Hacia las Experiencias Estimulantes

3, 10, 17, 24 Motivación Extrínseca - identificada

7, 14, 21, 28 Motivación Extrínseca - introyectada

1, 8, 15, 22 Motivación Extrínseca – regulación externa

5, 12, 19, 26 Amotivación

Nota: Para utilizar esta escala Ud. sólo requiere citar la referencia completa de la versión adaptada al contexto Universitario Chileno.

Gracias por vuestro interés.

Appendix XI- English Version of the Learning Climate Questionnaire (Long and short versions included).

Perceived Autonomy Support: The Climate Questionnaires

The Learning Climate Questionnaire (LCQ)

The LCQ has a long form containing 15 items and a short form containing 6 of the items. The questionnaire is typically used with respect to specific learning settings, such as a particular class, at the college or graduate school level. Thus, the questions are sometimes adapted slightly, at least in the instructions, so the wording pertains to the particular situation being studied--an organic chemistry class, for example. In these cases, the questions pertain to the autonomy support of an individual instructor, preceptor, or professor. If, however, it is being used to assess a general learning climate in which each student has several instructors, the questions are stated with respect to the autonomy support of the faculty members in general. Below, you will find the 15-item version of the questionnaire, worded in terms of "my instructor." If you would like to use the 6-item version, simply reconstitute the questionnaire using only items # 1, 2, 4, 7, 10, and 14.

Scoring: Scores on both the 15-item version and the 6-item version are calculated by averaging the individual item scores. However, for the long version, before averaging the item scores, you must first "reverse" the score of item 13 (i.e., subtract the score on item 13 from 8 and use the result as the item score for this item--for example, the score of 3, when reversed would become 5). Higher average scores represent a higher level of perceived autonomy support.

Learning Climate Questionnaire

This questionnaire contains items that are related to your experience with your instructor in this class. Instructors have different styles in dealing with students, and we would like to know more about how you have felt about your encounters with your instructor. Your responses are confidential. Please be honest and candid.

1. I feel that my instructor provides me choices and options.

1	2	3	4	5	6	7
strongly			neutral			strongly
disagree						agree

2. I feel understood by my instructor.

9. My instructor answers my questions fully and carefully.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

10. My instructor listens to how I would like to do things.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

11. My instructor handles people's emotions very well.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

12. I feel that my instructor cares about me as a person.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

13. I don't feel very good about the way my instructor talks to me.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

14. My instructor tries to understand how I see things before suggesting a new way to do things.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

15. I feel able to share my feelings with my instructor.

1 2 3 4 5 6 7
strongly neutral strongly

Appendix XII- Spanish short Learning Climate Questionnaire (LCQ) Version.

LCQ – Short Form

Este cuestionario contiene ítems que están relacionados con tu experiencia con el profesor/a de esta asignatura. Los profesores tienen diferentes estilos en el trato con los estudiantes y nos gustaría conocer **cómo te sientes en tu relación con tu profesor**. Tus respuestas son anónimas y confidenciales. Por favor, sé honesto/a y sincero/a.

1 Absolutamente en desacuerdo	2 Muy poco de acuerdo	3 Un poco de acuerdo	4 Moderadamente de acuerdo	5 Bastante de acuerdo	6 Muy de acuerdo	7 Totalmente de acuerdo
-------------------------------------	--------------------------------	----------------------------	----------------------------------	-----------------------------	------------------------	-------------------------------

1. Mi profesor/a me transmite confianza para hacer las cosas bien en la asignatura.	1	2	3	4	5	6	7
2. Confío mucho en mi profesor/a.	1	2	3	4	5	6	7
3. Mi profesor/a maneja muy bien las emociones de las personas.	1	2	3	4	5	6	7
4. Me siento muy bien con la forma en que mi profesor/a me habla.	1	2	3	4	5	6	7
5. Mi profesor/a intenta comprender mi punto de vista antes de explicarme una nueva forma de hacer las cosas.	1	2	3	4	5	6	7

Appendix XIII- Authorisation to use the Spanish versions of the short Learning Climate Questionnaire (LCQ), the Basic Psychological Needs Satisfaction Scale (BPNS) and the Assessment Experience Questionnaire (AEQ).



César Orsini <cesar.orsini@gmail.com>

Saludos y Autorización para utilizar instrumentos

Juan Luis Núñez Alonso <juanluis.nunez@ulpgc.es>
Para: César Orsini <cesar.orsini@gmail.com>

5 de febrero de 2015, 15:29

Hola César,

siento el retraso en contestar.

Por supuesto, tienes la autorización para utilizar los instrumentos de evaluación con fines de investigación.

Te adjunto los instrumentos que solicitas o el artículo donde lo puedes encontrar.

No sabría qué instrumento recomendarte para evaluar la consecuencia cognitiva. Nosotros nos hemos focalizado más en estudiar los aspectos emocionales/afectivos o los conductuales. En la bibliografía de la SDT puedes encontrar algunos ejemplos válidos.

Un abrazo.

Juan Luis.

<p>Juan Luis Núñez Alonso <i>Profesor Titular de Universidad</i> Departamento de Psicología y Sociología</p> <p>t +34 928 45 8924 f +34 928 45 8846 www.ulpgc.es</p>	 <p>UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA</p>
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De: César Orsini <cesar.orsini@gmail.com>

Enviado: lunes, 02 de febrero de 2015 17:30

Para: Núñez Alonso, Juan Luis; Juan Luis Núñez Alonso

Asunto: Saludos y Autorización para utilizar instrumentos

Muy estimado Prof. Juan Luis Núñez,

Lo saludo nuevamente, y en esta ocasión le escribo con dos objetivos principales.

El primero es en relación a los instrumentos que utilizaré para el estudio que llevaré a cabo este año sobre motivación académica en estudiantes de odontología Chilenos. Como le comentaba en mi correo anterior, quería pedir su autorización y si fuera tan amable de enviarme los siguientes instrumentos que su grupo de investigación ha validado. Obviamente, estos los utilizaré solo con fines de investigación y con la cita bibliográfica correspondiente (tanto en la tesis doctoral, como en los papers que deriven de ella):

- 1.- La versión corta del LCQ en Español.
- 2.- La Escala de Satisfacción de las Necesidades Psicológicas en Educación (ESNPE)
- 3.- La Versión Española del Assessment Experience Questionnaire (AEQ). Pretendo utilizar la sub escala de cantidad y calidad de feedback.

El segundo objetivo de este correo es pedir su opinión sobre las variables que consideraré como consecuencias de los distintos tipos de motivación. Para el nivel afectivo pretendo utilizar la escala de autoestima de Rosemberg validada por su grupo (este instrumento Ud. ya me lo envió). Para el nivel de comportamiento (Behaviour), pretendo utilizar la variable estrategias de estudio profunda y superficial del cuestionario de Biggs. Para el nivel cognitivo no tengo claro que instrumento utilizar, y quería consultarle si su grupo de investigación ha validado algún instrumento que pueda utilizar para medir la variable una cognitiva o si Ud ha utilizado alguna escala que me pueda recomendar.

De antemano le agradezco su siempre buena disposición.
Un abrazo desde el frío y nevado Glasgow!
César.

--

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University of Chile.

4 archivos adjuntos



LCQ 5 SP Short Form.doc
42K



Traducción y validación de la versión española de la Échelle de Satisfacción des Besoins
Psychologiques en el contexto educativo.pdf
286K



Artículo AEQ.pdf
507K



AEQ cuestionario SP.doc
71K

Appendix XIV- English version of the Assessment Experience Questionnaire (AEQ).

Assessment Experience Questionnaire (V3.3)

By filling out this questionnaire I understand that I am agreeing to participate in a research study

Please respond to every statement by circling 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree to indicate the strength of your agreement or disagreement

Programme of Study:

Biographical Data: (please tick as appropriate)

Male Female.....

Age (17 -21.....) (22 -30)..... (31 +.....)

Average achievement on this course: (1st.....); (2:1.....); (2:2.....) (3.....)

Please respond with respect to your experience so far of the programme named above, including all its assessment components

strongly disagree
disagree
neutral
agree
strongly agree

1	I used the feedback I received to go back over what I had done in my work	1	2	3	4	5
2	The feedback I received prompted me to go back over material covered in the course	1	2	3	4	5
3	I received hardly any feedback on my work	1	2	3	4	5
4	You had to study the entire syllabus to do well in the assessment	1	2	3	4	5
5	The assessment system made it possible to be quite selective about what parts of courses you studied	1	2	3	4	5
6	The way the assessment worked you had to put the hours in regularly every week	1	2	3	4	5
7	It was always easy to know the standard of work expected	1	2	3	4	5
8	I paid careful attention to feedback on my work and tried to understand what it was saying	1	2	3	4	5
9	The teachers made it clear from the start what they expected from students	1	2	3	4	5
10	The staff seemed more interested in testing what I had memorised than what I understood	1	2	3	4	5
11	It was possible to be quite strategic about which topics you could afford not to study	1	2	3	4	5
12	It was often hard to discover what was expected of me in this course	1	2	3	4	5
13	On this course it was necessary to work consistently hard to meet the assessment requirements	1	2	3	4	5
14	Too often the staff asked me questions just about facts	1	2	3	4	5
15	I didn't understand some of the feedback on my work	1	2	3	4	5
16	Whatever feedback I received on my work came too late to be useful	1	2	3	4	5
17	The way the assessment worked on this course you had to study every topic	1	2	3	4	5
18	To do well on this course all you really needed was a good memory	1	2	3	4	5
These questions are about the way you go about your learning on the course						
19	When I'm reading I try to memorise important facts which may come in useful later	1	2	3	4	5
20	I usually set out to understand thoroughly the meaning of what I am asked to read	1	2	3	4	5
21	I generally put a lot of effort into trying to understand things which initially seem difficult	1	2	3	4	5
22	I often found myself questioning things that I heard in classes or read in books	1	2	3	4	5
23	I find I have to concentrate on memorising a good deal of what we have to learn	1	2	3	4	5
24	Often I found I had to study things without having a chance to really understand them	1	2	3	4	5
Learning from the exam (only to be completed if there were exams on the course)						
25	Doing exams brought things together for me	1	2	3	4	5
26	I learnt new things while preparing for the exams	1	2	3	4	5
27	I understood things better as a result of the exams	1	2	3	4	5
Overall satisfaction						
28	Overall I was satisfied with the quality of this course	1	2	3	4	5

Comments you would like to make:

Scales

Quantity of effort (alpha=0.69)

- 6 The way the assessment worked you had to put the hours in regularly every week
- 13 On this course it was necessary to work consistently hard to meet the assessment requirements

Coverage of syllabus (alpha=0.85)

- 4 You had to study the entire syllabus to do well in the assessment
- 5 The assessment system made it possible to be quite selective about what parts of courses you studied (Negative scoring)
- 11 It was possible to be quite strategic about which topics you could afford not to study (Negative scoring)
- 17 The way the assessment worked on this course you had to study every topic

Quantity and quality of feedback (alpha=0.61)

- 3 I received hardly any feedback on my work (Negative scoring)
- 15 I didn't understand some of the feedback on my work (Negative scoring)
- 16 Whatever feedback I received on my work came too late to be useful (Negative scoring)

Use of feedback (alpha=0.70)

- 1 I used the feedback I received to go back over what I had done in my work
- 2 The feedback I received prompted me to go back over material covered in the course
- 8 I paid careful attention to feedback on my work and tried to understand what it was saying

Appropriate assessment

- 10 The staff seemed more interested in testing what I had memorised than what I understood (Negative scoring)
- 14 Too often the staff asked me questions just about facts (Negative scoring)
- 18 To do well on this course all you really needed was a good memory (Negative scoring)

Clear goals and standards

- 7 It was always easy to know the standard of work expected
- 9 The teachers made it clear from the start what they expected from students
- 12 It was often hard to discover what was expected of me in this course (Negative scoring)

Surface Approach

- 19 When I'm reading I try to memorise important facts which may come in useful later
- 23 I find I have to concentrate on memorising a good deal of what we have to learn
- 24 Often I found I had to study things without having a chance to really understand them

Deep Approach

- 20 I usually set out to understand thoroughly the meaning of what I am asked to read.
- 21 I generally put a lot of effort into trying to understand things which initially seem difficult
- 22 I often found myself questioning things that I heard in classes or read in books

Learning from the examination (alpha=0.78)

- 25 Doing the exams brings things together for me
- 26 I learn new things while preparing for the exams
- 27 I understand things better as a result of the exams

Satisfaction

- 28 Overall I am satisfied with the teaching on this course

Appendix XV- Spanish version of the Assessment Experience Questionnaire (AEQ).

Assessment Experience Questionnaire (V3.3)

- Titulación.....
- Curso....
- Hombre..... Mujer.....
- Edad....

Por favor, indique su grado de acuerdo a cada enunciado mediante un círculo siguiendo las siguientes claves de puntuación:

Totalmente en desacuerdo	En desacuerdo	De acuerdo	Muy de acuerdo	Totalmente de acuerdo
1	2	3	4	5

Por favor, responda de acuerdo a su experiencia respecto al proceso de evaluación del curso pasado.

1. Utilicé el feedback que recibí para revisar lo que había hecho en mi trabajo.	1	2	3	4	5
2. El feedback que recibí, me hizo volver a consultar el material visto en el curso.	1	2	3	4	5
3. Apenas recibí feedback sobre mi trabajo.	1	2	3	4	5
4. Tuve que estudiar todos los temas del programa para realizar bien la evaluación.	1	2	3	4	5
5. El sistema de evaluación me permitió ser bastante selectivo acerca de qué temas del programa debía estudiar.	1	2	3	4	5
6. Por la forma en la que se planteó la evaluación, tenía que planificarte unas horas de estudio semanales.	1	2	3	4	5
7. Fue fácil saber los criterios de evaluación esperados.	1	2	3	4	5
8. Presté atención al feedback que me dieron los profesores sobre mi trabajo y traté de comprenderlo.	1	2	3	4	5
9. Los profesores aclararon desde el principio lo que esperaban de sus estudiantes.	1	2	3	4	5
10. El profesorado parecía más interesado en valorar lo que había memorizado que lo que había comprendido.	1	2	3	4	5
11. Pude ser bastante estratégico y dejar de estudiar algunos temas.	1	2	3	4	5
12. A veces fue difícil saber lo que se esperaba de mí en este curso.	1	2	3	4	5
13. En este curso fue necesario trabajar de forma constante para cumplir los requisitos de la evaluación.	1	2	3	4	5
14. El profesorado muchas veces me preguntó sólo cuestiones de datos memorísticos.	1	2	3	4	5
15. No comprendí algunos aspectos del feedback que me dieron los profesores sobre mi trabajo.	1	2	3	4	5
16. Todo el feedback que me dieron sobre mi trabajo llegó demasiado tarde para ser útil.	1	2	3	4	5
17. Por la forma de evaluar las asignaturas de este curso tenía que estudiar todos y cada uno de los temas.	1	2	3	4	5
18. Para tener éxito en este curso todo lo que se necesitaba era tener memoria.	1	2	3	4	5
19. Cuando leía trataba de memorizar los datos importantes que podrían ser útiles más adelante.	1	2	3	4	5
20. Generalmente me proponía comprender a conciencia el significado de lo que me pedían que leyera.	1	2	3	4	5
21. Normalmente me esforzaba en comprender lo que inicialmente parecía difícil.	1	2	3	4	5
22. Durante el curso, a veces me cuestioné cosas que se decían en clase o que leía.	1	2	3	4	5
23. Tenía que concentrarme en memorizar gran cantidad de información que tenía que aprender.	1	2	3	4	5
24. A veces tenía que estudiar cosas sin tener oportunidad de comprenderlas.	1	2	3	4	5
25. Hacer los exámenes me ayudó a relacionar e integrar los temas.	1	2	3	4	5
26. Aprendí cosas nuevas mientras preparaba los exámenes.	1	2	3	4	5
27. Comprendí mejor los temas después de haber realizado los exámenes.	1	2	3	4	5
28. En general, estoy satisfecho con la enseñanza de este curso.	1	2	3	4	5

Appendix XVI- Original French version of the Basic Psychological Needs Satisfaction Scale (*Échelle de Satisfaction des Besoins Psychologiques*).

SATISFACTION DES BESOINS PSYCHOLOGIQUES

Indiquez le sport auquel vous ferez référence tout au long des 15 prochains énoncés :

.....
Lisez attentivement chacun des énoncés suivants. Ensuite en utilisant l'échelle ci-dessous, indiquez dans quelle mesure ces énoncés sont exacts pour vous.

1 2 3 4 5 6 7
Pas vrai du Moyennement Complètement
tout vrai vrai

DANS MON SPORT, ...

1) ..., je me sens libre de mes choix.	1	2	3	4	5	6	7
2) ..., j'ai beaucoup de sympathie pour les personnes avec lesquelles j'interagis.	1	2	3	4	5	6	7
3) ..., souvent, je ne me sens pas très compétent.	1	2	3	4	5	6	7
4) ..., je me sens généralement libre d'exprimer mes idées et mes opinions.	1	2	3	4	5	6	7
5) ..., je m'entends bien avec les personnes avec lesquelles je rentre en contact.	1	2	3	4	5	6	7
6) ..., j'ai le sentiment de bien réussir.	1	2	3	4	5	6	7
7) ..., j'ai la possibilité de prendre des décisions à propos de mon programme d'entraînement.	1	2	3	4	5	6	7
8) ..., les personnes que je côtoie m'estiment et m'apprécient.	1	2	3	4	5	6	7
9) ..., j'estime être en mesure de répondre aux exigences de mon programme d'entraînement.	1	2	3	4	5	6	7
10) ..., je participe à l'élaboration de mon programme d'entraînement.	1	2	3	4	5	6	7
11) ..., je considère les personnes avec lesquelles j'interagis régulièrement comme mes amis.	1	2	3	4	5	6	7
12) ..., je n'ai pas beaucoup de possibilités de montrer ce dont je suis capable.	1	2	3	4	5	6	7
13) ..., je peux donner mon avis concernant l'élaboration de mon programme d'entraînement.	1	2	3	4	5	6	7
14) ..., je me sens à l'aise avec les autres.	1	2	3	4	5	6	7
15) ..., souvent, je ne me sens pas très performant.	1	2	3	4	5	6	7

Perceptions d'autonomie : 1 / 4 / 7 / 10 / 13

Perceptions d'affiliation : 2 / 5 / 8 / 11 / 14

Perceptions de compétence : 3 (inversé) / 6 / 9 / 12 (inversé) / 15 (inversé)

Gillet, N., Rosnet, E., & Vallerand, R. J. (sous presse). Développement d'une échelle de satisfaction des besoins fondamentaux en contexte sportif. *Revue Canadienne des Sciences du Comportement*.

Appendix XVII- Spanish version of the Basic Psychological Needs Satisfaction Scale in the context of higher education.

IV. Escala de Satisfacción de las Necesidades Psicológicas en Educación

Por favor, lea las siguientes declaraciones. Luego, utilizando la siguiente escala, indique cómo estas afirmaciones son ciertas para usted en el **ámbito Universitario, marcando con una X la respuesta que más se ajusta a usted.**

Totalmente en desacuerdo	En desacuerdo	De acuerdo	Muy de acuerdo	Totalmente de acuerdo
1	2	3	4	5

En la Universidad, ...

1) ..., Me siento libre en mis decisiones.	1	2	3	4	5
2) ..., Siento mucha simpatía por las personas con las que me relaciono.	1	2	3	4	5
3) ..., A menudo me siento muy competente.	1	2	3	4	5
4) ..., Generalmente me siento libre para expresar mis opiniones.	1	2	3	4	5
5) ..., Me siento bien con las personas con las que me relaciono.	1	2	3	4	5
6) ..., Tengo la sensación de hacer las cosas bien.	1	2	3	4	5
7) ..., Tengo la posibilidad de tomar decisiones sobre los programas de las asignaturas.	1	2	3	4	5
8) ..., Las personas que me rodean me valoran y me aprecian.	1	2	3	4	5
9) ..., Creo que puedo responder a las exigencias de los programas de las asignaturas.	1	2	3	4	5
10) ..., Participo en la elaboración de mi programa de asignatura.	1	2	3	4	5
11) ..., Considero mis amigos a las personas con las que me relaciono normalmente.	1	2	3	4	5
12) ..., Tengo muchas posibilidades de demostrar de qué soy capaz.	1	2	3	4	5
13) ..., Puedo opinar sobre la elaboración de los programas de las asignaturas.	1	2	3	4	5
14) ..., Me siento a gusto con los demás.	1	2	3	4	5
15) ..., A menudo siento que puedo hacerlo bien.	1	2	3	4	5

Appendix XVIII- Original English versions of the Revised Study Process Questionnaire (R-SPQ-2F).

19

Revised Study Process Questionnaire (R-SPQ-2F)

This questionnaire has a number of questions about your attitudes towards your studies and your usual way of studying.

There is no *right* way of studying. It depends on what suits your own style and the course you are studying. It is accordingly important that you answer each question as honestly as you can. If you think your answer to a question would depend on the subject being studied, give the answer that would apply to the subject(s) most important to you.

Please fill in the appropriate circle alongside the question number on the “General Purpose Survey/Answer Sheet”. The letters alongside each number stand for the following response.

- A — this item is *never* or *only rarely* true of me
- B — this item is *sometimes* true of me
- C — this item is true of me about *half the time*
- D — this item is *frequently* true of me
- E — this item is *always* or *almost always* true of me

Please choose the *one* most appropriate response to each question. Fill the oval on the Answer Sheet that best fits your immediate reaction. Do not spend a long time on each item: your first reaction is probably the best one. Please answer each item.

Do not worry about projecting a good image. Your answers are CONFIDENTIAL.

Thank you for your cooperation.

1. I find that at times studying gives me a feeling of deep personal satisfaction.
2. I find that I have to do enough work on a topic so that I can form my own conclusions before I am satisfied.
3. My aim is to pass the course while doing as little work as possible.
4. I only study seriously what’s given out in class or in the course outlines.
5. I feel that virtually any topic can be highly interesting once I get into it.
6. I find most new topics interesting and often spend extra time trying to obtain more information about them.
7. I do not find my course very interesting so I keep my work to the minimum.
8. I learn some things by rote, going over and over them until I know them by heart even if I do not understand them.
9. I find that studying academic topics can at times be as exciting as a good novel or movie.
10. I test myself on important topics until I understand them completely.
11. I find I can get by in most assessments by memorising key sections rather than trying to understand them.

12. I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.
13. I work hard at my studies because I find the material interesting.
14. I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.
15. I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with topics.
16. I believe that lecturers shouldn't expect students to spend significant amounts of time studying material everyone knows won't be examined.
17. I come to most classes with questions in mind that I want answering.
18. I make a point of looking at most of the suggested readings that go with the lectures.
19. I see no point in learning material which is not likely to be in the examination.
20. I find the best way to pass examinations is to try to remember answers to likely questions.

Scoring is in the following cyclical order:

1. Deep Motive, 2. Deep Strategy, 3. Surface Motive, 4. Surface Strategy
5. " " etc.

Deep Approach Score: \sum All Deep Motive scores + all Deep Strategy scores

Surface Approach Score: \sum All Surface Motive scores + all Surface Strategy scores

Appendix XIX- Spanish versions of the Revised Study Process Questionnaire (R-SPQ-2F).

Cuestionario sobre enfoques de aprendizaje (John Biggs)

Este cuestionario presenta una serie de cuestiones que tienen que ver con las actitudes hacia el estudio y con su manera habitual de estudiar

No hay una única manera correcta de estudiar. Depende más bien de lo que se adapta a su propio estilo y al curso que está estudiando.

Es muy importante que responda a cada pregunta lo más sinceramente posible

Si cree que la respuesta a una pregunta depende de lo que se trate de estudiar, entonces responda como si se tratara de la asignatura o asignaturas *más importantes* para Vd.

Por favor, señale la respuesta que mejor le identifique con esta clave:

- A. *Nunca o casi nunca* es verdad en mi caso.
- B. Es cierto *a veces*.
- C. Esta afirmación es cierta *en la mitad de las ocasiones*.
- D. *Con frecuencia* es cierto en mi caso.
- E. *Siempre o casi siempre* es verdad.

Elige por favor la respuesta más apropiada para cada pregunta. Señale la respuesta que mejor refleje su primera reacción. No emplee mucho tiempo con cada pregunta; probablemente su primera reacción es la que mejor le identifica.

Responda por favor a todas las preguntas.

No se preocupe por dar una buena imagen; sus respuestas son confidenciales.

	Nunca, rara vez	A veces	La mitad de las veces	Frecuen temente	Siempre o casi siempre
1. Me doy cuenta de que estudiar me proporciona a un sentimiento de profunda satisfacción personal.					
2. Al elaborar o estudiar un tema, no me encuentro satisfecho hasta que me he formado mis propias conclusiones sobre él.					
3. Mi objetivo es aprobar el curso haciendo el mínimo trabajo posible					
4. Sólo estudio seriamente lo que se da en las clases o lo que está en los programas detallados de las asignaturas.					
5. Me parece que cualquier tema puede llegar a ser altamente interesante una vez que te metes en él.					

	Nunca, rara vez	A veces	La mitad de las veces	Frecuen- temente	Siempre o casi siempre
6. Encuentro interesantes la mayoría de los nuevos temas y empleo tiempo extra intentando obtener mayor información sobre ellos.					
7. Dado que no encuentro el curso muy interesante voy en mi trabajo a lo mínimo.					
8. Aprendo las cosas repitiéndolas hasta que me las sé de memoria incluso aunque no las comprenda.					
9. Estudiar temas académicos puede ser a veces tan apasionante como leer una buena novela o ver una buena película.					
10. Me hago preguntas a mí mismo sobre los temas importantes hasta que los comprendo totalmente					
11. Creo que puedo aprobar la mayoría de las evaluaciones memorizando los aspectos clave en lugar de intentar comprenderlos.					
12. Generalmente limito mi estudio a lo que está específicamente ordenado, porque creo que es innecesario hacer cosas extra.					
13. Trabajo duro en mis estudios porque encuentro los temas interesantes.					
14. Empleo bastante de mi tiempo libre en buscar más información sobre temas interesantes que se han discutido en las diferentes clases.					
15. Me parece que no ayuda estudiar los temas en profundidad. Confunde y hace perder el tiempo cuando todo lo que se necesita es un conocimiento por encima de los temas.					
16. Creo que los profesores no deberían esperar que los alumnos dedicaran mucho tiempo a estudiar cosas que no van a caer en el examen.					
17. Voy a la mayoría de las clases con preguntas a las que desearía encontrar respuesta.					

	Nunca, rara vez	A veces	La mitad de las veces	Frecuen- temente	Siempre o casi siempre
18. Es muy importante para mí echar un vistazo a la mayoría de las lecturas recomendadas que tienen que ver con las clases.					
19. No le encuentro sentido a aprender contenidos que probablemente no caerán en el examen					
20. Me parece que la mejor manera de pasar los exámenes es recordar las respuestas de las posibles preguntas.					

Las respuestas se codifican de 1 (*nunca o rara vez*) a 5 (*siempre o casi siempre*).

Clave de corrección

Enfoque profundo	Enfoque superficial
1 + 2 + 5 + 6 + 9 + 10 + 13 + 14 + 17 + 18.	3 + 4 + 7 + 8 + 11 + 12 + 15 + 16 + 19 + 20

Estos dos enfoques se pueden subdividir en *Motivo y Estrategia*

Enfoque profundo		Enfoque superficial	
Motivo	Estrategia	Motivo	Estrategia
1 + 5 + 9 + 13 + 17	2 + 6 + 10 + 14 + 18	3 + 7 + 11 + 15 + 19	4 + 8 + 12 + 16 + 20

El cuestionario se puede reducir a la mitad, con sólo las *estrategias*, ítems 2, 4, 6, 8, 10, 12, 14, 16, 18 y 20).

Fuente original en inglés: BIGGS, J., KEMBER, D. and LEUNG, D.Y.P. (2001). The revised two-factor Study Process Questionnaire: R-SPQ-2F. *British Journal of Educational Psychology*, 71, 133-149..

Fuentes para citar esta versión en español (adaptación hecha con el procedimiento de *back translation* al español, inglés, alemán, francés, italiano y euskera) con la colaboración del primer autor, J. Biggs). En las dos primeras fuentes la escala está en los anexos de los capítulos.

MUÑOZ SAN ROQUE, ISABEL; PRIETO NAVARRO, LEONOR y TORRE PUENTE, JUAN CARLOS (2012). Enfoques de aprendizaje, autorregulación, autoeficacia, competencias y evaluación. Un estudio descriptivo de estudiantes de educación infantil y primaria. En TORRE PUENTE, JUAN CARLOS (2012) (Coordinador). *Educación y nuevas sociedades*. Madrid: Universidad Pontificia Comillas, 237-266.

MUÑOZ SAN ROQUE, ISABEL y MARTÍNEZ FELIPE, MARÍA (2012). Enfoques de aprendizaje, expectativas de autoeficacia y autorregulación ¿Las metodologías de enseñanza utilizadas en el proyecto piloto del EEES [Espacio Europeo de Educación Superior] afectan a la calidad del aprendizaje? En MUÑOZ SAN ROQUE, ISABEL (2012) (Coordinadora). *El Espacio Europeo de Educación Superior ¿un cambio deseable para la Universidad?* Madrid: Universidad Pontificia Comillas. 47-103.

Appendix XX- Authorisation to use the Spanish versions of the Revised Study Process Questionnaire (R-SPQ-2F).



César Orsini <cesar.orsini@gmail.com>

Solicitud para utilizar versión española de 'The revised two-factor study process questionnaire: R-SPQ-2'

César Orsini <cesar.orsini@gmail.com>

12 de enero de 2014, 2:07

Para: justicia@ugr.es

Cc: fcano@ugr.es, berben@ugr.es, jfuente@ual.es

Profesores Fernando Justicia, Francisco Cano, Ana Belén García Berbén y Jesús de la Fuente Arias,

Buenos días, por favor permítanme presentarme. Mi nombre es César Orsini Sánchez, soy odontólogo de Chile y actualmente candidato a Doctor en educación para profesiones del área de la salud, en la Universidad de Glasgow, Escocia U.K.

El proyecto de investigación que estoy llevando a cabo se centra en motivación en estudiantes de pre-grado de la carrera de Odontología. Una de mis propuestas consiste en la validación de una escala de motivación. Para evaluar su validez externa pretendo correlacionarla con medidas y variables relacionadas entre las cuales considero a la versión en español de la escala 'The revised two-factor study process questionnaire: R-SPQ-2'. Por esta razón les escribo, para solicitar vuestro permiso para utilizar este cuestionario, solo para fines académicos y con la correspondiente referencia a vuestros trabajos realizados.

Muchas Gracias.

Atentamente,

--

Dr. Cesar Orsini S.

DDS, MEd.

Doctoral student in Health Professions Education

University of Glasgow

Scotland UK.

jesus de la fuente <jfuente@ual.es>

12 de enero de 2014, 11:05

Responder a: jfuente@ual.es

Para: César Orsini <cesar.orsini@gmail.com>, justicia@ugr.es

Cc: fcano@ugr.es, berben@ugr.es

Hola Cesar:

Gracias por tu interes en nuestro trabajo. Creo que represento a los demas autores al darte la autorizacion. Nos gustaria saber los resultados de tu investigacion cuando los publiques.

Un cordial saludo,
Jesus de la Fuente Arias
Universidad de Almeria

Version 1

Appendix XXI- Original English versions of the Rosenberg Self-esteem Scale.

ROSENBERG SELF-ESTEEM SCALE

Reference:

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Description of Measure:

A 10-item scale that measures global self-worth by measuring both positive and negative feelings about the self. The scale is believed to be uni-dimensional. All items are answered using a 4-point Likert scale format ranging from strongly agree to strongly disagree.

Abstracts of Selected Related Articles:

Gray-Little, B., Williams, V.S.L., & Hancock, T. D. (1997). An item response theory analysis of the Rosenberg Self-Esteem Scale. *Personality and Social Psychology Bulletin*, *23*, 443-451.

The Rosenberg Self-Esteem Scale, a widely used self-report instrument for evaluating individual self-esteem, was investigated using item response theory. Factor analysis identified a single common factor, contrary to some previous studies that extracted separate Self-Confidence and Self-Depreciation factors. A unidimensional model for graded item responses was fit to the data. A model that constrained the 10 items to equal discrimination was contrasted with a model allowing the discriminations to be estimated freely. The test of significance indicated that the unconstrained model better fit the data—that is, the 10 items of the Rosenberg Self-Esteem Scale are not equally discriminating and are differentially related to self-esteem. The pattern of functioning of the items was examined with respect to their content, and observations are offered with implications for validating and developing future personality instruments.

Baumeister, R. F., Campbell, J. D., Krueger, J. I., & Vohs, K. D. (2003). Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyles? *Psychological Science in the Public Interest*, *4*, 1-44.

Summary – Self-esteem has become a household word. Teachers, parents, therapists, and others have focused efforts on boosting self-esteem, on the assumption that high self-esteem will cause many positive outcomes and benefits—an assumption that is critically evaluated in this review.

Appraisal of the effects of self-esteem is complicated by several factors. Because many people with high self-esteem exaggerate their successes and good traits, we emphasize objective measures of outcomes. High self-esteem is also a heterogeneous category, encompassing people who frankly accept their good qualities along with narcissistic, defensive, and conceited individuals.

The modest correlations between self-esteem and school performance do not indicate that high self-esteem leads to good performance. Instead, high self-esteem is partly the result of good school performance. Efforts to boost the self-esteem of pupils have not been shown to improve academic performance and may sometimes be counterproductive. Job performance in adults is sometimes related to self-esteem, although the correlations vary widely, and the direction of causality has not been established. Occupational success may boost self-esteem rather than the reverse. Alternatively, self-esteem may be helpful only in some job contexts. Laboratory studies have generally failed to find that self-esteem causes good task performance, with the important exception that high self-esteem facilitates persistence after failure.

People high in self-esteem claim to be more likable and attractive, to have better relationships, and to make better impressions on others than people with low self-esteem, but objective measures disconfirm most of these beliefs. Narcissists are charming at first but tend to alienate others eventually. Self-esteem has not been shown to predict the quality or duration of relationships.

High self-esteem makes people more willing to speak up in groups and to criticize the group's approach. Leadership does not stem directly from self-esteem, but self-esteem may have indirect effects. Relative to people with low self-esteem, those with high self-esteem show stronger in-group favoritism, which may increase prejudice and discrimination.

Neither high nor low self-esteem is a direct cause of violence. Narcissism leads to increased aggression in retaliation for wounded pride. Low self-esteem may contribute to externalizing behavior and delinquency, although some studies have found that there are no effects or that the effect of self-esteem vanishes when other variables are controlled. The highest and lowest rates of cheating and bullying are found in different subcategories of high self-esteem.

Self-esteem has a strong relation to happiness. Although the research has not clearly established causation, we are persuaded that high self-esteem does lead to greater happiness. Low self-esteem is more likely than high to lead to depression under some circumstances. Some studies support the buffer hypothesis, which is that high self-esteem mitigates the effects of stress, but other studies come to the opposite conclusion, indicating that the negative effects of low self-esteem are mainly felt in good times. Still others find that high self-esteem leads to happier outcomes regardless of stress or other circumstances.

High self-esteem does not prevent children from smoking, drinking, taking drugs, or engaging in early sex. If anything, high self-esteem fosters experimentation, which may increase early sexual activity or drinking, but in general effects of self-esteem are negligible. One important exception is that high self-esteem reduces the chances of bulimia in females.

Overall, the benefits of high self-esteem fall into two categories: enhanced initiative and pleasant feelings. We have not found evidence that boosting self-esteem (by

therapeutic interventions or school programs) causes benefits. Our findings do not support continued widespread efforts to boost self-esteem in the hope that it will by itself foster improved outcomes. In view of the heterogeneity of high self-esteem, indiscriminate praise might just as easily promote narcissism, with its less desirable consequences. Instead, we recommend using praise to boost self-esteem as a reward for socially desirable behavior and self-improvement.

Ciarrochi, J., Heaven, P. C. L., & Fiona, D. (2007). The impact of hope, self-esteem, and attributional style on adolescents' school grades and emotional well-being: A longitudinal study.

We examined the distinctiveness of three "positive thinking" variables (self-esteem, trait hope, and positive attributional style) in predicting future high school grades, teacher-rated adjustment, and students' reports of their affective states. Seven hundred eighty-four high school students (382 males and 394 females; 8 did not indicate their gender) completed Time 1 measures of verbal and numerical ability, positive thinking, and indices of emotional well-being (positive affect, sadness, fear, and hostility), and Time 2 measures of hope, self-esteem, and emotional well-being. Multi-level random coefficient modelling revealed that each positive thinking variable was distinctive in some contexts but not others. Hope was a predictor of positive affect and the best predictor of grades, negative attributional style was the best predictor of increases in hostility and fear, and low self-esteem was the best predictor of increases in sadness. We also found that sadness at Time 1 predicted decreases in self-esteem at Time 2. The results are discussed with reference to the importance of positive thinking for building resilience.

Scale:

Instructions

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

1. On the whole, I am satisfied with myself.
Strongly Agree Agree Disagree Strongly Disagree
2. At times I think I am no good at all.
Strongly Agree Agree Disagree Strongly Disagree
3. I feel that I have a number of good qualities.
Strongly Agree Agree Disagree Strongly Disagree
4. I am able to do things as well as most other people.
Strongly Agree Agree Disagree Strongly Disagree
5. I feel I do not have much to be proud of.
Strongly Agree Agree Disagree Strongly Disagree
6. I certainly feel useless at times.

Strongly Agree	Agree	Disagree	Strongly Disagree
7. I feel that I'm a person of worth, at least on an equal plane with others.			
Strongly Agree	Agree	Disagree	Strongly Disagree
8. I wish I could have more respect for myself.			
Strongly Agree	Agree	Disagree	Strongly Disagree
9. All in all, I am inclined to feel that I am a failure.			
Strongly Agree	Agree	Disagree	Strongly Disagree
10. I take a positive attitude toward myself.			
Strongly Agree	Agree	Disagree	Strongly Disagree

Scoring:

Items 2, 5, 6, 8, 9 are reverse scored. Give “Strongly Disagree” 1 point, “Disagree” 2 points, “Agree” 3 points, and “Strongly Agree” 4 points. Sum scores for all ten items. Keep scores on a continuous scale. Higher scores indicate higher self-esteem.

Appendix XXII- Spanish versions of the Rosenberg Self-esteem Scale.

ESCALA DE AUTOESTIMA

Traducción de la escala de Autoestima de Rosenberg (1965)

A continuación se presenta una lista de afirmaciones sobre la manera en que uno se siente consigo mismo. Señale redondeando con un círculo la respuesta que más se ajusta a usted siguiendo la siguiente clave de puntuación.

Totalmente en desacuerdo	En desacuerdo	De acuerdo	Totalmente de acuerdo	
1	2	3	4	
1. En general, estoy satisfecho conmigo mismo.	1	2	3	4
2. A veces, pienso que no soy bueno en nada.	1	2	3	4
3. Tengo la sensación de que poseo algunas buenas cualidades.	1	2	3	4
4. Soy capaz de hacer las cosas tan bien como la mayoría de las personas.	1	2	3	4
5. Siento que no tengo demasiadas cosas de las que sentirme orgulloso.	1	2	3	4
6. A veces, me siento realmente inútil.	1	2	3	4
7. Tengo la sensación de que soy una persona de valía al menos igual que la mayoría de la gente.	1	2	3	4
8. Ojalá me respetara más a mí mismo.	1	2	3	4
9. En definitiva, tiendo a pensar que soy un fracasado.	1	2	3	4
10. Tengo una actitud positiva hacia mí mismo.	1	2	3	4

Appendix XXII- Authorisation to use the Spanish versions of the Rosenberg Self-esteem Scale.



César Orsini <cesar.orsini@gmail.com>

Re: Instrumentos

Juan L. Nuñez <jnunez@dps.ulpgc.es>
Para: Cesar Orsini <cesar.orsini@gmail.com>

28 de febrero de 2014, 11:12

Estimado César Orsini,

autorizo la utilización de los instrumentos de evaluación adjuntos a este correo con fines de investigación.

Un saludo cordial.

Dr. Juan Luis Núñez.
Grupo de Estudios Motivacionales.
Universidad de Las Palmas de Gran Canaria.

Subjective Vitality Scales

Scale Description

The concept of subjective vitality refers to the state of feeling alive and alert--to having energy available to the self. Vitality is considered an aspect of eudaimonic well-being (Ryan & Deci, 2001), as being vital and energetic is part of what it means to be fully functioning and psychologically well.

Ryan and Frederick (1997) developed a scale of subjective vitality that has two versions. One version is considered an individual difference. In other words, it is an ongoing characteristics of individuals which has been found to relate positively to self-actualization and self-esteem and to relate negatively to depression and anxiety. The other version of the scale assesses the state of subjective vitality rather than its enduring aspect. At the state level, vitality has been found to relate negatively to physical pain and positively to the amount of autonomy support in a particular situation (e.g., Nix, Ryan, Manly, & Deci, 1999). In short, because the concept of psychological well-being is addressed at both the individual difference level and the state level, the two levels of assessing subjective vitality tie into the two level of well being.

The original scale had 7 items and was validated at both levels by Ryan and Frederick (1997). Subsequent work by Bostic, Rubio, and Hood (2000) using confirmatory factor analyses indicated that a 6-item version worked even better than the 7-item version.

References

Ryan, R. M., & Frederick, C. M. (1997). On energy, personality and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality, 65*, 529-565.

Ryan, R. M., & Deci, E. L. (2001). To be happy or to be self-fulfilled: A review of research on hedonic and eudaimonic well-being. In S. Fiske (Ed.), *Annual Review of Psychology* (Vol. 52; pp. 141-166). Palo Alto, CA: Annual Reviews, Inc.

Nix, G. A., Ryan, R. M., Manly, J. B., & Deci, E. L. (1999). Revitalization through self-regulation: The effects of autonomous and controlled motivation on happiness and vitality. *Journal of Experimental Social Psychology, 35*, 266-284.

Bostic, T. J., Rubio, D. M., & Hood, M. (2000). A validation of the subjective vitality scale using structural equation modeling. *Social Indicators Research, 52*, 313-324.

The Scales

Note: Below is the original scale developed by Ryan and Frederick (1997). Subsequent research by Bostic, Rubio, and Hood (2000) indicates that eliminating items # 2 improves the scale's effectiveness. First, the individual difference version is presented, and then the state version. Scoring information follows the scales.

Ryan, R. M., & Frederick, C. M. (1997). On energy, personality and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, 65, 529-565.

Bostic, T. J., Rubio, D. M., & Hood, M. (2000). A validation of the subjective vitality scale using structural equation modeling. *Social Indicators Research*, 52, 313-324.

Individual Difference Level Version

Vitality Scale

Please respond to each of the following statements by indicating the degree to which the statement is true for you in general in your life. Use the following scale:

1	2	3	4	5	6	7
not at all			somewhat			very
true			true			true

1. I feel alive and vital.
2. I don't feel very energetic.
3. Sometimes I feel so alive I just want to burst.
4. I have energy and spirit.
5. I look forward to each new day.
6. I nearly always feel alert and awake.
7. I feel energized.

State Level Version

Vitality Scale

Please respond to each of the following statements in terms of how you are feeling **right now**. Indicate how true each statement is for you at this time, using the following scale:

1	2	3	4	5	6	7
not at all			somewhat			very
true			true			true

1. At this moment, I feel alive and vital.
2. I don't feel very energetic right now.
3. Currently I feel so alive I just want to burst.
4. At this time, I have energy and spirit.
5. I am looking forward to each new day.
6. At this moment, I feel alert and awake.
7. I feel energized right now.

Scoring Information for the Subjective Vitality Scale. A scale score is formed for either version of the scale by averaging the individual's items scores. As noted above, it is recommended that you use six items, omitting item #2, in which case a person's score would be the average of the six items. If you do use item #2, that item has to be reverse scored before it is averaged with the other items. Thus, you would subtract the person's score on item #2 from 8 before averaging the resulting number with the person's responses on the other six items.

Appendix XXV- Spanish versions of the Subjective Vitality Scale.

ESCALA DE VITALIDAD SUBJETIVA (VS)

(Ryan & Frederick, 1997; Balaguer, Castillo, García-Merita, y Mars, 2005)

Por favor, responde a cada una de las siguientes afirmaciones, indicando el grado en que por lo general son verdaderas para ti en el **AMBITO UNIVERSITARIO**.

	No es verdad		Algo de verdad			Verdadero	
	1	2	3	4	5	6	7
1. Me siento vivo y vital	1	2	3	4	5	6	7
2. A veces me siento tan vivo y enérgico que solo quiero saltar	1	2	3	4	5	6	7
3. Tengo energía y ánimo	1	2	3	4	5	6	7
4. Espero con ansias cada nuevo día	1	2	3	4	5	6	7
5. Casi siempre me siento alerta y despierto	1	2	3	4	5	6	7
6. Me siento activo (siento que tengo mucha energía)	1	2	3	4	5	6	7

Appendix XXVI- Authorisation to use the Spanish version of the Subjective Vitality Scale.



César Orsini <cesar.orsini@gmail.com>

(Fwd) Solicitud para utilizar instrumento

Priscila Fabra López <Priscila.Fabra@uv.es>
Para: cesar.orsini@gmail.com
Cc: isabel.balaguer@uv.es

6 de febrero de 2015, 19:31

Buenas tardes César,

Mi nombre es Priscila Fabra, miembro de la Unidad de Investigación de Psicología del Deporte de la Universidad de Valencia que dirige la Profesora Isabel Balaguer. Le escribo en respuesta a su solicitud. Nos alegra que esté interesado en administrar nuestra validación del instrumento, aquí lo adjuntamos junto con los artículos de dos trabajos donde se analizaron tanto variables motivacionales como la vitalidad subjetiva.

Esperemos que sean de su agrado.

Un saludo cordial,

Priscila Fabra.
www.uipd.es

----- Missatge reenviat -----

Per a: Isabel.Balaguer@uv.es
Assumpte: Solicitud para utilizar instrumento
De: César_Orsini <cesar.orsini@gmail.com>
Data: Thu, 5 Feb 2015 17:47:33 +0000

Dra. Isabel Balaguer,

Buenas tardes, por favor permítame presentarme. Mi nombre es César Orsini Sánchez, soy odontólogo de Chile y actualmente candidato a Doctor en educación en ciencias de la salud, en la Universidad de Glasgow, Escocia U.K.

EL proyecto de investigación que estoy llevando a cabo se centra en motivación en estudiantes de pre-grado de la carrera de Odontología. Una de mis propuestas consiste en trabajar con el modelo de motivación propuesto por la teoría de la Autodeterminación, específicamente aplicado al contexto odontológico. Una de las variables que pretendo analizar como consecuencia afectiva, corresponde a la Vitalidad.

Por esta razón le escribo, para solicitar vuestro permiso para utilizar, y si fuese tan amable de enviarme, el instrumento de validación al español de la "Subjective Vitality Scale", solo para fines académicos y con la correspondiente referencia a vuestro trabajos realizado.

- Balaguer, I., Castillo, I., García-Merita, M., & Mars, L. (2005, July). Implications of structured extracurricular activities on adolescent's well-being and risk behaviors: Motivational mechanisms. Proceedings of the 9th European Congress of Psychology, Granada, Spain.

Muchas Gracias.

Atentamente,

--

Dr Cesar Orsini

DDS, MEd.

Doctoral candidate in Health Professions Education

University of Glasgow

Scotland UK.

Advanced Programme in Higher Education

Teaching and Learning Centre

University of Chile.

3 archivos adjuntos



Escala de Vitalidad Subjetiva.doc

32K



2011.BalaguerCastilloDudaGarciaMerita_RPD.pdf

194K

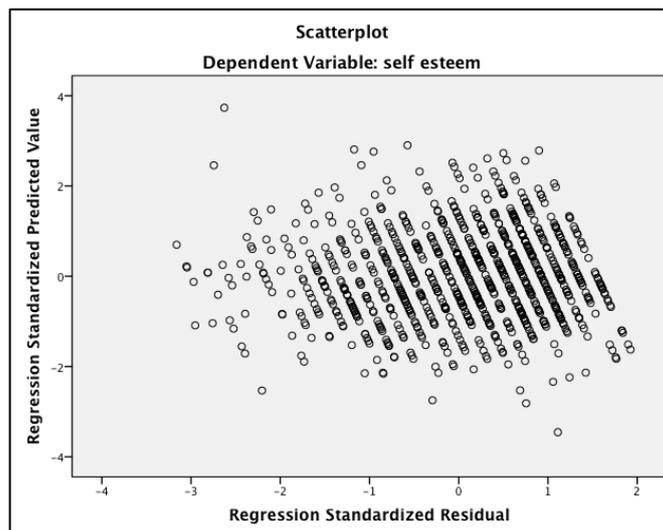
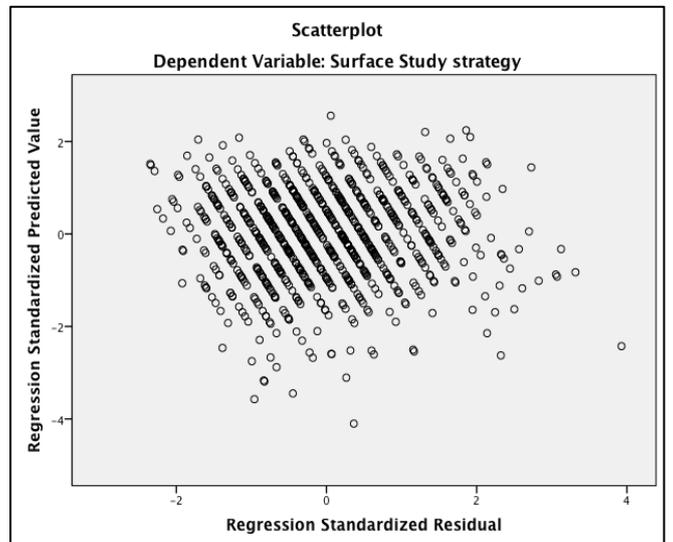
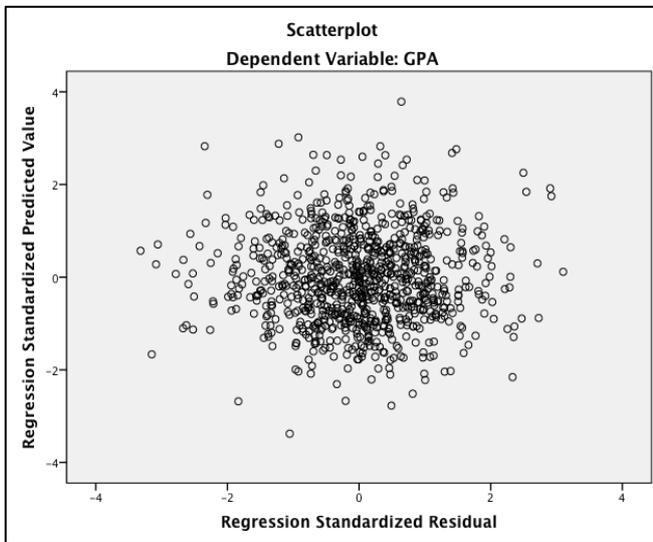
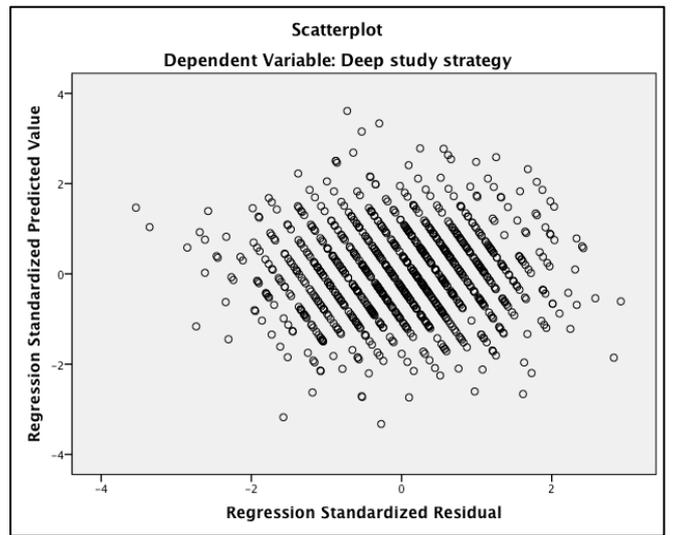
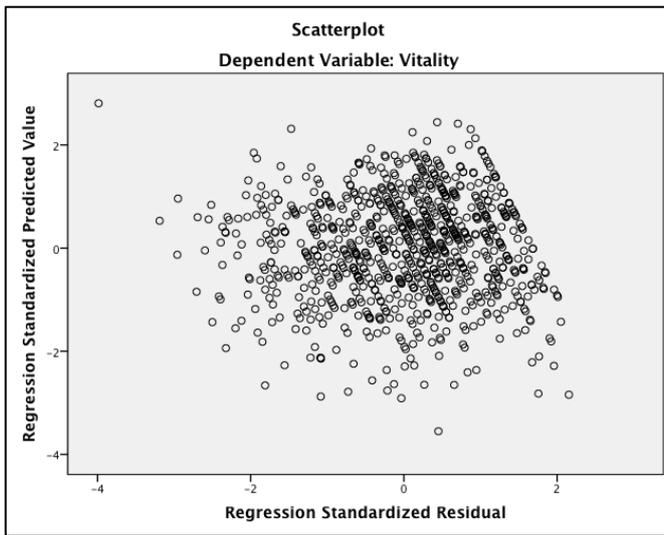


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Appendix XXVII- Testing the assumptions of the general linear model

1. Linearity and Homoscedasticity



2. Multicollinearity

Coefficients

Model	Collinearity Statistics	
	Tolerance	VIF
Relative Autonomous Motivation	,955	1,048
Quantity Quality Feedback	,886	1,129
Autonomy Support	,697	1,434
Autonomy Satisfaction	,689	1,451
Competence Satisfaction	,605	1,652
Relatedness Satisfaction	,648	1,544

3. Independent Errors

Predictors: (Constant), Relative Autonomous Motivation, Autonomy Satisfaction, Competence Satisfaction, Relatedness Satisfaction, Autonomy Support, Quantity-Quality of Feedback.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,514	,264	,260	1,16654	1,878

Dependent Variable: Vitality

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,502	,252	,247	4,302	1,825

Dependent Variable: Self-esteem

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,408	,166	,161	3,494	1,968

Dependent Variable: Surface Study Strategy

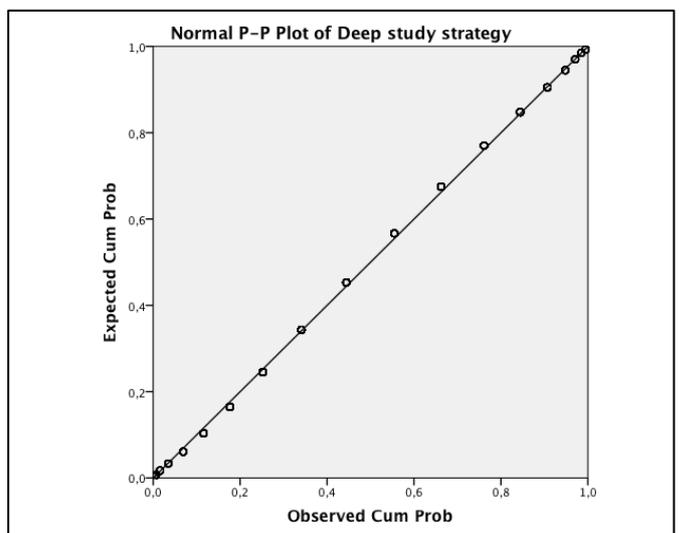
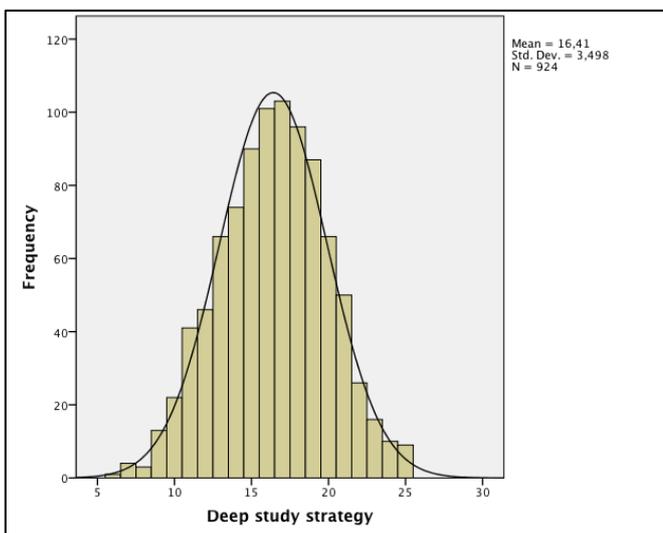
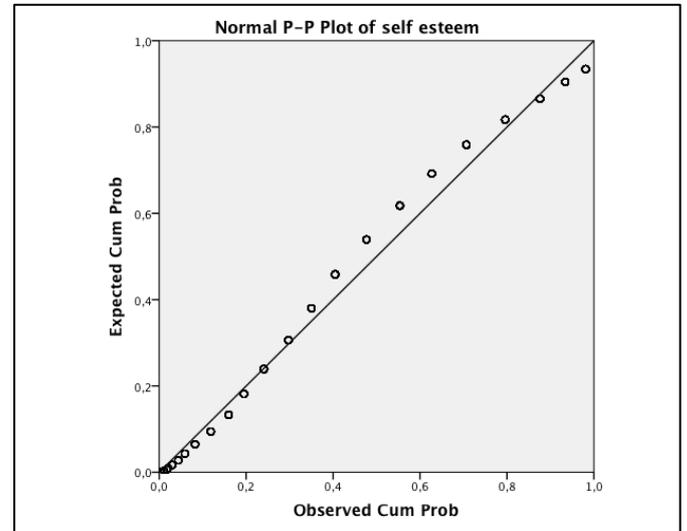
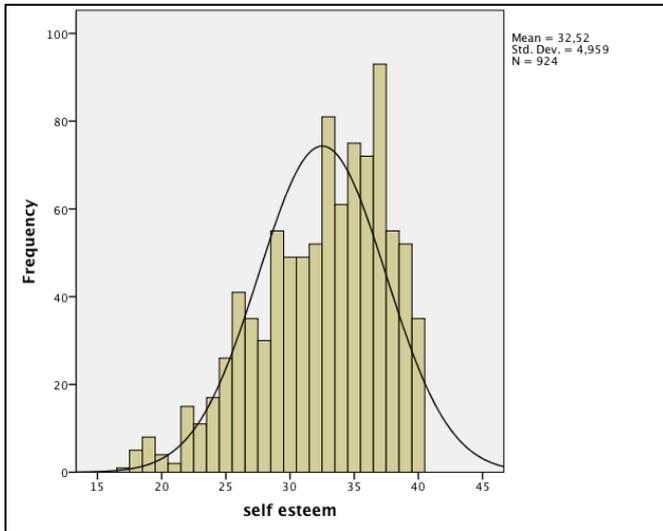
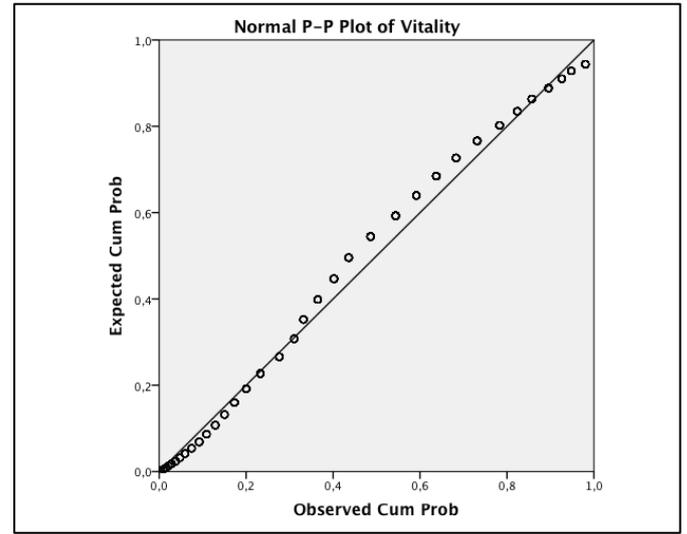
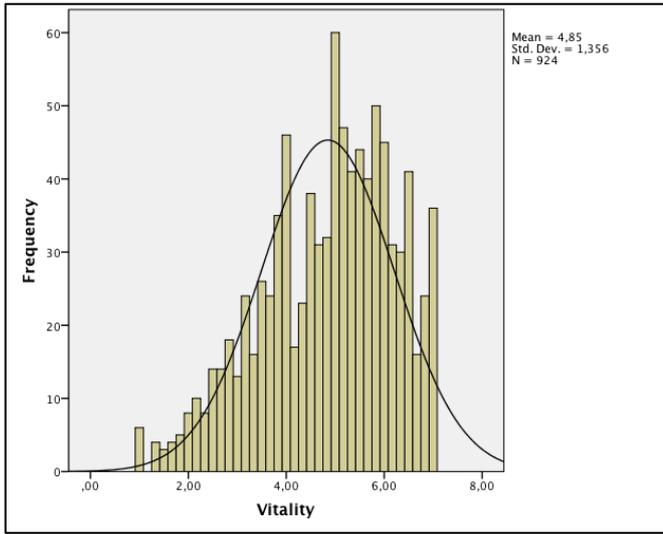
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,472	,223	,217	3,094	1,952

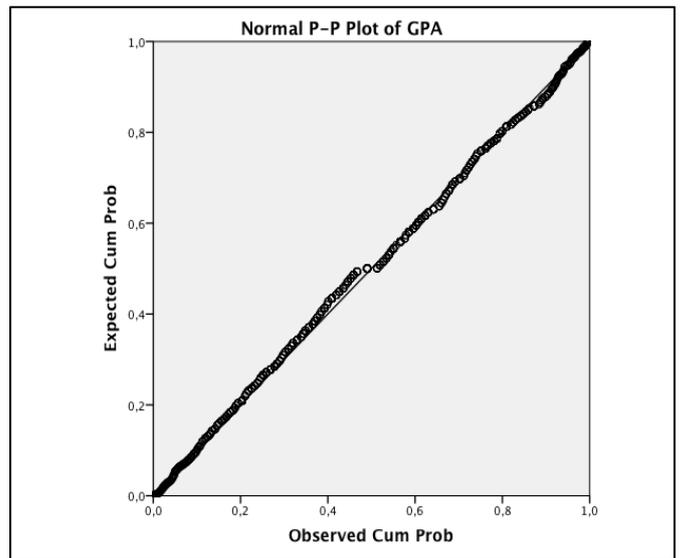
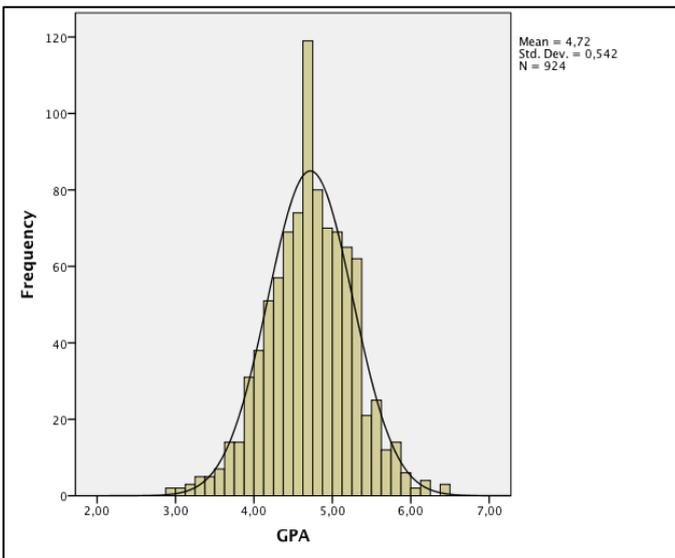
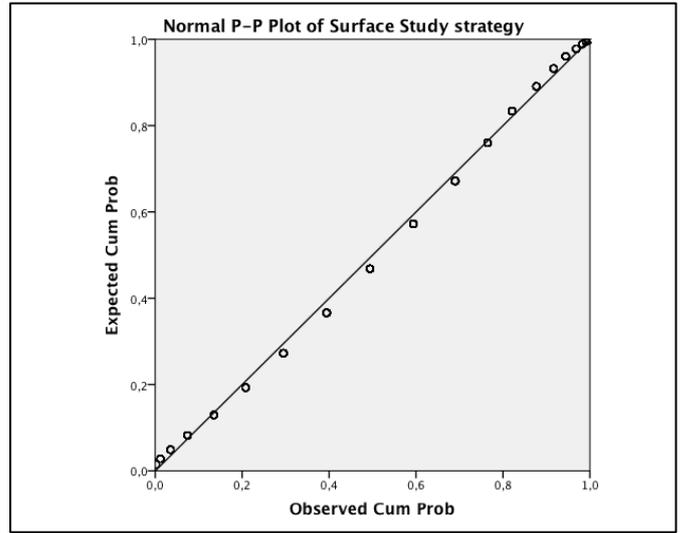
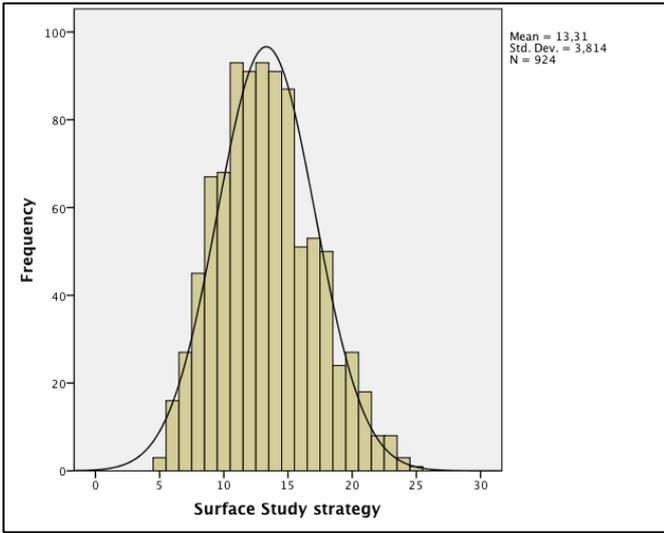
Dependent Variable: Deep Study Strategy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,228	,052	,046	,52963	1,860

Dependent Variable: GPA

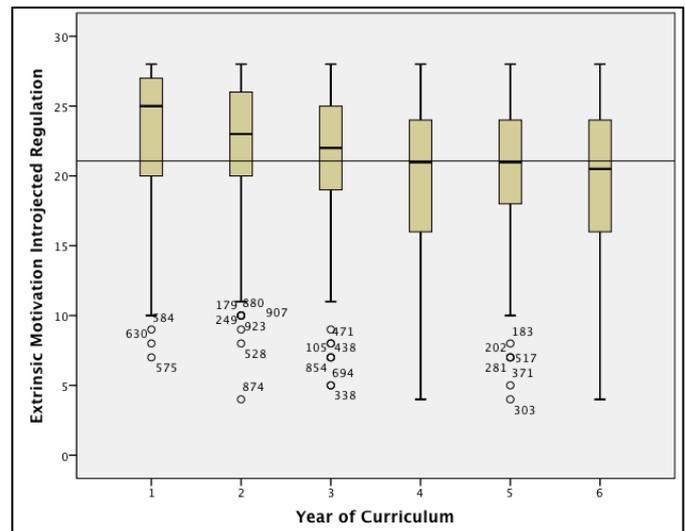
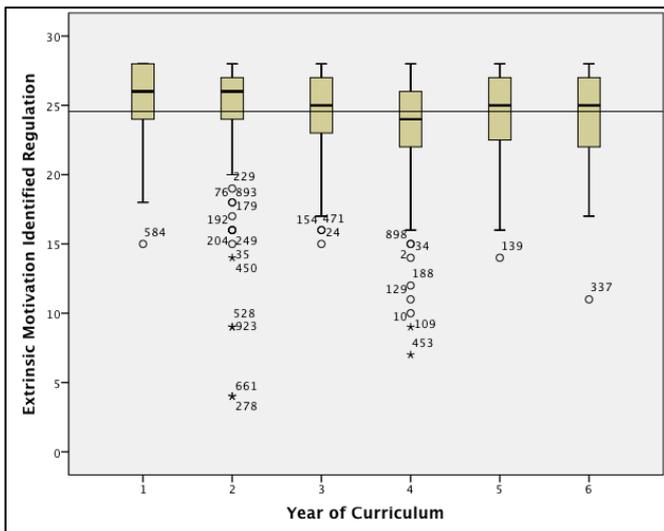
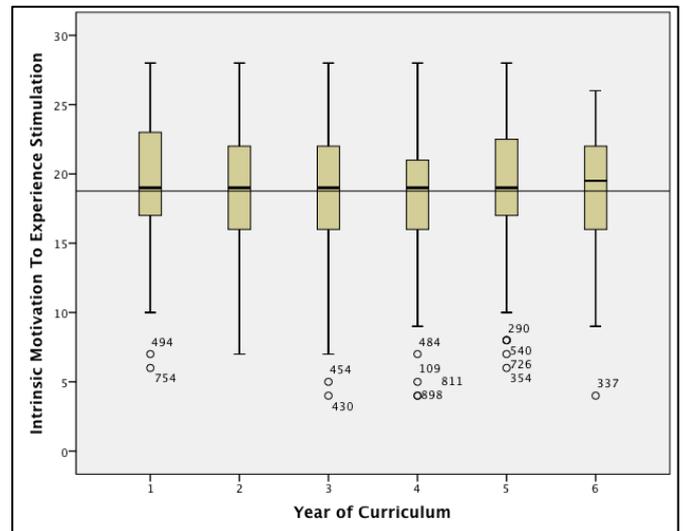
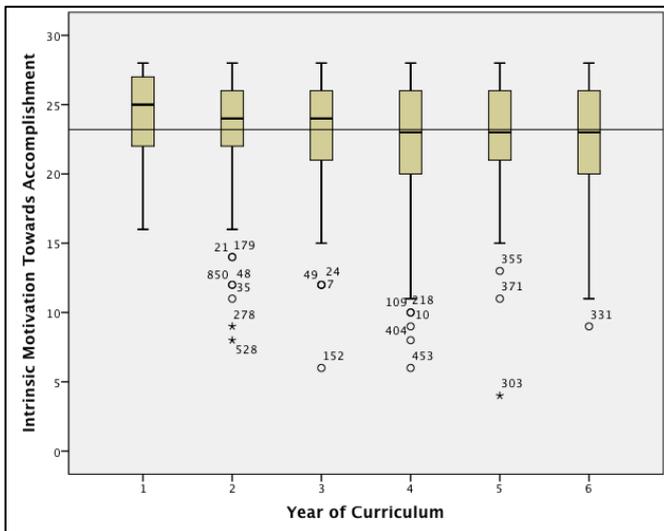
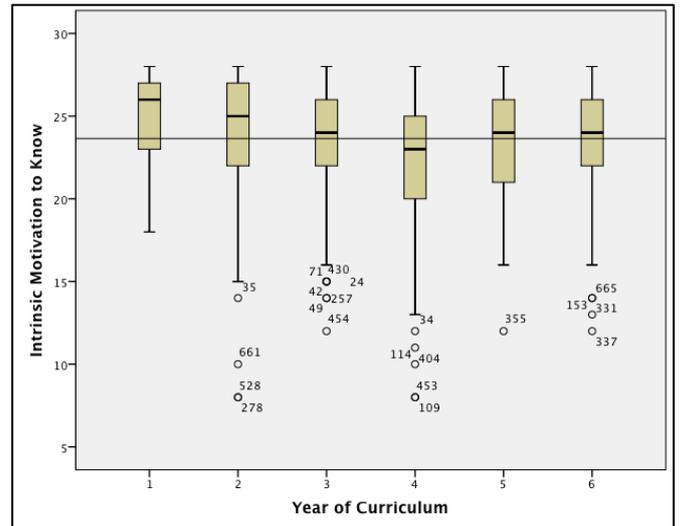
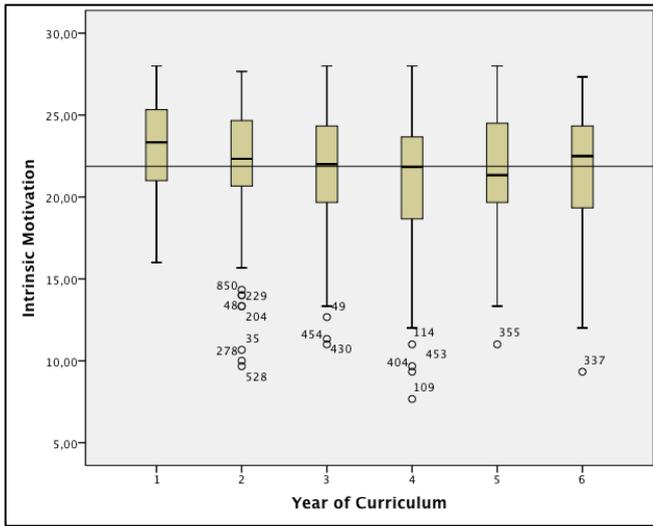
4. Normality: Histograms and P-plots of outcome variables

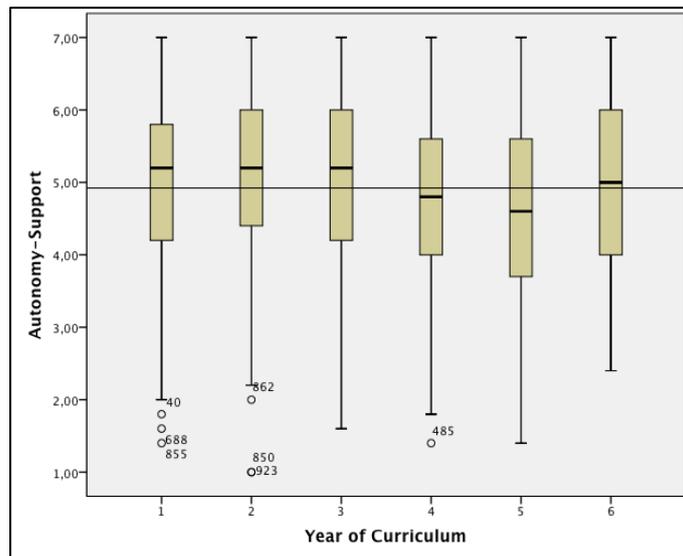
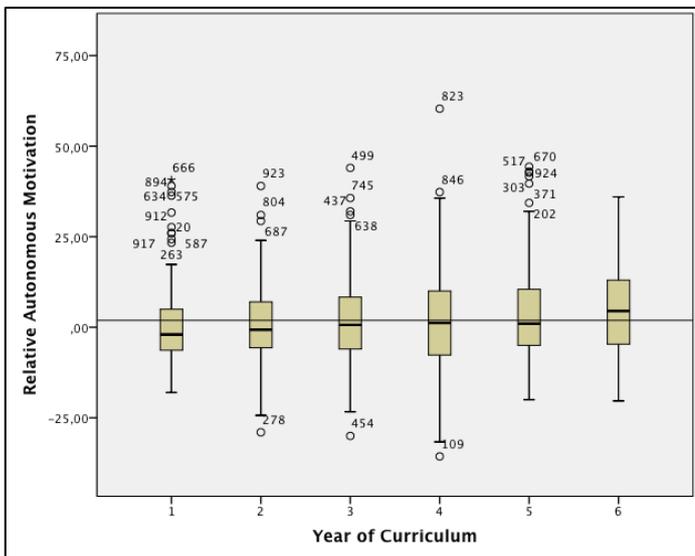
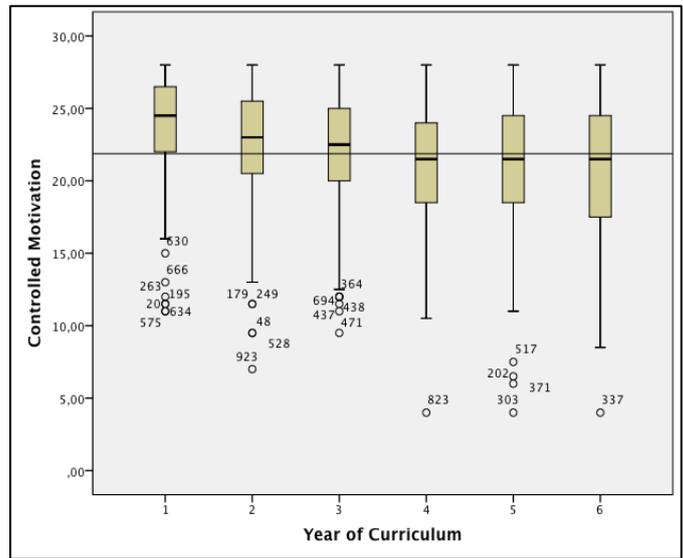
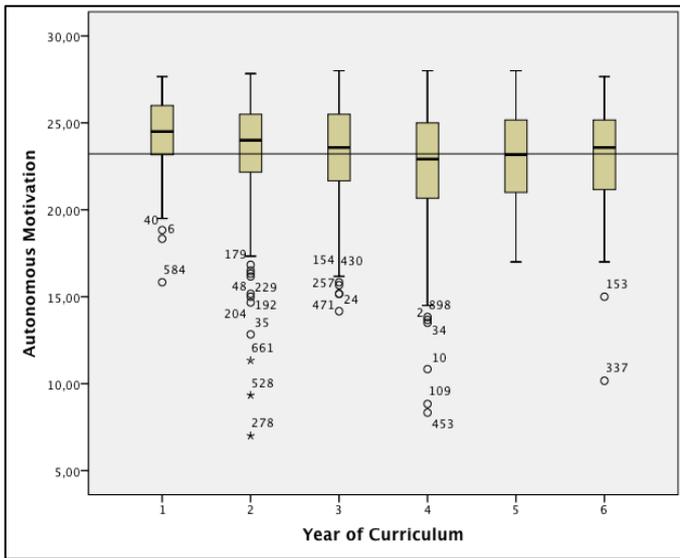
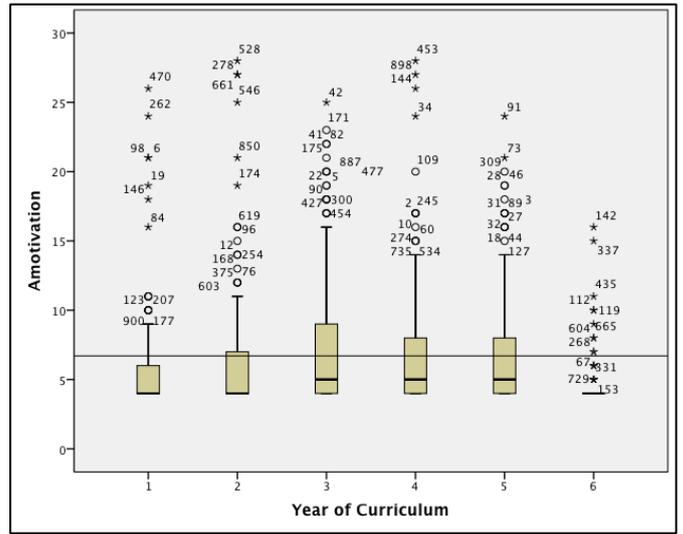
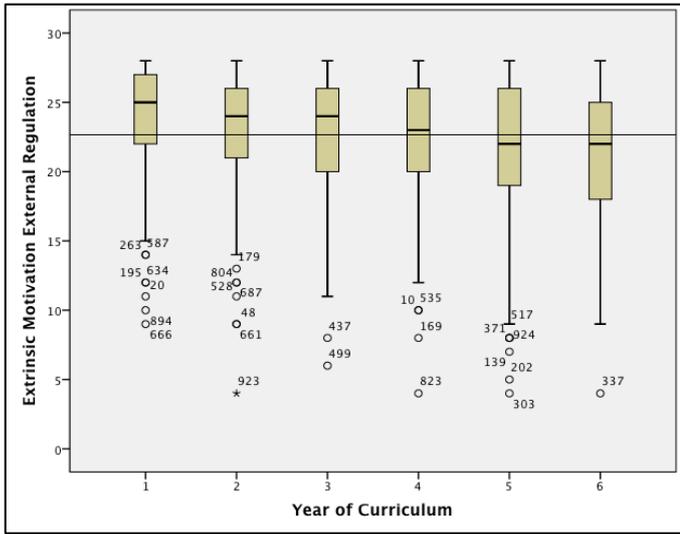


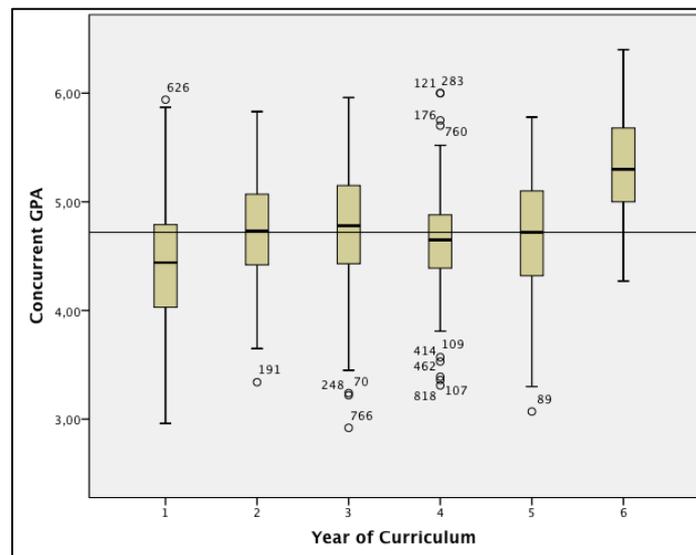
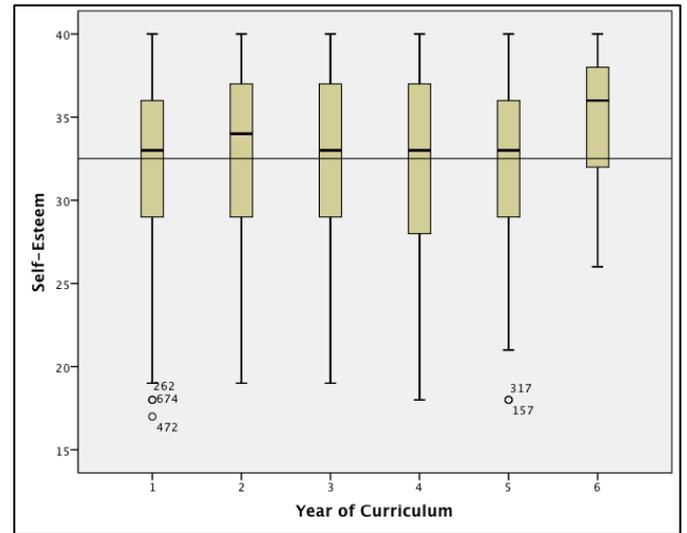
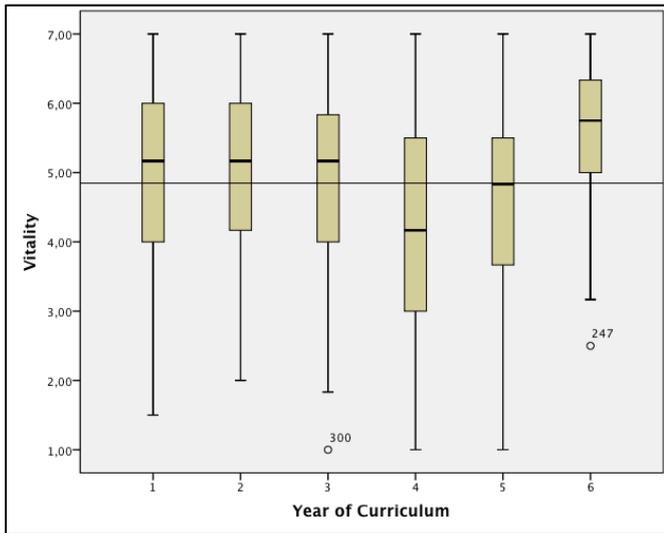


Appendix XXVIII- Box-plots showing year-of-curriculum differences in all variables.

Horizontal reference line represents the mean.







Appendix XXIX- Topic-related peer reviewed conference presentations

1. Orsini C. and Binnie V. Selected Oral Presentation: ***The Mediating Role of Basic Psychological Needs Satisfaction between feedback and Self-determined Motivation in Dental Education.*** In: Annual Meeting of the Association for Dental Education in Europe (ADEE), Barcelona, Spain. August 2016.
2. Orsini C. and Binnie V. Poster Presentation: ***The Mediating Role of Basic Psychological Needs Satisfaction between Autonomy-Support and Self-determined Motivation in Dental Education.*** In: Annual Conference of the Association for Medical Education in Europe (AMEE), Barcelona, Spain. August 2016.
3. Orsini C. and Binnie V. Poster Presentation: ***Facilitating Optimal Motivation in Dental Education: Strategies to Promote an Autonomy Supportive Clinical Learning Environment.*** In: Annual Conference of the Association for Medical Education in Europe (AMEE), Glasgow U.K. September 2015.
4. Orsini C. and Binnie V. Poster Presentation: ***Do Self-determined Forms Of Motivation Lead To Better Affective Educational Outcomes? A Structural Equation Model Analysing A Dental Student Sample.*** In: Annual Meeting of the Association for Dental Education in Europe (ADEE), Szeged Hungary. August 2015.
5. Orsini C, Evans P, Ledezma P, and Fuentes F. Poster Presentation: ***How Do Clinical Tutors Encourage Intrinsic Motivation In Undergraduate Students? A Systematic Review.*** In: 4th National Scottish Medical Education Conference, Edinburgh U.K. May 2014.

The Mediating Role of Basic Psychological Needs Satisfaction between Quality-Quantity of Feedback and Self-determined Motivation in Dental Education.

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Aims

Self-determination theory (SDT) postulates that teachers' constructive feedback, when mediated by students' perception of their basic psychological needs satisfaction (BPNS) of feeling autonomous, competent and related to significant others^{2,3}, is associated with increased levels of self-determined motivation¹. Therefore, our aim is to test the mediating role of BPNS between quality-quantity of feedback and motivation, in a dental student sample.

Materials and Methods

We conducted a cross-sectional study collecting data on demographics, quality-quantity of feedback, perception of BPNS, and motivation, from 929 Chilean undergraduate dental students. Mediation of BPNS was tested based on the Preacher & Hayes approach⁴ and then integrated in a structured equation model, controlling for gender, age, and year of curriculum.

Results

There was a significant indirect effect of quality-quantity of feedback on self-determined motivation through BPNS ($b=0.111$, $p=0.004$, BCaCI [0.039,0.197]), representing a small but significant effect-size ($K^2=0.021$, BCaCI [0.007,0.038]). The final model (Quality-quantity of feedback→BPNS→Motivation [Controls]) fitted well the data and all regression weights reflected positive associations, with a stronger significant indirect path and a weaker non-significant direct path.

Conclusions

Quality-quantity of feedback affects self-determined motivation of dental students through the mediation of BPNS. Consequently, it is not the intended effect of teachers' constructive feedback that impacts motivation, instead it is the impact it has on students' perception of BPNS that will have a positive or negative effect on their motivation.⁵⁻⁷ This is the first study on the mediating role of BPNS between quality-quantity of feedback and dental students' motivation. For dental education, a constructive feedback that facilitates BPNS would lead students to engage and value academic activities, which is expected to contribute towards them becoming better practitioners and therefore to increase patient-safety.

Take-home Message

Teachers' constructive feedback affects self-determined motivation of dental students through the mediating effect of BPNS. Therefore, the BPNS of autonomy, competence and relatedness should be considered when planning interventions to increase dental students' self-determined motivation, which in turn may improve educational outcomes and student-patient interaction.

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The Mediating Role of Basic Psychological Needs Satisfaction between Autonomy-Support and Self-determined Motivation in Dental Education.



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Background

Self-determination theory (SDT)¹ postulates that teachers' autonomy-support, when mediated by students' perception of their basic psychological needs satisfaction (BPNS) of autonomy, competence and relatedness,^{2,3} is associated with increased levels of self-determined motivation¹.

Therefore, our aim is to test the mediating role of BPNS between autonomy-support and motivation, in a dental student sample.

Summary of Work

We conducted a cross-sectional study collecting data on demographics, autonomy-support, perception of BPNS, and motivation, from 929 Chilean undergraduate dental students. Mediation of BPNS was tested based on the Preacher & Hayes approach⁴ and then integrated in a structured equation model, controlling for gender, age, and year of curriculum.

Summary of Results

There was a significant indirect effect of autonomy-support on self-determined motivation through BPNS, representing a small-to-medium effect-size (Fig. 1). The final model fitted well the data and all regression weights reflected positive associations, with a stronger significant indirect path and a weaker non-significant direct path (Fig. 2).

Figure 1. Autonomy-Support as predictor of Relative Autonomous Motivation (RAM), mediated by BPNS. BCa Bootstrapped CI based on 1000 samples. K²: kappa-squared.

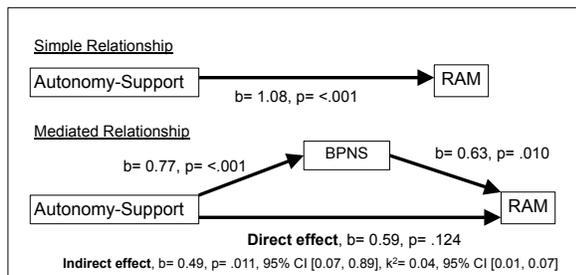
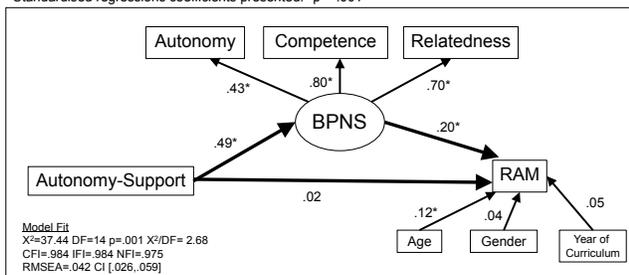


Figure 2. Structured equation model of autonomy-support as predictor of Relative Autonomous Motivation (RAM), mediated by BPNS, controlling for the effects of age, gender and year of curriculum. Standardised regressions coefficients presented. *p < .001



Discussions

Autonomy-support affects self-determined motivation of dental students through the mediation of BPNS. Consequently, it is not the intended effect of teachers' autonomy-support that impacts motivation, instead it is the impact it has on students' perception of BPNS that will have a positive or negative effect on their motivation.⁵

Conclusion

This is the first study on the mediating role of BPNS between autonomy-support and dental students' motivation. For dental education, an autonomy-supportive environment that facilitates BPNS would lead students to engage and value academic activities, which is expected to contribute towards them becoming better practitioners and therefore to increase patient-safety.

Take-home message

Teachers' autonomy-support affects self-determined motivation of dental students through the mediating effect of BPNS. Therefore, the BPNS of autonomy, competence and relatedness should be considered when planning interventions to increase dental students' autonomous motivation, which in turn may improve educational outcomes and student-patient interaction.

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Facilitating Optimal Motivation in Dental Education: Strategies to Promote an Autonomy Supportive Clinical Learning Environment.



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Background

Self-Determination theory (SDT)¹ postulates studying motivation from a multidimensional approach, based on autonomous motivation, controlled motivation, and amotivation.

Internalisation of students' motivation towards an autonomous form has been associated with increased interest, effort, and wellbeing.²⁻³ To achieve autonomous motivation, SDT suggests that teaching environments should satisfy students' needs for feeling autonomous, competent, and related to significant others.⁴ Consequently, an autonomy-supportive clinical teaching environment becomes crucial for satisfying these needs and promoting students' autonomous motivation.

The aim of this study is to describe and understand how clinical teachers promote an environment that supports these needs, in order to facilitate dental students' autonomous motivation.

Summary of Work

A qualitative case study approach was adopted. Data were collected through semi-structured interviews with nine experienced undergraduate clinical teachers from one dental school in Chile, and analysed through a thematic analysis.

Summary of Results

Overall teachers stressed the relevance of empowering, supporting and building a horizontal relationship with students. Emerged themes included the control of external motivators; gradual transference of responsibility; encouragement of personal interests; timely and constructive feedback; providing a vicarious learning experience; teamwork, and providing a safe environment.

Supporting Students' Autonomy		Supporting Students' Competence		Supporting Students' Relatedness	
Control and manage external motivators	Gradual Transference of Responsibility	Give Timely and Constructive Feedback	Provide Appropriate Clinical Challenges	Promote Teamwork and Team Discussion	Get to know students and let them know you
Refocus uninteresting activities	Identify and Encourage Personal Interests	Provide a Vicarious Learning Experience	Value Students' Clinical Practice	Behavioural Role Model	Accept Criticism
Support Proactivity and Give Choice				Provide a Safe Environment	Empathy and Assertiveness

Conclusions

Despite cultural differences we believe our findings are transferable to different dental and health professions education contexts, as they raise awareness on the relevance of autonomous motivation in educational settings and provide insights on how teachers may support students to internalize their behaviours.

Take-home message

An autonomy-supportive environment may lead students to value and engage in academic activities, and eventually foster the use of an autonomy-supportive style to motivate their patients.

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Do Self-determined Forms Of Motivation Lead To Better Affective Educational Outcomes? A Structural Equation Model Analysing A Dental Student Sample.



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Background and Purpose

Motivation is of key importance in educating student clinicians.

Self-Determination Theory (SDT)¹ investigates the roles of autonomous and controlled behaviours, studying motivation based on different quality types, and not solely based on amount and as a unitary construct.²

These quality types are autonomous motivation, controlled motivation, and amotivation.³ Evidence from other educational contexts suggests that autonomous motivation leads to positive academic consequences, at the behavioural, cognitive and affective level.^{2,4} By contrast, controlled motivation and amotivation are associated with low competence and poor well-being.^{5,6}

Therefore, we developed a motivational model aiming to examine how self-determined motivation affects affective outcomes, through study motives, in dental education.

Methodology

This is a correlational cross-sectional study.

Data on Academic Motivation, Deep and Surface Study Motives, Academic Self-concept, and Positive Emotions, were collected from 783 dental students in one dental school in Santiago-Chile.

Structural Equation Modelling (SEM) was used to test a hypothesised model in which higher Self-determination Index scores (SDI, relative level of self-determined and autonomous motivation) would positively affect Deep study motives, which would positively affect academic self-concept and positive emotions, and in which higher SDI scores would negatively affect surface study motives, which in turn would negatively affect academic self-concept and Positive emotions.

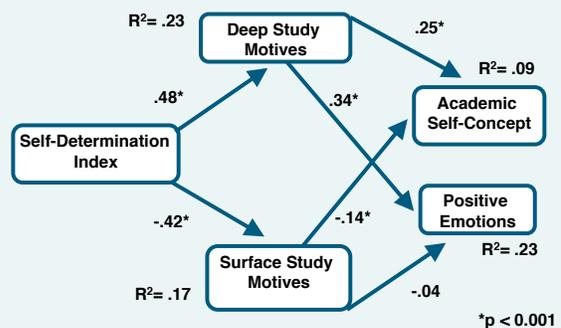
Results

The model fitted well the data, $X^2=4.372$, $df=2$, $p=0.112$, $CFI=.997$, $GFI=.998$, $RMSEA=0.039$, $SRMR=0.0157$.

SEM results supported the hypothesised model; all regression weights reflected the expected directions and were significant (except Surface study motives \Rightarrow Positive emotions, non-significant).

Self-determined forms of motivation showed positive association with affective outcomes (Academic self-concept/ Positive Emotions) through Deep study motives and negative association to them through Surface study motives.

The Model



Conclusions

Our findings suggest that it is not sufficient to be motivated to derive positive affective outcomes. The key need is for motivation in a self-determined fashion.

Further research should continue studying motivation in health professions education, as it may serve as a solid base from which adaptation-promoting interventions may be designed, which may lead students to engage in academic activities in a self-determined way.

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How Do Clinical Tutors Encourage Intrinsic Motivation In Undergraduate Students? A Systematic Review.

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Background and Purpose

Clinical teaching has been suggested as an important factor influencing students intrinsic motivation and performance^{1,2}. Internalisation of students motivation towards an intrinsic form is associated with increased interest, commitment, effort, learning, and satisfaction with education³⁻⁵. Self-Determination theory (SDT)³ postulates that Intrinsic motivation and autonomous forms of self-regulation are the desired type of motivation in students, as they have been associated with deep learning, better performance and well-being. SDT claims three basic psychological needs that have to be satisfied in order to achieve intrinsic motivation and internalisation of autonomous self-regulation. These are the needs for autonomy, competence and relatedness.

The aim of this study is to provide a critical appraisal of what is known on how clinical teachers promote intrinsic motivation in their students.

Methods

Electronic searches were performed across four databases (Medline, Embase, PsycINFO, and ERIC), relevant journals, grey literature, and retrieved bibliography of selected articles. The quality of each study was assessed using the Critical Appraisal Skills Programme.

Results

In total, searches produced 28,273 references, from which 16 studies met the inclusion criteria. Main themes were identified in three categories: The support of autonomy, competence and relatedness. Major findings are outlined in Table 1.

Conclusions

The research-based evidence indicates that teachers should work to satisfy students' basic psychological needs to foster internalisation of self-regulation. These results suggest that teachers should interact with students in a more 'human centred' teaching style, as these actions predict motivational internalisation. Several themes emerged from different contexts and further investigation should expand them. Autonomy supportive teaching in health professions educations would benefit students and may actually result in more effective health care delivery.

Table 1.- Clinical Tutors Supporting Students' Intrinsic Motivation

Supporting Autonomy	Supporting Competence	Supporting Relatedness
Identify what students want	Provide Optimal Challenges	Respect Students
Provide different learning approaches		
Give value to uninteresting tasks	Provide Structured Guidance	Give Emotional Support
Promote Active Participation		
Give Choice	Value Students' Work	Acknowledge students' expressions of negative effect
Give learning responsibility		
Provide Freedom	Give Positive and Constructive Feedback	
Avoid External Reward		

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Appendix XXX- Topic-related peer reviewed publications

1. Orsini C, Binnie V, Fuentes F, Ledezma P and Jerez O. ***Implications of motivation differences in dental students' preclinical-clinical transition: A one-year follow-up study***. Educación Médica. 2016. DOI: 10.1016/j.edumed.2016.06.007
2. Orsini C, Binnie VI, and Wilson SL. ***Determinants and outcomes of motivation in health professions education: A systematic review based on Self-determination theory***. Journal of Educational Evaluation for Health Professions. 2016;13:19. DOI: 10.3352/jeehp.2016.13.19
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ELSEVIER



BRIEF ORIGINAL

Implications of motivation differences in preclinical-clinical transition of dental students: A one-year follow-up study

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KEYWORDS

Motivation;
Self-determination;
Dental education;
Preclinical-clinical
transition;
Chile

Abstract

Background: Patient contact and clinical-based learning have been suggested as positive determinants of student motivation. However, few studies have been conducted on how this impacts dental student motivation. Based on the self-determination theory, this study aims to explore differences in the quality of motivation of dental student transition from preclinical (no previous patient contact) to clinical courses.

Methods: A longitudinal study was conducted with 95 Chilean students who completed the Academic Motivation Scale in two iterations over a one-year period.

Results: Paired *t*-test showed a significant increase in relative autonomous motivation as well as in amotivation.

Discussions: This suggests that while clinical contact supports student self-determination, an abrupt transition might be associated with maladjustment, which could lead to feelings of inadequacy and anxiety. Future research could usefully explore if early and gradual clinical experiences enhance student adaptation to the clinical context, thus increasing relative autonomous motivation and decreasing amotivation in the time.

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<http://dx.doi.org/10.1016/j.edumed.2016.06.007>

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PALABRAS CLAVE

Motivación;
Autodeterminación;
Educación
odontológica;
Transición
preclínico-clínica;
Chile

Implicaciones de diferencias motivacionales en la transición preclínico-clínica de estudiantes de odontología: un estudio longitudinal de un año

Resumen

Antecedentes: El contacto con pacientes y la enseñanza clínica han sido señalados como determinantes positivos de la motivación de estudiantes. Sin embargo, es limitada la evidencia sobre cómo estas variables impactan en la motivación en estudiantes de odontología. Basándonos en la teoría de la autodeterminación, el objetivo de este estudio fue explorar las diferencias motivacionales en la transición preclínica (sin previo contacto con pacientes) a la clínica en estudiantes de odontología.

Métodos: Se realizó un estudio longitudinal en el cual 95 estudiantes chilenos respondieron en 2 ocasiones la Escala de motivación educativa en un periodo de un año.

Resultados: La prueba t de muestras pareadas mostró, al mismo tiempo, un aumento significativo de motivación autónoma relativa y de amotivación.

Discusiones: Esto sugiere que, mientras el contacto clínico beneficia la autodeterminación de los estudiantes, una transición abrupta puede llevar a estados de inadaptación y ansiedad. Se sugiere que futuras investigaciones exploren si la experiencia clínica temprana beneficiaría la adaptación de estudiantes, aumentando así la motivación autónoma relativa y disminuyendo la amotivación en el tiempo.

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Introduction

Recent research in dental education has suggested a strong association between self-determined forms of motivation and positive outcomes, such as higher self-concept, positive emotions, and deep study motives,¹ with similar findings reported in medical education.² However, few studies have explored which determinants impact students' quality of motivation.

These studies have been conducted following the principles of the self-determination theory of motivation (SDT).³ SDT focuses on quality types of motivation and makes a distinction, from the least to the most self-determined types, between (1) amotivation i.e., lacking the intention to act, (2) controlled motivation (CM) i.e., originating from external sources and aimed at doing something because it leads to a separable outcome, and (3) autonomous motivation (AM) i.e., originating within the individual and engaging in activities because they are interesting, valuable or enjoyable. As reasons for engaging in activities become more self-determined, outcomes become increasingly positive. For a comprehensive review of self-determined motivation in health professions education, we refer the reader to the work of Ten Cate et al.⁴

It has been suggested that supporting students' autonomous forms of motivation might lead to positive educational outcomes, which in turn may encourage students to use a more autonomy-supportive style when relating to patients, and therefore support patients' autonomous motivation towards their healthcare.⁴ However, little attention has been paid in dental education to which variables are likely to influence students to engage in academic activities out of autonomous motivation.

Patient-related factors such as extent of patient responsibility and clinical contact, have been reported to increase students' perceptions of autonomy and relatedness, and

motivation for learning.⁵ This is especially relevant to dental education, where students start treating patients (under tutor supervision) in early years. Traditionally, the transition from preclinical to clinical-based learning has occurred during the third or fourth year, and benefits from this transition have been shown for students' communication skills, self-awareness and socialization.⁶ Additionally, previous research in dental education has supported an even earlier and more gradual transition,⁷ mainly because of the feelings of inadequacy, fear, and anxiety that an abrupt transition may cause at the same time.⁸ This has grown in importance in light of recent findings from a cross-sectional study suggesting that third and fourth year dental students, despite reporting a more autonomous than controlled motivation profile, were at the same time reporting higher amotivation scores than other years of study.¹

A question that rises from this is how clinical contact impacts students' motivation. Therefore, the aim of this study is to explore the differences in students' quality of motivation to engage in academic activities in the transition from preclinical to clinical courses. To the extent of our knowledge, this is the first study to undertake a longitudinal analysis on this topic and thus provides an important opportunity to advance the understanding of motivation and its determinants in dental education.

Methods

We conducted a longitudinal panel design study⁹ at the Dental School of the University San Sebastian in Santiago, Chile. The dental school has a six-year discipline-based undergraduate curriculum, where the first two years comprise basic sciences, progressing to a preclinical third year, and finally to clinical-based fourth, fifth and sixth years.

Please cite this article in press as: Orsini C, et al. Implications of motivation differences in preclinical-clinical transition of dental students: A one-year follow-up study. *Educ Med*. 2016. <http://dx.doi.org/10.1016/j.edumed.2016.06.007>

Table 1 Preclinical – clinical RAM and amotivation means (standard deviations), and *t*-test differences with 95% BCa bootstrap confidence intervals.

Sample	Pre clinical RAM mean (SD)	Clinical RAM mean (SD)	Pearson's correlation	Mean difference	95% difference BCa CI	<i>t</i>	<i>p</i> -value	Effect size (Cohen's <i>d</i>)
Total	-1.64 (11.10)	1.26 (14.50)	.699	-2.90	[-4.88, -0.80]	-2.71	0.008	-0.22
Sample	Pre clinical amotivation mean (SD)	Clinical amotivation mean (SD)	Pearson's correlation	Mean difference	95% difference BCa CI	<i>t</i>	<i>p</i> -value	Effect size (Cohen's <i>d</i>)
Total	6.22 (4.86)	7.49 (5.33)	.554	-1.27	[-2.25, -0.32]	-2.57	0.010	-0.25

Note: 95% bias corrected and accelerated confidence intervals based on 1000 bootstrap samples. RAM, relative autonomous motivation.

Students were invited to participate voluntarily in two iterations: at the end of the first semester of the third year (no prior patient contact) and one year after, on the fourth year, where they had experienced a full semester of clinical-based learning. An ad-hoc power analysis (alpha level of 0.05, power of 0.80 and effect size of 0.3) resulted in a total sample size of 71 students; nevertheless we invited the entire 2014 third-year and 2015 fourth-year cohorts, in order to have a representative sample and to account for possible non-responses and attrition.

Data were collected on demographics and students' quality of motivation for attending university. The latter was measured through the Academic Motivation scale (AMS),¹⁰ which is a self-reported instrument composed by 28 items, where students rate how closely a list of reasons for studying at university reflects their own motivation. We used a Chilean-Spanish version, which had been previously validated with a dental student sample (Cronbach's alpha 0.77).¹

We used the variables of amotivation and a single score to measure AM over CM. The latter is known as relative autonomous motivation and provided a general estimate of students' degree of autonomous motivation.² This was calculated by combining, weighting, and adding the respective AMS-items that form AM and CM, so as to compute a Relative Autonomous Motivation index (RAM). A positive RAM suggested an autonomous or self-determined profile, which is considered the 'good' type of motivation,³ whereas a negative RAM indicated a controlled or non self-determined profile. Previous research has reported reliable scores for amotivation, CM and AM (Cronbach's alpha 0.83, 0.74, and 0.75, respectively), and the successful use of RAM to combine the measures of CM and AM.²

After checking for normal distribution of differences between scores, the SPSS® software version 20.0 was used to computed descriptive statistics, reliability, and paired *t*-tests with BCa Bootstrap confidence intervals and effect sizes, in order to test for differences in RAM and Amotivation in the preclinical-clinical transition. The study had ethics clearance (0039 2015-03-08/03) through the Dental School's Ethics Committee.

Results

A total of 95 students (74.2% response rate) agreed to participate, with an average age of 22.7 years (SD = 2.19) at the first iteration. There were 57 (60%) females and 38 (40%) males, which represented the normal gender distribution within the dental school.

The mean Cronbach alpha values of the AMS were 0.81 and 0.80 at the first and second iteration, respectively. This was consistent with the results from previous research.¹

Table 1 presents the results obtained from the paired *t*-test amongst the preclinical and clinical transition for RAM and amotivation. A negative mean score for RAM was reported in the preclinical year, suggesting a controlled motivation profile. By contrast, these students reported a positive mean RAM score in the first clinical year, suggesting a change towards an autonomous motivation profile. This difference was significant (*p* = 0.008), with a small effect size (Cohen's *d* = -0.22). In other words, the transition to the first clinical year accounted for a 22% of the variance in RAM. Interestingly, when comparing amotivation scores, there was a significant increase from preclinical to clinical courses (*p* = 0.010), with a small effect size (Cohen's *d* = -0.25).

Discussion and conclusions

Our results show positive and significant differences on RAM when transitioning from a preclinical to a clinical environment. These results further support those from previous research,¹¹ which argue that motivation is a dynamic state that may change as moving from preclinical to clinical contexts. Additionally, these findings might be explained by the enhanced perception of autonomy and relatedness associated with the clinical learning cycle, both of which SDT suggests need to be satisfied in order to enhance autonomous motivation.³

Amotivation results were in agreement with those obtained in a recent study,¹ where dental students in their first clinical year showed, at the same time, an autonomous

over a controlled motivation profile as well as reporting a significant increase in amotivation.

These results might seem contradictory at first, but SDT postulates that amotivation is neither an autonomous nor a controlled form of motivation; it is the lack of it.³ Therefore, a possible explanation for the increase in RAM and amotivation at the same time, might be that, despite reporting an autonomous motivation profile, students were uncertain where to put their efforts because of unsubstantiated feelings or inadequacy to the clinical context.¹² In other words, students were self-determined when engaging in activities in this new, challenging and exciting clinical environment, but at the same time an abrupt transition might be making them not to know what to expect and therefore to feel maladjusted and experience anxiety, uncertainty and lack of confidence.⁸ Moreover, previous research in health professions education has correlated amotivation with negative emotions and behaviours.¹

These findings have important implications for supporting early and gradual clinical contact experiences, as these have been previously associated with improvement and quicker development of interpersonal and clinical skills, better understanding of basic sciences, improvement of confidence, and the alleviation of feelings of inadequacy, uncertainty and anxiety.^{6,8,13}

Our findings may be somewhat limited by the educationally important but still small effect sizes, and are not to be generalized as they come from one sample in one dental school. Additionally, it was not possible to assess the effect of other variables, such as teachers' autonomy-support and perceived competence and relatedness, which might contribute to explain larger variance in the results.

Future research should consider additional variables, a longer follow-up period design and the inclusion of early and gradual clinical experiences, so to explore if students' adaptation to the clinical context would lead to an increase in RAM and a decrease in amotivation.

This is the first study to provide evidence on the relevance of the preclinical-clinical transition for students' self-determination, and it may very well serve as a good starting point for more studies on determinants of motivation in dental education.

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None.

Conflict of interest

The authors of this article declare no conflict of interest.

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Review article

Determinants and outcomes of motivation in health professions education: a systematic review based on self-determination theory

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Abstract

Purpose: This study aimed at conducting a systematic review in health professions education of determinants, mediators and outcomes of students' motivation to engage in academic activities based on the self-determination theory's perspective. **Methods:** A search was conducted across databases (MEDLINE, CINAHL, EMBASE, PsycINFO, and ERIC databases), hand-search of relevant journals, grey literature, and published research profile of key authors. Quantitative and qualitative studies were included if they reported research in health professions education focused on determinants, mediators, and/or outcomes of motivation from the self-determination and if meeting the quality criteria. **Results:** A total of 17 studies met the inclusion and quality criteria. Articles retrieved came from diverse locations and mainly from medical education and to a lesser extent from psychology and dental education. Intrapersonal (gender and personality traits) and interpersonal determinants (academic conditions and lifestyle, qualitative method of selection, feedback, and an autonomy supportive learning climate) have been reported to have a positive influence on students' motivation to engage in academic activities. No studies were found that tested mediation effects between determinants and students' motivation. In turn, students' self-determined motivation has been found to be positively associated with different cognitive, affective, and behavioural outcomes. **Conclusion:** This study has found that generally, motivation could be enhanced by changes in the educational environment and by an early detection of students' characteristics. Doing so may support future health practitioners' self-determined motivation and positively influence how they process information and their emotions and how they approach their learning activities.

Keywords: Cognition; Medical education; Motivation; Personal autonomy; Review literature as topic

Introduction

Motivation is increasingly becoming a major area of interest within the field of health professions' education as it has been suggested to have a pivotal role for students' academic success

and wellbeing and for patients' outcomes [1]. Amongst the several motivational theories, the self-determination theory (SDT) has gathered special attention in recent years, generating evidence across numerous domains, such as education, health, and psychology [2]. Moreover, several authors have stressed the role of SDT and its implications for health education, suggesting that many of its principles may explain why students thrive in clinical education settings [1,3].

SDT investigates the roles of self-determined and controlled behaviours in different environments, postulating motivation

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Behaviour	Not self-determined	←—————→			Most self-determined
Type of motivation	Amotivation	Controlled motivation		Autonomous motivation	
Type of regulation	No regulation	External	Introjected	Identified	Intrinsic
Locus of causality	Impersonal	External	Somewhat external	Somewhat internal	Internal

Fig. 1. The self-determination theory continuum of motivation. From Ryan et al. *Contemp Educ Psychol* 2000;25:54-67, with permission from Elsevier [4].

as a multidimensional construct based on three different quality types; in a continuum ranging from the least to the most self-determined forms there is amotivation, controlled motivation, and autonomous motivation [2,4] (Fig. 1). Autonomous and controlled motivation refer to an individual’s intention to act (though leading to different outcomes), conversely amotivation refers to the lack of it. The latter is therefore represented by a non-regulation state that results from an individual not valuing a behaviour or outcome, in other words, what students’ do seems to be unrelated to the consequences derived from their actions.

Following the continuum, controlled motivation refers to pursuing an activity out of a sense of obligation, or as a means to an end. It has been subdivided into two types of regulation that can be ordered along the continuum. The lower self-determined form is external regulation, in which students engage in activities mainly to obtain rewards or to avoid punishment. This is followed by introjected regulation, in which individuals begin to internalize the reasons for their actions; however, behaviour is still regulated by external demands or requirements from the environment to avoid internal conflict, such as shame or guilt [5].

Autonomous motivation refers to engaging out of pleasure and satisfaction and/or by valuing the importance of an activity. It has also been subdivided into two types of regulation, on the one hand there is identified regulation, in which behaviour becomes valued, important and emitted out of choice, and although the locus of causality is somewhat internal it stills represents an instrument to achieve an objective. On the other hand, there is internal regulation, which is usually referred to as intrinsic motivation, being this the most self-determined form of behaviour and denoting the drive to pursue an activity simply for the pleasure or satisfaction derived from it, without internal or external pressures [5]. Intrinsic Motivation has been considered as a global construct with three subdivisions being at the same level and not following a continuum, but categorized as subtypes. Firstly, there is intrinsic motivation to know, which relates to concepts such as curiosity or motivation to learn; secondly, there is intrinsic motivation towards accomplishments, which reflects commitment towards an activity for the pleasure and satisfaction gained when one attempts

to accomplish or create something; and finally, there is intrinsic motivation to experience stimulation, which indicates engagement for fun, excitement, and positive sensations.

These concepts are important, as they explain large part of students’ behaviour and lead to significant and varied outcomes. As such, past research has shown that cognitive, behavioural, and affective outcomes become increasingly positive as actions are endorsed following the continuum pattern of motivation, from the lowest to the highest self-determined type [2]. For instance, several studies in higher education have found that internalisation of students’ motivation towards an autonomous form is associated with positive educational outcomes, e.g., deep study strategies, enhanced conceptual learning, and creativity. In contrast, least self-determined forms of motivation, such as controlled motivation and amotivation, have been associated with more negative outcomes, e.g., low competence and poor wellbeing [1].

From the above, the question that arises is how motivation is influenced and what makes a student adopt a certain type of regulation. SDT postulates that motivation is influenced by both intrapersonal and interpersonal factors [5]. Intrapersonal factors refer to an individual’s inherent characteristics (e.g., gender, age, or ethnicity) and to personality traits. On the other hand, interpersonal forces are represented by social factors, in other words, by social experiences in which others have powerful impact on our motivation. Previous studies have highlighted, in educational contexts, the influence of interpersonal factors such as teachers’ autonomy-support, extent of responsibility, selection procedure, and early patient contact [6,7].

In addition, SDT proposes that all individuals have the need to feel autonomous, competent, and related to the surrounding social environment in order to be self-determined in their actions [2]. Therefore, the effects of social factors on motivation are suggested to be indirect. Previous research has reported that social factors are mediated by how they facilitate or prevent an individual’s perception of the three basic psychological needs of autonomy, competence, and/or relatedness [1]; this facilitation supports and maintenances optimal motivation, leading to positive developmental and psychological outcomes. In contrast, social factors that do not facilitate individual’s perceptions of these needs will yield less optimal forms

of motivation, leading to more negative outcomes. In the case of health professions education, the facilitation of self-determined forms of motivation is expected to contribute towards students becoming better practitioners.

Consequently, by studying different determinants and outcomes of motivation, educators may plan and implement interventions that stimulate students to engage in activities in a more self-determined fashion, which in turn may lead to positive outcomes benefiting themselves and their patients. The aim of this study, therefore, was to conduct a systematic review to answer the following questions in the context of health professions education: first, what is the evidence on different intrapersonal and interpersonal determinants of self-determined motivation and how are these associations characterised?; second, is there evidence for the mediating effect of the basic psychological needs satisfaction on the relationship between determinants and self-determined motivation?; and third, what is the evidence on different cognitive, affective, and behavioural outcomes of self-determined motivation and how are these associations characterised?

While Kusrurkar et al. [8] conducted a literature review on motivation studies focusing on medical education from a general perspective, a growing body of literature has been developed in health professions' education explicitly based on SDT. Therefore this review builds on previous research and focuses on determinants and outcomes of motivation in SDT-based research expanding the scope to all health professions and providing detailed evidence synthesis on what the current knowledge is, the identification of gaps, recommendations for future research, and stressing the crucial role that motivation has on the educational decision-making processes of future health professionals.

Methods

The review was conducted during June and September 2015,

following the 'structured approach to the reporting in health-care education of evidence synthesis statement' [9]. Ethics approval was obtained from the Medical School of the University of Glasgow, as being part of a larger project (project number: 200140106).

Data collection

The systematic search was conducted in four phases. Firstly, a comprehensive search was conducted throughout the Medline, CINHALL, Embase, PsycINFO, and ERIC databases. Three essential concepts were identified for the search strategy: 'motivation based on SDT', 'determinants, mediators, and outcomes', and 'health professions education.' These were expanded considering synonyms, alternative spelling, and related terms. Nevertheless, each database has its own indexed subject headings; therefore we adapted our keyword combination according to each thesaurus. The core search strategy for Medline is presented in Table 1.

Secondly, relevant journals were hand-searched through their printed/online versions, and articles were selected based on the relevance of their titles based on the PRISMA statement [10] (Fig. 2). Thirdly, to account for publication bias, unpublished and grey literature were accessed through the 'system for information on grey literature in Europe' (www.opengrey.eu) using the aforementioned set of keywords.

Finally, the publications of experts in the field were reviewed by accessing key authors' 'Research Gate' profiles (www.researchgate.net) and through the publications of the faculty list on the 'SDT Website' (www.selfdeterminationtheory.org/faculty). In total, 4,058 article titles were scoped, corresponding to the profiles of 93 researchers from areas such as general education, psychology, medicine and dentistry. This approach provided a useful way to systematically review SDT-related publications from leading authors and also provided a fast and simple way of contacting them when additional information was required.

Table 1. Medline search strategy

Search strategy	
Search based on concept 1: motivation based on SDT	- Subject headings: (MH "motivation+") OR (MH "personal autonomy") - Free text search: academic motivation OR (intrinsic OR extrinsic OR controlled OR autonomous) w1 motivation OR self w1 determination w1 theory OR self w1 determination OR SDT OR self w1 regulation
Search based on concept 2: determinants, mediators, and outcomes	- Subject headings: (MH "cognition") OR (MH "behavior") OR (MH "emotions+") - Free text search: determinants OR antecedents OR autonomy w1 support OR mediator OR mediation OR psychological w1 mediators OR autonomy OR competence OR relatedness OR outcome* OR consequence* OR (cognitive OR behavioural OR affective) w1 (outcome* OR consequence*)
Search based on concept 3: health professions education	- Subject headings: (MH "education+") OR (MH "education, Medical, undergraduate") - Free text search: 'postgraduate student*' OR (dental OR medical OR psychology OR nursing) w1 (education OR student OR school) OR health w1 professions w1 education OR clinical w1 teach*
Search 1 AND Search 2 AND Search 3	

SDT, self-determination theory; MH, subject heading; +, explode function; w1, proximity command; *, truncation.

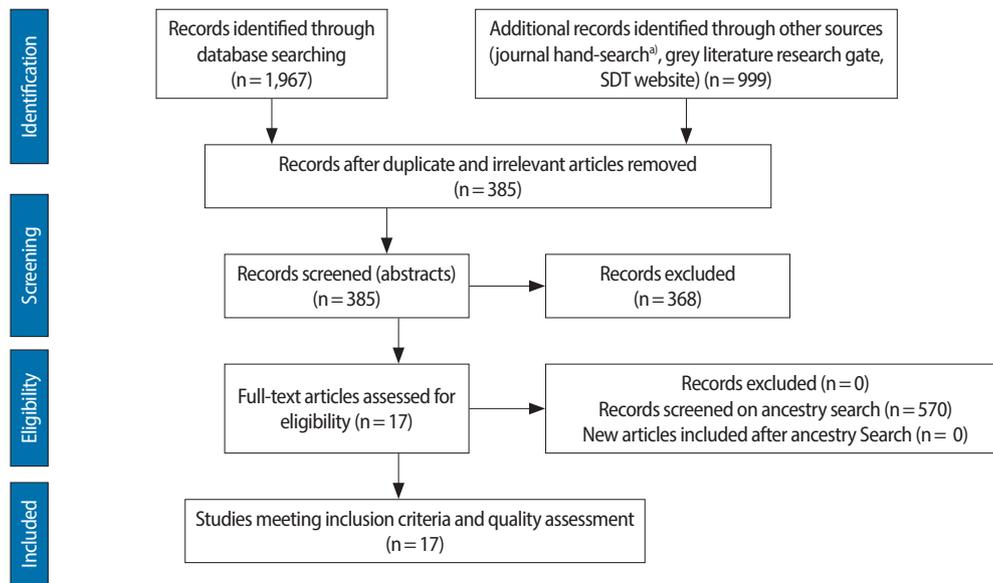


Fig. 2. Flow chart summarising the review process with number of articles reviewed and retained at each stage. From Moher et al. PLoS Med 2009;6: e1000097 [10]. ^{a)} *Academic Medicine, Advances in Health Science Education, Educational and Psychological Measurements, Educational Psychology, Education for Health, European Journal of Dental Education, Journal of Dental Education, Journal of Educational Evaluation for Health Professions, Journal of Personality, Medical Education, Medical Teacher, and Motivation and Emotions.*

Table 2. Setting the scope of the search: inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
1. Empirical studies based on the SDT perspective, focusing on determinants, mediating variables, or outcomes of motivation.	1. Studies not empirical in nature like viewpoints, editorials, opinions or books.
2. Empirical studies that report research on students or teachers in undergraduate or postgraduate health professions education.	2. Studies on populations other than students or teachers in health professions education.
3. Valid and reliable quantitative research.	3. Studies not focusing on motivation from the SDT perspective and not considering determinants, mediating variables, or outcomes of motivation.
4. Credible and dependable qualitative research.	4. Studies referring to motivation in undergraduate or postgraduate contexts without a focus on health professions education.
5. Articles available in English, Spanish and French language.	5. Studies published in languages other than English, Spanish, or French.
6. Studies published from 1971 (first SDT-related publication) to 2015.	6. Studies published before year 1971.

SDT, self-determination theory.

To be included in the review, all references were assessed based on the inclusion/exclusion criteria described in Table 2. All retrieved articles were exported to a reference manager for selection procedures. This stage was divided in three phases conducted by two authors independently and moderated by a third author whenever in disagreement. In phase one, duplicates and irrelevant titles were removed. In phase two the abstracts of the remaining articles were reviewed using the inclusion/exclusion criteria. When there was doubt on the exclusion of a particular article, it was advanced to phase three, so it could be assessed based on the full text rather than on the abstract. In phase three, the full text of each article was screened, enabling a final decision. Subsequently, applying the same three phases, an ancestry search of the selected articles' references

was conducted through the Web of Science.

As a mixture of qualitative and quantitative papers were expected to emerge, we opted for the semi-structured quality analysis 'Questions to ask of research or evaluation evidence', published in the first BEME guide [11]. This appraisal instrument is applicable to several methods; it has 17 items responding to a 'yes/no' question aimed at analysing the quality of different areas of a research paper.

Data analysis

A meta-analysis of results was not possible due to methodological heterogeneity, therefore we approached the review as a narrative synthesis through a thematic analysis using the Nvivo ver. 10.0 software (QSR International, Doncaster, Aus-

Table 3. Summary of key study characteristics

Author(s) (year, country) [reference]	Research topics	Type of study	Sample	Data collection Instruments ^{a)}	Data analysis method*	Selected findings & comments on determinants, mediators and/or outcomes of self-determined motivation
Bailey & Phillips (2016, Australia) [26]	Explore relationships between motivation, university adaptation, wellbeing, and academic performance	Cross-sectional correlational	184 First-year psychology students, 73% females, mean age 19.3	Self-report of academic performance, academic motivation scale, student adaptation to college questionnaire, the anxiety and depression subscales of general health questionnaire, meaning in life questionnaire, satisfaction with life scale and positive and negative affect schedule	Correlations and hierarchical regression	Outcomes: intrinsic motivation was positively associated with wellbeing, meaning in life, positive emotions and academic performance, and negatively associated with negative emotions. Amotivation had the reverse pattern. Introjected Regulation showed a positive association with positive emotions and with anxiety. Motivational orientations predicted wellbeing, mental health, and academic performance.
Baker (2004, UK) [27]	Examine relations between motivation and adjustment to university, stress, well-being and academic performance	Cross-sectional correlational	91 Second-year psychology students, 78% females, mean age 19.5	Self-report of academic performance, academic motivation scale, college adaptation questionnaire, general health questionnaire, and perceived stress scale	Correlations and hierarchical regression	Outcomes: Controlling for gender and age, amotivation led to worse psychosocial adjustment to university, higher levels of perceived stress, and greater psychological. Intrinsic motivation (to know) was associated with lower levels of stress. Neither extrinsic nor intrinsic motivation, nor amotivation were related to academic achievement. Determinants: overall strength of motivation and its subscales of willingness to sacrifice, readiness to start and persistence correlations were positively correlated with autonomous motivation, and it decreased and became negative as moving towards controlled motivation and amotivation.
Kusurkar et al. (2011, The Netherlands) [20]	Validity of the Strength of motivation for medical school questionnaire	Cross-sectional Psychometric	1,494 Medical students from two universities, 72% females	Strength of motivation for medical school questionnaire, academic motivation scale and exhaustion subscale of Maslach burnout inventory	Correlations, group differences and exploratory factor analysis	Outcomes: relative autonomous motivation was positively associated with good study strategy, which was positively associated with high study effort and better performance. Females and qualitative selection procedures showed a higher self-determined profile.
Kusurkar et al. (2013, The Netherlands) [17]	Explore relationships between motivation, study strategy, effort and academic performance by gender and method of admission	Cross-sectional correlational	383 Second-to-six year medical students, 72% females, mean age 23.3	Method of admission and academic performance provided by university. Study effort, academic motivation scale and revised study process questionnaire	Correlations, regression, group differences and structured equation modelling	Determinants: males reported higher controlled motivation and higher perceived competence even when reporting higher surface learning strategy, lower deep learning strategy and lower or equal performance.
Kusurkar et al. (2013, The Netherlands) [14]	Implications of gender on motivation, performance, learning approaches, exhaustion, autonomy support and perceived competence	Cross-sectional correlational	95 Fourth year medical students, 71.5% females	Academic performance provided by university, Academic motivation scale, revised study process questionnaire, Maslach burnout inventory, learning climate questionnaire and perceived competence questionnaire	Group differences	Outcomes: high intrinsic low controlled motivation was associated with good study hours, deep learning strategy, good academic performance and low exhaustion. High intrinsic high controlled motivation was associated with a good learning profile, except showing high surface strategy. Low intrinsic high controlled and low intrinsic low controlled motivation were associated with least desirable learning behaviours.
Kusurkar et al. (2013, The Netherlands) [16]	Generate motivational profiles and test associations with different outcomes	Quantitative, Cross-sectional correlational	844 Year one-to-six medical students, 71.5% females	Academic performance provided by university, Academic motivation scale, study hours per week, study process questionnaire, and exhaustion subscale of Maslach burnout inventory	Correlations, K-cluster, analysis of variance and multivariate analysis of covariance	

(continued to the next page)

Table 3. Continued.

Author(s) (year, country) [reference]	Research topics	Type of study	Sample	Data collection Instruments ^{a)}	Data analysis method*	Selected findings & comments on determinants, mediators and/or outcomes of self-determined motivation
Orsini et al. (2016, Chile) [23]	Understand how clinical teachers encourage intrinsic motivation	Phenomenology	9 Clinical dental teachers, 7 males, mean age of teaching experience 15	Semi-structured interviews on how teachers supported students' needs for autonomy, competence, and relatedness	Thematic analysis	Determinants: teachers emphasise the influence that the learning climate has on students' intrinsic motivation, stressing the relevance of empowering, supporting and building a horizontal relationship. Themes included: transference of responsibility; personal interests; constructive feedback; vicarious learning experience; teamwork, and safe environment. Determinants: third and fourth years showed the highest motivation scores. Outcomes: intrinsic and identified regulation showed positive correlations with deep motives, academic self-concept and positive affect, and negative correlation with surface motives. Amotivation showed the reverse pattern.
Orsini et al. (2015, Chile) [18]	Validity of the academic motivation scale in a dental students sample	Cross-sectional Psychometric	989 Year one-to-six dental students, 62% females, mean age 22.5	Academic performance provided by university. Academic motivation scale, deep and surface motives subscales of revised study process questionnaire, academic subscale of abbreviated five-factor self-concept questionnaire, and positive subscale of positive and negative affect schedule	Confirmatory factor analysis, correlations and group differences	Determinants: third and fourth years showed the highest motivation scores. Outcomes: intrinsic and identified regulation showed positive correlations with deep motives, academic self-concept and positive affect, and negative correlation with surface motives. Amotivation showed the reverse pattern.
Park et al. (2012, Republic of Korea) [19]	Examine relationships between stress, motivation, personality, academic performance, and depression	Cross-sectional correlational	160 First-year medical students, 72.5% males	Academic performance provided by university. Academic motivation scale, medical stress scale, personality inventory, Beck depression inventory, and Hamilton depression scale	Correlations, group difference, regression and path analyses	Determinants: psychopathological was negatively correlated with self-determined motivation.
Sobral (2004, Brazil) [15]	Describe medical students' motivation relationships with different learning outcomes	Cross-sectional correlational with a longitudinal panel design component	297 Second year medical students, 57% males, mean age 20.4	Academic performance provided by university. Academic motivation scale, reflection-in-learning scale, approaches to studying inventory, 4 semesters follow-up on peer tutoring activity, and intention to continue studies	Correlations, K-cluster and group differences	Outcomes: autonomous motivation was associated with higher levels of meaning orientation, reflection in learning, academic achievement, cross-year peer-tutoring, and intention to continue with studies, and had negative relationship with reproductive orientation to learning. Amotivation showed the reverse pattern and controlled motivation was positively related to reproductive orientation. Outcomes: self-determined motivation was positively associated with performance and negatively associated with depression. Stress was positively correlated with amotivation and identified regulation and negatively correlated with intrinsic motivation and with external regulation.
Stoeber et al. (2011, UK) [28]	Investigate relationships between passion for studying, academic engagement, burnout and motivation	Cross-sectional correlational	103 Second-year psychology students, 89% females, mean age 20	Passion scale, Utrecht Work Engagement Scale-student, Maslach burnout inventory, and Sheldon's idiographic method for motivational analysis	Correlations, multiple analysis of variance, multiple regression	Outcomes: autonomous motivation showed positive association with harmonious passion and engagement for studying, and negative significant association with burnout. Controlled motivation showed the reverse pattern.

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Table 3. Continued.

Author(s) (year, country) [reference]	Research topics	Type of study	Sample	Data collection Instruments ^{a)}	Data analysis method*	Selected findings & comments on determinants, mediators and/or outcomes of self-determined motivation
Tanaka et al. (2009, Japan) [13]	Examine relationships between personality traits and intrinsic motivation	Cross-sectional correlational	119 Second year medical students, 70% males, mean age 20.5	Temperament and character inventory and intrinsic motivation scale toward learning.	Regression analyses	Determinants: on simple regression, persistence, self-directedness, cooperativeness and self-transcendence were positively associated with intrinsic motivation. On multiple regressions, adjusted for age and gender, persistence, self-directedness, and self-transcendence were positively associated with intrinsic motivation.
Tanaka et al. (2011, Japan) [21]	Examine relationships between academic and family conditions and intrinsic motivation	Cross-sectional correlational	120 Second year medical students, 69% females, mean age 20.5	Self-report of lifestyle, family and academic conditions, and intrinsic motivation scale toward learning.	Regression analyses	Determinants: spending time with family, taking pleasure in school and learning, understanding lectures, and attending school regularly, were positively associated with intrinsic motivation.
Williams & Deci (1996, USA) [7]	Exploration of SDT in students' adoption of psychosocial values and an autonomy-supportive style in patient interviewing skills	Longitudinal-panel design	Study 1: 91 second-year medical students Study 2: 56 second-year medical students and course instructors	Data collection: two times over 24 weeks on study 1 and five times on study 2 (three within the course, after 6 months, and after 2 years) Instruments: physician psychosocial belief scale, general causality orientation scale, learning climate questionnaire, learning self-regulation questionnaire, interviewing competence scale, instructors' psychosocial beliefs, and health-care climate questionnaire	Correlations and regression analyses	Determinants and outcomes: positive relations between autonomous motivation, psychosocial beliefs, and perceived competence at interviewing before starting the course; perceived autonomy supportiveness of instructors promoted autonomous motivation, perceived competence, psychosocial beliefs, and behaving more autonomy-supportive with simulated patients. Increased relative autonomy mediated relations between instructors' autonomy support and the enhancement of psychosocial values and perceived competence.
Williams et al. (1994, USA) [25]	Compare effects of facilitating students' interest versus controlling students learning during internal medicine clerkship	Cross-sectional correlational	89 Fourth year medical students at two Universities	Modified learning climate questionnaire, competence in internal medicine scale, interest in internal medicine scale, pressure, tension scale, internal medicine career choice, and prior likelihood for career choice	Correlations, and structured equation modelling	Determinants and outcomes: an autonomy supportive learning climate predicted increased perceived competence and interest, which in turn predicted specialty choice. Conversely, a controlling learning climate did not predict perceived competence or interest.
Williams et al. (1997, USA) [24]	Examine relationships between autonomy-support, perceived competence, interest, prior likelihood and choosing internal medicine or surgery as a career	Cross-sectional correlational	210 Fourth year medical students at three Universities, 61% males, mean age 27.4	Modified learning climate questionnaire, competence in internal medicine and surgery scale, interest in internal medicine scale, internal medicine and surgery career choice, and prior likelihood for career choice	Correlations, multiple regression and structured equation modelling	Determinants and outcomes: perceived autonomy support predicted students' choices of internal medicine or surgery, even after the effects of prior (and actual) likelihood had been removed.
Wouters et al. (2014, The Netherlands) [22]	Investigate type of motivation and differences between selected and non-selected applicants of medical school.	Phenomenology	96 Applicants, 72% females, mean age 23	Document review of motivation statements	Thematic and content analysis, and frequency and group comparison	Determinants: selected and non-selected applicants did not differ in types of motivation, reporting mainly autonomous motivation for applying. Findings raise questions on the validity and reliability of the statement on motivation as a tool for selection.

^{a)}All studies collected self-reported demographics and conducted descriptive analyses.

tralia). A data extraction form was developed including key methodological information, selected findings, and comments relevant to the research question (Table 3). The thematic analysis facilitated the translation of concepts between studies by identifying prominent themes and summarising their findings under recurrent headings, therefore allowing the integration of qualitative and quantitative evidence [12].

The unit of analysis was focused on the identification and establishment of relations between determinants, mediators, and educational outcomes of motivation based on SDT. The thematic analysis was organised in three phases. The first phase was an open coding stage based on constant comparison and mainly aimed at reducing the data, extracting the essential ideas and resulting in the grouping of segments into different categories, i.e., determinants, mediators, and outcomes. The second phase was a central coding stage, aimed at combining and relating different categories amongst each other and grouping them into themes and subthemes. Finally, the third phase was an interpretative stage aimed at drawing conclusions and reflecting on the findings.

Results

Electronic and additional sources identified 2,966 references. When duplicates and irrelevant titles were removed, 385 papers were forwarded for abstract screening and later full-text assessment. Of these, 17 met the eligibility criteria. Subsequently, 570 titles were screened in the ancestry search, from which no new articles were included. Finally, all 17 papers were rated as of good quality evidence and were included in the review. Fig. 2 presents a flow chart summarising the review process.

All selected studies stated clear objectives and were found to be relevant for the study of self-determined motivation in health professions education. Table 3 provides a summary of the key findings. Reports came from different locations, such as North and South America, Australia, Europe, and Asia, thus providing evidence of the topic's relevance for different health professions education settings. In terms of the specific subjects, the majority of the research has been dedicated to explore motivation in medical education ($n = 12$, 71%), and to a lesser extent in psychology ($n = 3$, 18%), and dental education ($n = 2$, 11%) (Table 3).

Determinants, mediators, and outcomes of self-determined motivation

Fig. 3 shows a summary of the identified variables and their overall relationships with autonomous motivation. Determinants were divided into intrapersonal and interpersonal, and outcomes were divided into cognitive, affective, and behavioural.

Intrapersonal determinants

Age: Inconclusive evidence was reported on the association between age and medical students' motivation. While a study conducted with American medical students [7] reported that older students exhibited a more autonomous profile, endorsing less impersonal reasons, studies with Japanese and Dutch medical students [13,14] have reported non-significant associations in regression analyses.

Gender: Women have shown a more self-determined profile than men. Five studies [7,14, 15, 16,17] found that gender was significantly associated with autonomous motivation of medical students, and that women and men reported, respectively, higher autonomous motivation and higher controlled motivation. Two studies reported inconclusive findings. Nevertheless, they were limited by their motivation instrument, aimed at secondary school students [13], and by the small effect sizes reported by dental students [18].

Personality traits: Three studies analysed the relationship between personality traits and self-determined motivation. Psychopathological levels of personality (i.e., mental illness) were negatively associated with self-determined motivation in Korean medical students [19], while persistence, self-directedness, cooperativeness, self-transcendence, readiness to start/enter medical school, and willingness of a student to sacrifice for his/her medical study were positively associated with Dutch and Japanese medical students' autonomous forms of motivation and showed contrary findings for controlled motivation and amotivation [13,20].

Interpersonal determinants

Academic conditions and lifestyle: One study found significant associations between intrinsic motivation and Japanese students' taking pleasure in learning and in university, attending university and being able to understand lectures. Additionally, in the same study, time spent with family (≥ 1 hour per day) was found to be a positive predictor of intrinsic motivation [21].

Year of curriculum: Students' progression throughout the curriculum showed inconclusive associations with motivation. For instance, Chilean dental students' autonomous and controlled forms of regulation and amotivation showed significant differences per year of study [18]; however, amotivation showed an increasing pattern, with the highest scores corresponding to the fourth year i.e., when students start their clinical and patient-based learning, and decreased from that point until the end of the sixth year. The reverse pattern was reported for intrinsic motivation. Additionally, a study on Dutch medical students reported year of curriculum as a non-significant predictor of autonomous motivation [17].

Qualitative method of selection: Qualitative vs. weighted lot-

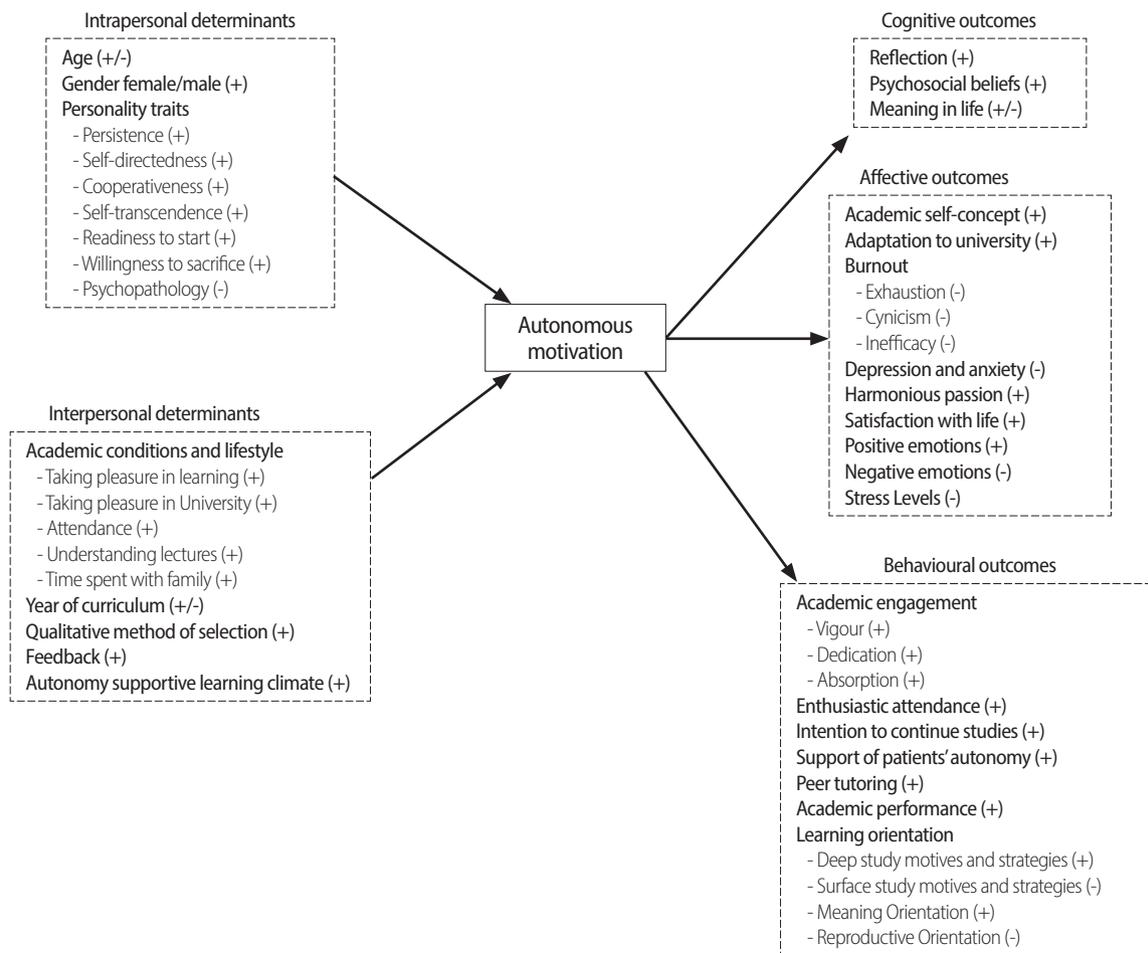


Fig. 3. Summary of determinants and outcome variables and their relationship with autonomous motivation. (+), overall positive correlation; (-), overall negative correlation; (+/-), inconclusive correlation.

tery system of medical students was found to affected relative autonomous motivation [17]. Indeed, students that underwent a qualitative method of selection showed higher autonomous motivation as well as lower amotivation scores than weighted lottery selected students. When integrated into a model, qualitative selected students' autonomous motivation showed a positive indirect effect on grade point average through good study strategies ($\beta = 0.32, P < 0.01$), which was stronger than the effect reported for weighted lottery selected students ($\beta = 0.18, P < 0.01$). When applying to medical school, both selected and non-selected students' statement for application showed strong autonomous reasons, therefore its validity and reliability was questioned, as it tends to emphasize socially desirable answers highlighting autonomous reasons and underreporting controlled motivation [22].

Feedback: Dental teachers reported the relevance of providing timely and constructive feedback as a way of supporting students' intrinsic motivation and encouraging their percep-

tion of competence in one-on-one clinical teaching situations [23]. In their experience, feedback had to be given as a dialogue, highlighting the good things and what should be improved, and focusing on the task rather than on the person.

Autonomy supportive learning climate: Four studies informed about the significance of an autonomy supportive learning climate to support students' autonomous motivation. The autonomy supportiveness of teachers predicted American medical students' higher autonomous self-regulation towards a 24-week patient-interview course and over a two and one-half-year period [7]. Likewise, but in a different setting, learning in an autonomy supportive climate for a specific subject predicted students' autonomous motivation to follow a surgery or an internal medicine residency path, even after the effects of prior and actual likelihood for that specialty were removed [24,25]. Dental faculty defined an autonomy supportive climate as a teaching style that supports the transfer of responsibility, refocuses uninteresting activities, identifies and encourages personal in-

terests, and supports proactivity and choice [23].

Mediators

No studies were found to test the mediation effect of students' perception of the basic psychological needs between determinants and motivation.

Cognitive outcomes

Reflection: As Brazilian medical students' motivation became more self-determined, the correlation with reflection in learning became stronger [15]. Therefore, as students' self-determined motivation increased, so did their metacognitive expertise.

Psychosocial beliefs: The biopsychosocial approach to medicine highlights the importance of practitioners being empathic, patient-centred, and sensitive to patients' psychological and social needs to provide high-quality care. In a 24-week patient-interviewing course, students who mostly engaged out of an autonomous orientation showed stronger psychosocial beliefs at the end of the course ($r = 0.25$) than students who engaged mostly out of controlled orientation ($r = -0.14$) or expressing an impersonal orientation ($r = -0.27$). Furthermore, when controlling for gender, an autonomous orientation and an impersonal orientation were found to be significant positive and negative predictors of psychosocial beliefs [7].

Meaning in life: Australian psychology students reported, with the exception of amotivation, all positive and similar associations between autonomous and controlled forms of motivation and presence of meaning in life [26]. In the same study, with the exception of intrinsic motivation to know, all autonomous and controlled motivation variables and amotivation showed positive and significant correlations with search for meaning in life. These results do not follow the theoretical continuum of SDT, and one reason might be due to the association of a contextual variable (academic motivation) with a general variable (meaning in life, as not being meaning in academic life).

Affective outcomes

Academic self-concept: A pattern consistent with SDT was found for dental students' motivation and academic self-concept [18]. Identified regulation and the three intrinsic motivation subtypes showed the strongest positive and significant correlations (from $r = 0.18$ to 0.24), introjected regulation showed a weaker but still positive and significant association ($r = 0.10$), external regulation score was very weak and non-significant ($r = 0.05$), while amotivation showed a negative and significant correlation ($r = -0.15$).

Adaptation to University: Amongst Australian psychology students, intrinsic motivation to know and to experience stim-

ulation were positive and significantly associated with measures of adaptation to university such as academic adjustment and institutional attachment, whereas introjected regulation showed a negative significant correlation with personal adjustment, as well as amotivation that showed a negative significant association with social adjustment and with all the aforementioned variables [26]. Furthermore, similar results were reported for British psychology students' suggesting that, as students' self-determination decreases, so does their adaptation to university [27].

Burnout: British psychology students' autonomous and controlled motivation showed, respectively, significant negative and positive associations with exhaustion, cynicism and inefficacy, which characterise the burnout syndrome [28]. These results were mirrored by Dutch medical students' reports on autonomous/controlled motivation and exhaustion [16].

Depression and anxiety: Amotivation showed a positive and significant correlation with Australian psychology students' depression ($r = 0.44$) and anxiety levels ($r = 0.36$) [26]. All other motivation types were non-significant, with the exception of introjected regulation, which showed a positive correlation with anxiety ($r = 0.16$). This is of special interest, as students endorsing this type of controlled motivation depend on success and achievements to alleviate internal pressure and avoid feelings of guilt, shame, and self-derogation, explaining the significant levels of anxiety in order to maintain their self-esteem, ego, and sense of pride. In line with these findings, Korean medical students' self-determined motivation was found to predict lower levels of depression [19].

Harmonious passion: Autonomous motivation of psychology students had a positive and significant correlation with harmonious academic passion ($r = 0.44$), which corresponds when individuals incorporate an activity freely into their self-identity, without incorporating any behavioural contingencies or rewards [28].

Satisfaction with life: Intrinsic motivation to know and amotivation showed significant positive and negative associations respectively with psychology students' satisfaction with life [26].

Positive and negative emotions: Self-determined motivation has also been associated with positive and negative emotions experienced in university. Increasingly stronger positive correlations from controlled to autonomous forms of motivation and negative correlations of amotivation with positive emotions have been reported by dental students [18]. Similar results were reported for psychology students, who additionally showed a positive association between amotivation and both negative emotions [26] and psychological distress [27].

Stress: Perceived levels of stress towards university were studied to assess the amount of stress students experience during

medical school, focusing on areas such as the school curriculum, the educational environment, and personal competence/endurance amongst others. Korean medical and British psychology students' stress levels towards university showed positive correlations with amotivation, which then turned increasingly negative when correlated with controlled and autonomous motivation [19,27].

Behavioural outcomes

Academic engagement: Psychology students' vigour, dedication, and absorption, all of which are indicators of academic engagement, showed positive and negative associations with autonomous and controlled motivation, respectively [28].

Enthusiastic attendance to class: When attending a 20-week course on patient interviewing skills, second year medical students endorsing autonomous reasons for studying showed a significant positive correlation with enthusiastic attendance, both on the first and second 10-week block [7].

Intention to continue studies: Self-determined motivation has also been associated with intentions to continue studying medicine, showing a positive and negative correlation with autonomous motivation and amotivation, respectively [15]. The latter was also supported by the fact that the only 3 students who dropped out of the medical programme, while the study took place, showed a high amotivation profile.

Support of patients' autonomy: Medical students' autonomous orientation at the end of a patient-interviewing course was positively correlated, six months later, with the autonomy-supportiveness towards standardized patients on cardiovascular risk and smoking cessation counselling [7].

Peer tutoring: Motivational patterns of medical students' choices of cross-year peer tutoring activity showed autonomous motivation as having a significant positive correlation with number of courses tutored within a four-semester timeframe [15].

Academic performance: For Australian psychology students [26], and for Dutch [16,17], Korean [19], and Brazilian [15] medical students, autonomous motivation was positive and significantly associated with high performance, and as motivation became more controlled, the correlation became weaker and non-significant, which in turn became negative and significant when associated with amotivation. On the other hand, two studies reported inconsistent findings in psychology and dental students [18,27], however authors recommended cautious interpretation of their findings, as these came from cumulative instead of concurrent grade point average.

Learning orientation: Students' reasons for studying showed significant correlations to the way students approached their learning process. Four studies reported [15, 16, 17, 18] that when medical and dental students' autonomous forms of mo-

tivation increased, so did their deep study strategies and meaning orientation to learning. On the other hand, as controlled forms of motivation increased, deep study strategies decreased and surface study strategies and reproductive orientations to learning increased. This suggests that stronger autonomous motivation goes together with enhanced self-regulation of learning.

Discussion

The study of motivation in health professions education from the SDT perspective has been investigated in different cultural educational settings, however, the health-profession-context in which it has been explored is quite narrow, being mostly dedicated to medical education with few exceptions in psychology and dental education. The latter represents an important challenge for health education researchers, mainly because of the differences between health professions' education and general education, and amongst the diverse health professions. These being different in several aspects, such as in the intensity of study, the timing and responsibility of patient contact, the requirement to carry out clinical work along with study, and the needs to follow a highly specifically defined path to being able to qualify to practice as a health professional. Indeed, several authors have highlighted the needs to continue expanding this research to other health areas [23,26], and similarly in medicine, authors have claimed that literature exists on students' motivation to enter medical school yet very little is known about what happens afterwards [15,20].

SDT argues that its principles are independent of the individuals' origin [2]. This is consistent with the findings from the reviewed articles, in which studies coming from different locations showed similar results. Future investigations should continue expanding cultural aspects such as gender and ethnic differences, as they provide important evidence about the external validity of SDT.

Studying students' types of motivation should be an important feature for teachers, administrators, and curriculum developers when aiding to identify different determinants that impact students' self-determination, which in turn may impact on educational outcomes and wellbeing [1]. The findings reported indicate that motivation is predicted by both the educational environment and students' personal characteristics (Fig. 3). Of these, some can be manipulated and some cannot, implying that motivation can vary depending on its predictors [8].

Regardless of being unlikely to be manipulated, intrapersonal characteristics play an important role in students' self-determination. Concerning gender, for instance, women appear to have a more autonomous profile than men, which is in

line with research on SDT coming from other domains [29]. Indeed, in medical education women have been clustered into an interest-motivated group (i.e., higher autonomous motivation), whereas men have been clustered into a status-motivated profile (i.e., higher controlled motivation) [16]. Therefore, intrapersonal determinants should not be overlooked, as they might provide teachers with different insights on how to mentor or give advice to students [14].

On the other hand, interpersonal determinants were mostly related to the educational environment and represent a group of variables in which great attention should be paid, as they represent the 'day-by-day' influences over motivation in which educators may intervene. The learning climate, this being controlling or autonomy supportive, is suggested to influence students' reasons for engaging in academic activities [1]. The relevance of creating an autonomy supportive learning climate in clinical education has been recently stressed by several authors [1,3,30], in which encouraging self-initiation, volitional activities, the use of constructive feedback, and providing rationale is pointed as crucial. The impact of learning in such environment has been suggested as beneficial for both students and patients, as students engaging in activities based on autonomous reasons are more likely to interact and support their patients' autonomy towards their healthcare [7]. Moreover, the emerging development of curricula based on entrusted professional activities [31], has common grounds with SDT by highlighting the importance of developing students' autonomy and competence over time. Since several academic conditions were related to students' self-determination, these variables may well be used for developing interventions for lowering the incidence of and/or increasing the recovery from low self-determined forms of motivation and prevent future academic failure [6,21]

Despite the inconclusive findings with regards to year of curriculum and motivation, it is interesting to note that motivation fluctuates along the curriculum. This was shown for dental students, in which amotivation reached the highest score in the fourth year (when transitioning from pre-clinical to clinical courses) and then decreasing towards the final sixth year, with the opposite pattern being shown for intrinsic motivation. As such, it seems possible that this is due to the experience students have when transitioning through different learning cycles (i.e., basic sciences and preclinical and clinical activities). It has been suggested that an early patient contact and vertical integration might increase students autonomous motivation and decrease the amotivation when experiencing an abrupt transition [1,18]. However, further research needs to be undertaken before the association between clinical transition and motivation is more clearly understood.

One unanticipated finding was that no study tested the me-

diating role of students' basic psychological needs satisfaction between interpersonal determinants and motivation. This mediating effect has been tested with success in other domains [32]. So far, there is useful evidence on how motivation is directly influenced by different determinants; nevertheless there is no evidence showing the effect of mediating variables. As to what impacts motivation is how students perceive these determinants to affect their basic psychological needs and not their original intended effect [2], many questions are still unanswered leaving abundant room for further research.

When students were experiencing autonomous reasons to attend university and for engaging in academic activities, positive cognitive, affective, and behavioural outcomes were reported. As to how students processed information, cognitive outcomes such as reflection were higher as motivation became more autonomous. Reflection in- and on-action has been related to an increased lifelong learning experience [33] and as students become more autonomous, so might their future self-regulation of learning. Additionally, in recent years there has been an increased emphasis on the technical-biological and pharmacological aspects of healthcare, which is believed to carry a dehumanisation of patient care [7]. Instead, as students' self-determination increased, so did their psychosocial beliefs towards a more humanistic approach to medical care.

The findings regarding students' affective outcomes are consistent with data obtained in research with primary and secondary school students and in other areas of higher education, in which autonomous motivation has been related to better psychological adjustment [34]. Moreover, these findings are also in line with those of James et al. [35] who suggested that amotivation is associated with an increased risk of students discontinuing university.

In terms of students' actions, as motivation orientations became more self-determined, behavioural outcomes became more positive. These findings seem to be consistent with research in other domains of higher education, where autonomous motivation has been related to sustained student involvement and with higher academic performance [36], and where controlled motivation/amotivation was shown to correlate with cheating [37] and plagiarism [38].

In general, students reported a mix of autonomous and controlled reasons for studying, thus supporting the idea that internal and external sources of motivation play an important role in the context of demanding undergraduate programmes. Nevertheless, internal and external reasons are associated with positive and negative outcomes respectively. Therefore, efforts should point at encouraging students to engage in activities out of interest and enjoyment. It is unrealistic, however, to think that students will participate out of intrinsic motivation all the time. This highlights the relevance of fostering the internalisa-

tion process of motivation, from external to internal reasons, in which students need clear rationale and autonomy-support to bridge the importance that learning activities will have for their professional practice and to engage from autonomous forms of motivation.

This review has applied robust methods and has led to relevant findings; nevertheless, there are a series of limitations that should be taken into account. First, we limited our analysis to English-, Spanish-, and French-language articles, which might have excluded relevant literature from other languages. Second, we searched the literature through multiple sources, however the review is inherently limited to these and some relevant publications might have been excluded. Third, the findings reported might be somewhat limited by the number of small-sized but still meaningful correlations and should be interpreted within the context of each study. Finally, the downside of bringing together research conducted in different health-related disciplines is that it involves a variety of educational contexts, study designs, and participants, where results found in one context might not be generalised to others. Nonetheless, details have been provided of the methods and results of the included studies, so that readers can judge the transferability of findings to different health professions education settings.

In conclusion, this study has found that generally, motivation could be enhanced by changes in the educational environment and by an early detection of students' characteristics. Doing so, may support future health practitioners' self-determined forms of motivation and positively influence how they process information and their emotions and how they approach their learning activities, which may ultimately contribute to the fundamental purpose of health professions education: the improvement of healthcare practice, patient care, and patients outcomes.

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Conflict of interest

No potential conflict of interest relevant to this article was reported.

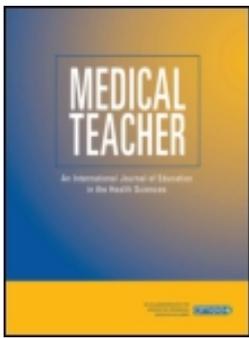
Supplementary material

Audio recording of the abstract.

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Entrustment decisions in dental education: Is it time to start formalising?

Cesar Orsini & Vivian I Binnie

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their graduates feel less prepared in, and be more proactive in implementing curriculum changes to address these areas. Thus, not only benefiting graduates by easing their transition into their new role as a doctor, but also ensuring greater patient safety.

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Entrustment decisions in dental education: Is it time to start formalising?

Dear Sir

The emerging concept of Entrustable Professional Activities (EPAs) has become a major area of interest for curriculum development in health professions education (ten Cate et al. 2015). Despite constituting a novel approach to build on the principles of competency-based education, little attention has been paid to EPAs in Dental Education.

From early years, supervised dental students start treating their own patients, with increasing complexity of procedures as progressing to senior years, so to meet the outcomes required for registration as ‘safe beginners’. As declared by the U.K. General Dental Council (2015), learning outcomes “must be set to prepare all potential registrants for safe and independent practice” (p. 5).

Consequently students’ workplace experience, flexible in time, intends to lead them to master different areas of professional practice. Here, a clinical teacher continuously

supervises a small group of students, and progression is based on the assessment of students’ cognitive, procedural and attitudinal competencies. These are based on different methods, such as simulation, written knowledge testing, or observation of clinical practice.

This is somehow in alignment with the principles of EPA-based education, but what happens in the day-by-day clinical work? Do students assume more responsibility with less supervision over time or work under direct and pro-active supervision always? Despite that clinical teachers acknowledge the relevance of gradual transference of responsibility and autonomy (Orsini et al. 2015), the decision is frequently made on an informal and individual scenario, relying on ad hoc or non-systematic judgements.

Informal and context-based entrustments come without long-term consequences, whereas summative entrustments represent formal declarations that support students’ perception of autonomy and are validated by more observers (ten Cate et al. 2015).

As it is becoming difficult to ignore the existence of EPAs, it might be the proper time to start complementing and thinking to move from informal to formal entrustment decisions, so to benefit students and patient-safety.

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Psychometric Validation of the Academic Motivation Scale in a Dental Student Sample

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Abstract: The Academic Motivation Scale is one of the most frequently used instruments to assess academic motivation. It relies on the self-determination theory of human motivation. However, motivation has been understudied in dental education. Therefore, to address the lack of valid instruments to assess academic motivation in dental education and contribute to future research in the field, the aim of this study was to analyze the psychometric properties of this instrument in a sample of dental students. Participants were 989 Chilean undergraduate dental students (86% response rate) who completed a survey containing a Chilean face-valid version of the Spanish Academic Motivation Scale and three other motivation-related instruments to assess the survey's construct and criterion validity. Later, 76 of the students (out of 100 invited) took the survey again to assess its test-retest stability. The instrument's construct validity was supported by the superior goodness of fit of the seven-subscale Academic Motivation Scale over competing models through confirmatory factor analysis and by the expected correlations among its subscales. The concurrent criterion validity was supported by the confirmation of correlations between its subscales and external criteria. Adequate internal consistency and test-retest correlations were also found. The evidence from this study suggests that the Academic Motivation Scale is a preliminarily valid and reliable instrument to assess motivation in the predoctoral dental context. Future research in this area is needed to confirm or refute these results.

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Keywords: dental education, academic motivation, Academic Motivation Scale, psychometrics, Chile

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Recent evidence suggests that intrinsically motivated students are likely to be engaged in deep-level study strategies¹ and to display enhanced conceptual learning,² creativity,³ cognitive flexibility,⁴ enhanced self-esteem,⁵ and better psychological well-being.⁶⁻⁹ By contrast, lack of motivation has been associated with low competence, poor well-being,¹⁰ and inadequate psychological adjustment to university life.¹¹ Previous researchers have claimed that understanding students' profiles and motivations is relevant to dental education.¹²⁻¹⁴

Many perspectives and theories have been proposed to better understand academic motivation, including those addressed in Graham's study.¹⁵ However, one of the most popular theories in education, which has generated a considerable amount of research, is the Self-Determination Theory.^{16,17} This theory investigates quality of motivation and roles of self-determined and controlled behaviors in academic environments and suggests a multidimensional construct, i.e., that behavior can be amotivated,

extrinsically motivated, or intrinsically motivated. As shown in Figure 1, these dimensions exist as a continuum from non-self-determined conduct to a fully self-determined form of behavior.¹⁶ Progression from amotivation to intrinsic motivation has been associated with positive academic and psychological consequences.^{8,18}

Amotivation is the absence of intent to pursue an activity, while extrinsic motivation refers to pursuing an activity out of a sense of obligation or as a means to an end.¹⁷ Extrinsic motivation has been subdivided into three types of regulation that can be ordered along the self-determination continuum.¹⁶ The lower form is external regulation, in which students participate to obtain rewards or to avoid punishment. In introjected regulation, individuals begin to internalize the reasons for their actions; however, their behavior is still regulated by external demands or requirements from the environment to avoid internal conflict. Finally, there is identified regulation, in which behavior becomes valued and important and

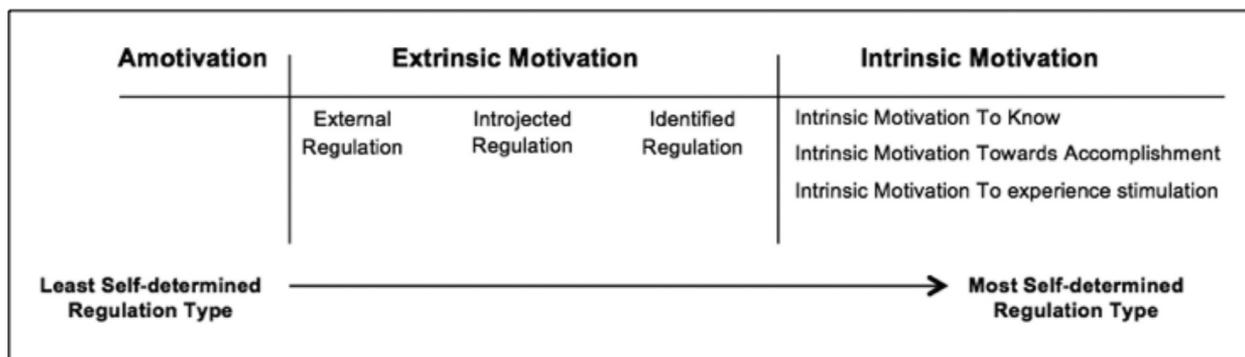


Figure 1. Self-determination continuum of motivation from least to most self-determined regulation type

Source: Adapted from Ryan RM, Deci EL. Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemp Educ Psychol* 2000;25:54-67.

seems similar to a form of self-determined regulation, although the conduct still represents an instrument to achieve something.

The most self-determined form of behavior is intrinsic motivation, which represents the drive to pursue an activity simply for the pleasure or satisfaction derived from it.¹⁹ It is considered a global construct with three subdivisions¹⁸ (i.e., not following a continuum but categorized as subtypes): intrinsic motivation to know, which relates to concepts such as curiosity or motivation to learn;²⁰ intrinsic motivation towards accomplishments, which reflects commitment to an activity for the pleasure and satisfaction gained when one attempts to accomplish or create something;^{16,17} and intrinsic motivation to experience stimulation, which indicates engagement for fun, excitement, and positive sensations.^{18,21}

There has been an increasing need for a standardized, valid, and reliable instrument to study students' academic motivation attributes. As such, the most comprehensive instrument derived from self-determination theory so far is the Academic Motivation Scale.²¹ This scale was developed in 1989 for French-Canadian higher education settings¹⁸ and was later validated in English,²¹ Spanish,²² and Turkish.¹⁹ It has seven subscales, one for each of the aforementioned types of regulation, and it is aimed at adolescents and adults in academic post-secondary environments.²³

To validate the instrument, previous studies in other educational contexts have tested the construct and criterion validity and reliability of the

scale.^{18,19,21-28} Those studies have found satisfactory internal consistency values (Cronbach's alpha 0.80) and high levels of temporal stability (test-retest mean of 0.75). The results of confirmatory factor analyses have supported the initially proposed seven-subscale structure, and the construct validity has been fulfilled through the establishment of several correlations among the seven subscales, confirming the presence of a continuum pattern with minimum deviations. This pattern represents the continuum of the Self-Determination Theory, in which adjacent scales show positive correlations, and the subscales at the opposite ends of the continuum show the highest levels of negative correlations.^{18,21} Furthermore, the Academic Motivation Scale has been integrated into empirical models that incorporate determinants (e.g., teachers' behaviors) and consequences of academic motivation (e.g., dropout, positive emotions, academic performance), providing support for its concurrent validity that other scales still lack.^{10,29}

The instrument has been applied in various cultures and educational contexts: for example, most students have reported external causes associated with vocational issues as their purpose for attending university, and females have been found to seem more intrinsic and self-determined than males.^{18,21,22,27,28} However, these phenomena have not been previously studied in dental education. Therefore, the aim of this study was to analyze the psychometric properties of this instrument in an undergraduate dental student sample in order to address the lack of valid instruments that assess academic motivation in dental

education and contribute to future research in the field. The study objectives were fourfold. First, the scale's construct validity was assessed by examining the goodness of fit of the proposed seven-factor model and by analyzing correlations among the seven subscales as ways to examine the continuum pattern of the Self-Determination Theory.^{18,21} Second, the scale's reliability and test-retest stability were estimated. Third, the scale's criterion (concurrent) validity was assessed by examining correlations between the instrument's subscales and scores from other variables deemed to represent motivational antecedents and consequences. The final objective was to determine the overall motivation of the dental student sample, in addition to differences in gender and year of study.

Methods

The Institutional Review Board of the Dental School of the University San Sebastian and the Medical School of the University of Glasgow reviewed and approved the research protocol (reference number: 0039-2001300103). The study was conducted in April and May 2014 at the Dental School of the University San Sebastian in Santiago, Chile.

This dental school has a six-year, discipline-based curriculum. The first two years are comprised of basic sciences, followed by a preclinical third year and clinic-based fourth, fifth, and sixth years. All students from year one through year six were invited to participate voluntarily. Confidentiality and anonymity were respected, and students had the option of withdrawing at any time with no consequences. Students gave their written consent authorizing the administrative department to provide their cumulative GPA solely to the authors, matched to the first seven digits of their ID number so that researchers could not access their names.

Data Collection

One teacher per academic year administered the questionnaire; this individual had been previously trained to address any questions. This structure allowed the absence of researchers and reduced the observer effect.³⁰ Students were informed that we were interested in better understanding the reasons why they attend the university and that there were no right or wrong answers. The questionnaire package contained demographic data and four instruments presented in Spanish. It took approximately 20 min-

utes to complete the questionnaire, but there were no time limitations. The survey took place on the university premises at the end of a class and with previous permission from the class's teacher. After one month, a randomly selected group of 100 students were invited to answer the Academic Motivation Scale in a second iteration to assess the scale's stability. We asked the students to provide data concerning age, gender, year of study, and the first seven digits of their ID number (to match test-retest and surveys with cumulative GPA).

The Academic Motivation Scale (Spanish version) instrument consists of 28 items divided among seven subscales (amotivation, external regulation, introjected regulation, identified regulation, intrinsic motivation to know, intrinsic motivation towards accomplishment, and intrinsic motivation to experience stimulation) of four items each.²² All items included the question "Why do you go to university?," which was to be answered by selecting a response from a seven-point scale ranging from 1=does not correspond at all to 7=corresponds exactly, with a middle value of 4=corresponds moderately. The subscale scores could range from 4 to 28. A high score on a subscale indicated high endorsement of that particular motivation type. The instrument is available from the corresponding author.

Students were asked to respond to three additional instruments, all of which have previously shown acceptable levels of internal consistency.^{22,31-33} The first instrument corresponds to the Deep and Surface Motives Subscales (ten items) of the Revised Study Process Questionnaire (R-SPQ-2F) (Spanish version), which measures two dimensions: deep- and surface-learning approaches.^{32,34} The second instrument corresponds to the Academic Subscale (three items) of the abbreviated Five-Factor Self-Concept Questionnaire (Spanish version).³¹ A high score indicates a higher self-concept towards the academic context. Finally, students were asked to answer the Positive Subscale of the Positive and Negative Affect Schedule (PANAS) (Spanish version), consisting of ten items that describe feelings of positive emotions.^{33,35} Students were asked to indicate how they experienced each of these emotions in the university setting on a rating scale.

Based on these instruments and their correlations with the Academic Motivation Scale, our hypotheses for this study were as follows. On the one hand, we expected a significant positive correlation between the Academic Motivation Scale's intrinsic subtypes and identified regulation with the

R-SPQ-2F deep motives subscale, academic subscale of the Five-Factor Self-Concept Questionnaire, and the positive subscale of the PANAS. On the other hand, a significant positive correlation was predicted between amotivation and external regulation with the R-SPQ-2F surface motives subscale. Additionally, we expected significant negative correlations between amotivation and external regulation with the R-SPQ-2F deep motives, academic subscale of the Five-Factor Self-Concept Questionnaire, and the positive affect subscale of the PANAS. Finally, no significant correlations were expected between the external criteria and the introjected regulation subscale.

Previous researchers have suggested the importance of testing the Academic Motivation Scale in different Latin American academic contexts due to inherent linguistic differences^{22,23,27} (at the time of this study, it had been tested in Paraguay²⁷ and Argentina²³). Therefore, prior to their application, the Spanish versions of the Academic Motivation Scale and the other three concurrent instruments scales were revised by a panel of faculty who were native Spanish speakers from Chile to assess their cultural equivalence. Minor changes were made and subsequently presented to a group of ten recently graduated students who expressed no observations or misunderstandings. This process resulted in face-valid Chilean-Spanish instruments.

Data Analysis

Data were analyzed with SPSS v22.0.0 and AMOS v20.0 software (SPSS Inc., Chicago, IL, USA), and the alpha level was set at ≤ 0.05 . First, the goodness of fit of the collected data to the seven-subscale model was compared to one-, three-, and five-subscale models through several indices of confirmatory factor analysis (CFA). A single scale model assumes that academic motivation is a one-dimensional construct. A three-subscale model consists of intrinsic motivation, extrinsic motivation, and amotivation. A five-subscale model includes the three types of extrinsic motivation, one global intrinsic motivation factor, and amotivation.^{18,21,23,26,28} The analyses were performed through the maximum likelihood estimates method. As no single measure is definitive, other researchers recommend the use of different indices simultaneously.^{36,37} We tested the chi-square statistic (X^2), the ratio of X^2 to degrees of freedom (X^2/df),³⁸ Fit Indices (comparative fit index, normed fit index, goodness-of-fit index, and

incremental fit index), and Residual Analyses (the standardized root mean square residual and the root mean square error of approximation). Overall, these fit statistic indices aim to test the underlying motivation theory, considering the implications of whether the proposed models are consistent with the data.

Second, Pearson correlation coefficients were calculated for the mean scores of each of the subscales of the Academic Motivation Scale to assess whether the collected data followed the Self-Determination Theory's continuum pattern. Both the Cronbach's alpha test of internal consistency and the correlation of temporal test-retest stability were calculated for each subscale of the Academic Motivation Scale. Pearson's correlation coefficients were calculated for the mean scores of each subscale of the Academic Motivation Scale and the three concurrent instruments, plus cumulative GPA, to test our hypotheses about the instrument and external criteria.

Means and standard deviations were computed for each subscale. To assess gender differences, independent-mean t-tests, effect sizes (Cohen's d value), and BCa Bootstrap confidence intervals were calculated. To assess year of study differences, ANOVA, effect size tests (omega value ω), and posterior post hoc testing (Hochberg GT2 and Games-Howell tests) were conducted. The Levene test was used to estimate equal variances; when the result was significant, the F-ratio was adjusted using the Welch's F.

Results

A total of 989 students participated in the survey (86% response rate), with an average age of 22.5 (SD=3.25). There were 613 (62%) females and 376 (38%) males. The distribution per year of study was as follows: 145 (15%) first year, 239 (24%) second year, 228 (23%) third year, 198 (20%) fourth year, 126 (13%) fifth year, and 53 (5%) sixth year. After one month, 76 students (38 females and 38 males with a mean age of 24.5 [SD=2.08]) answered the Academic Motivation Scale in a second iteration.

Construct Validity

Table 1 provides the results of confirmatory factor analysis of the competing models, showing an overall superior fit of the data to the seven-subscale model. For all the proposed models, the p-value for the X^2 -statistic was found to be significant, thus rejecting all models. Nevertheless, this test is described as being influenced by large sample sizes (as sample

Table 1. Goodness of fit indicators of proposed models for Academic Motivation Scale

	1 Dimension Scale	3 Subscales	5 Subscales	7 Subscales	Standard for Acceptance
Fit statistic					
X ²	6013.01	3010.26	1933.12	910.78	NA
df	350	347	340	309	NA
p-value	<0.0001	<0.0001	<0.0001	<0.0001	0.05
X ² /df	17.18	8.68	5.69	2.95	<3
Fit index					
CFI	0.54	0.78	0.87	0.95	>0.90
NFI	0.53	0.76	0.85	0.93	>0.90
GFI	0.59	0.79	0.86	0.94	>0.90
IFI	0.54	0.78	0.87	0.95	>0.90
Residual analysis					
SRMR	0.12	0.10	0.06	0.04	<0.05
RMSEA	0.13	0.09	0.07	0.04	<0.08

X²=chi-square test, df=degrees of freedom, X²/df=ratio of chi-square to degrees of freedom, CFI=comparative fit index, NFI=normed fit index, GFI=goodness-of-fit index, IFI=incremental fit index, SRMR=standardized root mean square residual, RMSEA=root mean square error of approximation, NA=not applicable

size increases, power increases, and the test of fit becomes more stringent).³⁷ Therefore, the ratio of X² to degrees of freedom (X²/df), which reduces the sensitivity to large sample sizes, was examined and showed acceptable values for the seven-subscale model. Fit indices and residual analyses also showed strong evidence to support the seven-subscale model. In other words, the data obtained from our dental student sample supported the use of the originally proposed seven-subscale construct to measure academic motivation. These results match those from previous studies in other fields.^{18,21,22,25,27,39}

The internal relationships among the Academic Motivation Scale subscales support the current seven-subscale structure and the continuum pattern of the Self-Determination Theory (Table 2). The three

subtypes of intrinsic motivation showed the strongest significant positive correlations in the continuum (from 0.59 to 0.69, p<0.01). Correlations between adjacent subscales showed stronger, more positive, and more significant coefficients (e.g., between intrinsic motivation to know and identified regulation; r=0.56, p<0.01) than between subscales farther apart, which showed weaker positive or even negative correlations (e.g., between intrinsic motivation to know and amotivation; r=-0.33, p<0.01).

Nevertheless, two deviations from the predicted model were found and must be highlighted. First, introjected regulation showed a stronger positive correlation with intrinsic motivation towards accomplishment (r=0.54) than with identified regulation (r=0.45), which is in between these two subscales

Table 2. Correlations coefficients between subscales of Academic Motivation Scale

Subscale	AM	EMER	EMIN	EMID	IMTA	IMES	IMTK
AM	–	0.01	-0.03	-0.25*	-0.33*	-0.18*	-0.33*
EMER		–	0.58*	0.42*	0.21*	0.13*	0.14*
EMIN			–	0.45*	0.54*	0.35*	0.36*
EMID				–	0.56*	0.47*	0.56*
IMTA					–	0.59*	0.69*
IMES						–	0.62*
IMTK							–

AM=amotivation, EMER=external motivation external regulation, EMIN=external motivation introjected regulation, EMID=external motivation identified regulation, IMTK=intrinsic motivation to know, IMTA=intrinsic motivation to accomplish, IMES=intrinsic motivation to experience stimulation

*p<0.01

Note: Intrinsic motivation subtypes do not follow the continuum and should be interpreted as a global construct.

as one follows the continuum. Second, amotivation showed a stronger negative correlation with identified regulation ($r=-0.25$) than with intrinsic motivation to experience stimulation ($r=-0.18$), which is farther apart when following the continuum.

Reliability

Internal consistency scores were between 0.75 and 0.83, except for identified regulation with an acceptable, but lower, score of 0.65 (Table 3). The correlation coefficient scores of pretest and posttest were between 0.70 and 0.78. Table 4 shows the correlations between the seven subscales and the tested external criteria (the three additional instruments and cumulative GPA). As hypothesized, the three intrinsic motivation subtypes and identified regulation showed the strongest positive and significant correlation coefficients with deep motives, academic self-concept, and positive affect. Amotivation showed significant negative correlations with the aforementioned con-

structs; external regulation showed non-significant and close to zero correlations; and, surprisingly, introjected regulation showed weak but significant positive scores. On the other hand, the most significant positive correlations with surface motives corresponded to amotivation, followed by external regulation and introjected regulation and finally by the three intrinsic motivation subtypes and identified regulation, which showed significant negative correlations.

Overall, these results confirmed our hypotheses and also supported the continuum of self-determination based on external criteria, providing evidence of the scale's concurrent validity. An example of how the continuum is reflected by these external criteria is shown in the correlations among deep motives and the seven motivation subscales (Table 4). Here, intrinsically motivated students showed the strongest positive correlations with deep motives, followed by identified regulation, introjected regulation, external regulation, and finally by amotivation with a nega-

Table 3. Internal consistency and test-retest correlations for each subscale of Academic Motivation Scale

AMS Subscale	Alpha Sample 1 (n=989)	Alpha Pretest Sample 2 (n=76)	Alpha Posttest Sample 2 (n=76)	Test-Retest Correlation Sample 2 (n=76)
AM	0.83	0.74	0.86	0.75
EMER	0.75	0.70	0.70	0.78
EMIN	0.81	0.80	0.79	0.75
EMID	0.65	0.63	0.66	0.70
IMTK	0.78	0.78	0.80	0.72
IMTA	0.80	0.78	0.78	0.71
IMES	0.80	0.82	0.82	0.74

AMS=Academic Motivation Scale, AM=amotivation, EMER=external motivation external regulation, EMIN=external motivation introjected regulation, EMID=external motivation identified regulation, IMTK=intrinsic motivation to know, IMTA=intrinsic motivation to accomplish, IMES=intrinsic motivation to experience stimulation

Table 4. Correlation coefficients between each subscale of Academic Motivation Scale and motivational correlates

	R-SPQ-2F		Abbr. AF5 Academic Self Concept	PANAS Positive Affect	GPA
	Deep Motives	Surface Motives			
AM	-0.18**	0.40**	-0.15**	-0.33**	0.08*
EMER	0.01	0.15**	0.05	0.03	-0.11**
EMIN	0.26**	0.10	0.10**	0.20**	-0.08**
EMID	0.32**	-0.07**	0.18**	0.25**	-0.04
IMTK	0.56**	-0.19**	0.21**	0.42**	-0.02
IMTA	0.50**	-0.16**	0.24**	0.42**	-0.02
IMES	0.53**	-0.16**	0.19**	0.35**	0.03
Cronbach's coefficient α	0.68	0.65	0.81	0.87	-

AM=amotivation, EMER=external motivation external regulation, EMIN=external motivation introjected regulation, EMID=external motivation identified regulation, IMTK=intrinsic motivation to know, IMTA=intrinsic motivation to accomplish, IMES=intrinsic motivation to experience stimulation

* $p<0.05$, ** $p<0.01$

tive correlation. This evidence for the continuum of self-determination based on external criteria is also observed with the academic self-concept and positive affect subscales and inversely with the surface motives subscales. Consistent with previous research results,^{26,39} inconclusive correlations were found between the motivation scale and academic performance in terms of cumulative GPA.

Students reported that their primary reason to attend university was driven by identified regulation, followed by intrinsic motivation to know and intrinsic motivation towards accomplishment, with amotivation being the least endorsed subscale (Table

5). Female students scored significantly higher in all subscales, with the exception of intrinsic motivation to experience stimulation (higher but not significant) and amotivation (males scored significantly higher). However, these scores represented small-sized effects, with the exception of introjected regulation and intrinsic motivation towards accomplishment for females, which were small to medium. It must also be stressed that the predictive value of the significant correlations between the subscales and cumulative GPA was not significant.

In contrast, all subscales showed significant mean differences per year of study (Table 6). How-

Table 5. Means (standard deviations) for total participants, males and females, and gender differences derived from Academic Motivation Scale BCa Bootstrap (95% CIs reported)

AMS Subscale	Mean (SD)			Mean Gender Difference				
	Total Participants (n=989)	Females (n=613)	Males (n=376)	Mean Difference	95% Difference BCa CI	t	p-value	Effect Size (Cohen's d)
AM	6.22 (3.88)	5.99 (3.58)	6.53 (4.15)	-0.54	[-1.08, -0.02]	-2.06	0.037	-0.14
EMER	22.50 (5.03)	22.85 (4.76)	21.97 (5.37)	0.91	[0.28, 1.63]	2.66	0.010	0.17
EMIN	21.48 (5.22)	22.12 (4.85)	20.51 (5.60)	1.61	[0.95, 2.37]	4.55	0.001	0.31
EMID	24.60 (3.21)	24.88 (3.15)	24.20 (3.10)	0.69	[0.25, 1.16]	3.32	0.001	0.22
IMTK	23.61 (3.55)	23.89 (3.31)	23.24 (3.79)	0.66	[0.21, 1.15]	2.74	0.011	0.18
IMTA	23.06 (4.07)	23.54 (3.77)	22.33 (4.34)	1.20	[0.66, 1.80]	4.38	0.001	0.30
IMES	17.80 (4.71)	18.07 (4.61)	17.41 (4.84)	0.63	[-0.23, 1.27]	2.01	0.062	0.14

AMS=Academic Motivation Scale, AM=amotivation, EMER=external motivation external regulation, EMIN=external motivation introjected regulation, EMID=external motivation identified regulation, IMTK=intrinsic motivation to know, IMTA=intrinsic motivation to accomplish, IMES=intrinsic motivation to experience stimulation

Table 6. Mean (standard deviation) and mean comparison of Academic Motivation Scale (AMS) subscales for students per year of study derived from AMS

AMS Subscale	Mean (SD)						Year of Study Means Comparison		
	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	F-test	p-value	Effect Size (ω)
AM	5.65 (3.48)	6.16 (3.86)	6.40 (4.25)	6.92 (4.39)	6.12 (3.16)	4.85 (1.91)	6.33	<0.0001	0.11
EMER	22.31 (4.62)	23.32 (4.75)	22.91 (5.24)	21.87 (5.27)	21.44 (5.30)	22.34 (4.38)	3.40	0.005	0.11
EMIN	22.77 (4.56)	22.21 (5.13)	21.33 (5.10)	21.25 (5.21)	19.77 (5.53)	20.10 (6.02)	6.39	<0.0001	0.16
EMID	24.70 (3.47)	24.91 (3.19)	24.87 (3.12)	24.40 (3.06)	23.86 (3.32)	24.23 (2.95)	2.45	0.032	0.09
IMTK	24.94 (3.32)	23.24 (3.74)	23.48 (3.45)	23.61 (3.55)	22.83 (3.40)	24.00 (3.19)	6.20	<0.0001	0.16
IMTA	24.02 (3.83)	22.88 (4.12)	23.00 (4.10)	23.26 (3.83)	21.93 (4.30)	23.45 (4.12)	3.93	0.002	0.12
IMES	18.73 (4.89)	17.26 (5.13)	17.68 (4.39)	18.24 (4.35)	17.46 (4.57)	17.67 (4.90)	2.28	0.045	0.08

AM=amotivation, EMER=external motivation external regulation, EMIN=external motivation introjected regulation, EMID=external motivation identified regulation, IMTK=intrinsic motivation to know, IMTA=intrinsic motivation to accomplish, IMES=intrinsic motivation to experience stimulation

ever, they all represented small-sized effects. In post hoc tests, the most relevant findings showed that final-year students were significantly less amotivated than second- ($p=0.005$), third- ($p=0.001$), fourth- ($p\leq 0.0001$), and fifth-year students ($p=0.015$). For intrinsic motivation, first-year students reported higher scores for intrinsic motivation to know than second- ($p\leq 0.0001$), third- ($p=0.001$), fourth- ($p=0.008$), and fifth-year students ($p\leq 0.0001$). First-year students also had higher scores for intrinsic motivation towards accomplishment relative to fifth-year students ($p\leq 0.0001$) and for intrinsic motivation to experience stimulation relative to second-year students ($p=0.046$).

Discussion

The results of this study indicate that the Academic Motivation Scale has acceptable levels of validity and reliability within the Chilean undergraduate dental context. These properties were assessed by testing the construct validity (degree to which the instrument measures what it claims, or purports, to be measuring based on the underlying theory), reliability (overall consistency of a measure), and concurrent (criterion) validity (how well a variable predicts an outcome based on information from other variables assessed simultaneously) of the scale.^{30,40}

The scale's construct validity was supported by the superior goodness of fit of the data to the seven-subscale model and by internal correlations among each subscale, reflecting the continuum of self-determination. This result highlights the importance of including all the types of motivation, which is supported by previous studies.^{18,21,22,24,26-28,39} It also has to be said that no previous research has found a 100% accurate continuum pattern. Deviations ranged from minor,^{18,19,21,22,27} such as the ones we found in the introjected regulation and amotivation subscales, to more significant ones,^{26,39,41} that question the instrument's underlying constructs. Further research should test the scale's construct validity and perhaps analyze and adjust the introjected regulation and amotivation subscales.

Reliability was supported by the acceptable internal consistency and adequate test-retest correlations. The lower but acceptable scores of identified regulation could be the result of an overlap and generation of ambiguity with the intrinsic motivation subtypes, as identified regulation is the most self-determined type of extrinsic motivation.^{18,21,22,26,27,39}

In addition, our results support what has been referred to as the most important step in instrument validation,⁴⁰ which is its relationship to external criteria, as this step provides evidence that the scores represent what they expect to represent. As predicted, the most self-determined (identified regulation and intrinsic motivation) and least self-determined (amotivation, external regulation, and introjected regulation) forms of regulation followed the hypothesized relationships with external criteria and provided additional support for the instrument's criterion validity, reflecting an alignment with the continuum of self-determination. One exception was cumulative GPA; however, our results corroborate the findings of a great deal of previous work in which the instrument has not predicted GPA.^{11,26,39} The one exception was a study in which self-reported GPA was collected, which may have introduced potential bias.²⁴ This inconsistency in our results may be due, on the one hand, to assessment types that may not reflect students' self-regulation or, on the other hand, to the fact that motivation is not a permanent state and students may adopt different types of regulations depending on influences from the teaching environment.⁸ Therefore, this would suggest that concurrent GPA would be a more appealing construct to analyze. It also has to be said that performance is not solely influenced by motivation and several other variables must be taken into account.^{11,42}

The Self-Determination Theory is explained and operationalized by seven subscales. According to this theory, dental students in our sample reported being primarily motivated to attend university by identified regulation, followed by the intrinsic motivation to know and intrinsic motivation towards accomplishment and finally by amotivation as the least endorsed subscale, which is consistent with previous research.^{18,22,24-27} Moreover, this autonomous self-regulation profile reflects what previous authors have noted: that dental and medical students have natural motivation to learn and to know the environment that surrounds them.^{43,44}

With regards to gender differences, and contrary to previous research in which females scored higher and significantly in the intrinsic motivation subtypes and males scored higher in the extrinsic and amotivation subscales,^{11,21,22,27,28} our findings did not show evidence of females having a more autonomous self-determined profile, as they scored higher than males in all intrinsic forms of regulation but also higher in the extrinsic subscales. Regarding differences by year of study, we found significant

differences in all subscales. The third and fourth years, in which students have their first contact with patients, showed the highest amotivation scores. These findings could correlate to the high dropout rates by the end of the third year in medicine and dentistry in Chile⁴⁵ and might indicate the need for an early patient contact learning strategy as well as introduction of curricular changes that may lead to a more self-determined student profile, such as horizontal and vertical integration, problem-based learning, and learning in small groups, among others.⁴⁴ Further research should study the predictive validity of the scale in relation to dropout rates for the introduction of motivational remedy strategies especially for students who report high scores towards either the most or least self-determined forms of regulation (external regulation, introjected regulation, and amotivation). However, the questions that arise are the following: Why do the preclinical and clinical years show a drop regarding the most self-determined forms of regulation? Is there a lack of support towards intrinsic motivation moving along the curriculum? Further research is needed to answer these questions. Nevertheless, all mean group comparisons should be interpreted with caution as they represent small effect sizes.

Based on all the above, this research has several practical implications that could benefit dental education by providing the opportunity to better understand students' motivation. Traditionally, academic motivation has been thought as a unitary construct differing only in amount. However, self-determination theory and particularly the Academic Motivation Scale support the study of motivation from a multidimensional perspective based on different quality types of motivation,⁸ which have been suggested to produce different cognitive, affective, and behavioral consequences.^{29,46} Therefore, dental students might have an equal degree of motivation, but how is this motivation characterized? Are they extrinsically or intrinsically motivated? What are the possible associated determinants and consequences? And above all, how can faculty and administrators create the conditions for students to be self-determined and adopt an autonomous self-regulation towards academic activities? This study provides certain insights, but further research on academic motivation in dental education is needed to address these questions.

Moreover, the validation of this instrument in dental education suggests the possibility of measuring motivation by itself rather than by inferring it from other variables. For instance, a previous study

measured motivation based on behavioral (e.g., time spent on a particular task) or affective (e.g., interest) variables rather than studying motivation as an independent construct.⁴⁷ If that were so, a student who spends hours on a specific task would be assumed automatically to be intrinsically motivated, without considering that the time spent on that particular task could be the result of an extrinsic form of regulation (such as external or introjected), which is driven by different determinants than the more self-determined forms of regulation and may also lead to different affective, behavioral, or cognitive outcomes.^{8,29} Using behavioral or affective variables as an index of motivation and, at the same time, as a consequence produces a problem of conceptual circularity.²⁹ One would be inferring a certain type or amount of motivation based on other variables and, at the same time, interpreting those variables as motivational outcomes. Therefore, measuring motivation as the "why of behavior"⁴⁸ independently of its determinants and consequences makes it possible to determine when a certain type of regulation produces a certain outcome and when it will not.²⁹

Despite the relevant findings, there are two important limitations to this study. First, generalizability cannot be assumed as this sample, though large, comes from only one dental school in one city of Chile. Second, all measures are self-reported and may introduce sources of potential bias. Although the instrument has reported high reliability and validity, self-reports constitute an inherent limitation due to possible influences such as social desirability, response biases, and lack of corroboration from other sources. Future research should be aimed at confirming or refuting our results with different samples and in different dental academic contexts.

Conclusion

The aim of this study was to test the psychometric properties of the Academic Motivation Scale with a group of Chilean dental students. As academic measures of motivation have not been widely used and reported in dental education, we intended to contribute by providing a preliminary valid measuring instrument to support and expand the study of academic motivation in dental education. Our results meet the recognized criteria for instrument validation. First, content validity was supported by the well-studied Self-Determination Theory. Second, the goodness of fit of the data to the proposed

seven-subscale model was superior compared with the competing models, and correlations among the subscales reflected the self-determination continuum with only two minor exceptions, thus supporting the instruments' construct validity. Third, adequate internal consistency and test-retest correlation were found. Finally, the criterion concurrent validity was supported by the predicted correlations of the instrument's subscales and external criteria, which also followed the self-determination continuum. Therefore, the evidence from this study suggests the Academic Motivation Scale as a preliminary valid and reliable instrument, providing support for its use in dental education research on academic motivation. This instrument provides the opportunity to study students' quality of motivation, with the possibility that future research will identify the most influential determinants and consequences of each type of regulation. Therefore, faculty, administrators, and researchers might identify these motivational profiles and modify activities, teaching strategies, or even the curriculum by including variables that might lead to more self-determined types of regulation, as these have been correlated with more positive educational and psychological outcomes. Moreover, this instrument provides the possibility of measuring motivation as a variable per se and not as a behavioral or affective construct. This fact may contribute to identifying remedial strategies that might enhance students' self-determination in academic activities or promote an autonomy-supportive teaching style.

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LETTER TO THE EDITOR

Self-determined motivation in Dental Education: Are we supporting autonomy or controlling behaviour?

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Why do some students seem more motivated than others? Why do they behave and engage in different ways when facing academic and clinical activities? As dental educators, we would all want our students to be self-motivated, self-starters, and take responsibility for their patients and learning, but how is it possible to support motivation without attempting to control behaviour and impose pressure?

Motivation has been defined as the energy for every action we make; it constitutes the perceived reasons and forces that drive people to engage in determined activities or exhibit certain behaviour, including educational achievements. Traditionally, motivation has been thought as a unitary concept differing only in amount, and being explained as if “the amount” increases, the associated behaviour will increase as well.

It is reasonable to think that if we measure a student’s amount of motivation it will positively correlate with the expected behaviour, but is “the amount” of motivation and behaviour what matters the most? Can the differences in quality of motivation and its consequences be explained only relying on “the amount”?

Self-Determination theory (SDT)¹, which investigates the roles of self-determined and controlled behaviours, postulates the study of motivation as a multidimensional construct based on three different quality types. From the least to the most self-determined forms, these correspond to amotivation, controlled motivation, and autonomous motivation.

Amotivation is the absence of intent to pursue an activity due to one’s failure to establish contingencies between activity and behaviour, in other words, what students’ do and the consequences from these actions, seem unrelated to them. Controlled motivation involves behaving under pressure, coercion and demands towards specific outcomes or rewards. Forces are perceived to be external to the self. In turn, autonomous motivation involves behaving with a full sense of volition, choice, and self-determination. It represents the drive to pursue an activity, either for the pleasure or satisfaction derived from it, or because you value the activity and freely choose to engage, without internal or external pressures.

Several studies have found that internalisation of students motivation towards an intrinsic and autonomous form is associated with positive educational outcomes, such as deep level

study strategies, enhanced conceptual learning, creativity, better academic performance, enhanced self-esteem, and better psychological wellbeing. In contrast, controlled motivation and amotivation have been associated with negative outcomes, such as low competence, poor wellbeing, and inadequate psychological adjustment to university life¹.

If autonomous forms of motivation have been associated with positive educational outcomes and are considered the desired forms of motivation, then how can we, as dental educators, promote and facilitate them? A first point to consider is that motivation is mostly influenced by interpersonal factors, in other words, by social experiences in which others have powerful impact. Past research, especially in health professions education has highlighted the influence of interpersonal human and non-human factors that may promote optimal forms of motivation, such as type of curriculum, extent of responsibility, selection procedures, type of assessments, early patient contact, and teaching style².

A second point to consider is that SDT postulates that these interpersonal factors do not impact motivation directly, their effect is mediated by the impact they have on students’ perceptions of three basic psychological needs that represent essential needs that every individual tries to fulfil. These correspond to the needs of autonomy, competence, and relatedness.

First, the need for autonomy refers to making decisions by one’s own will, based on one’s own needs and values. It does not mean that students act independently from their tutors, it means engaging in clinical activities because they want to, freely choosing to devote time and energy to their studies or to a particular academic activity. Second, the need for competence refers to the desire of feeling capable of performing a determined task and it is related to seeking challenges that are optimal to one’s abilities. In this context, competence is not defined as an attained skill or ability per se, but rather as a perception of confidence and effectiveness. Third, the need for relatedness is described as the need for belongingness or connectedness with significant others, as well as with a significant community. It means being accepted and valued by people surrounding us, such as fellow students, teachers, or patients.

Consequently, if the dental teaching and learning environ-



ment satisfies students' perceptions of the aforementioned needs, autonomous motivation will increase, and conversely, if it impairs such perceptions then it will have negative effects and will facilitate controlled forms of motivation and amotivation. It is the perception of the social factors and not their planned objective that mainly affects motivation.

A consequence of the above is that the different types of motivation lead students to different quality types of educational outcomes, mainly at the cognitive, affective, and behavioural level. Thus, a student can be motivated in amount but this does not guarantee positive outcomes, it depends on which quality type of motivation is driving students towards academic activities.

The dental teaching environment can facilitate these basic needs and foster autonomous motivation through what has been described as an "autonomy-supportive teaching style". This is characterised by providing meaningful rationale, options, opportunities for self-directed decisions, and minimising external pressures; thus encouraging students to feel more autonomous, competent and supported by their teachers and peers. Dental teachers have expressed several strategies and behaviours that could be transferred to different settings, such as controlling external motivators; a gradual transference of responsibility; identifying and encouraging personal interests; giving timely and constructive feedback; delivering a vicarious learning experience; teamwork, team discussion, and providing a safe environment³.

Therefore, when supporting students' motivation our efforts should not be focused on controlling their behaviour, they should rather be focused on creating the conditions by which students can be self-motivated to learn and engage in academic activities.

Moreover, research has shown that students in health professions who learn in environments that support autonomous motivation tend to act in more autonomy-supportive ways in their interactions with patients. This autonomy supportive practitio-

ner-patient interaction has shown positive health outcomes in behaviour related areas such as smoking cessation, weight loss, prescription adherence, glucose control, and oral health care⁴.

Despite the relevant consequences exposed above, little attention has been paid to motivation in dental education research. Most investigations have been conducted on psychology, medical, and general higher education. As curriculums and exit profiles are different among professions, it is coherent to think that the process of motivation, including its determinants and consequences, will be different as well. For this reason, identifying students' motivational profiles and different determinants and consequences is highly pertinent, particularly in the dental education context that has been known for being highly controlling and demanding for students. This may lead managers, curriculum designer, and faculty staff to shift from well-intended controlling ways of motivating students, to designing adaptation-promoting interventions such as student- and patient-centred approaches, which may lead students to engage in academic activities in a self-determined way⁵.

The fact that every discipline has its own language and invites particular ways of thinking, makes it a challenge for dental educators to become more familiar with educational theory and research, including theories of motivation, in order to better understand and inform the process of dental education, that will ultimately benefit future practitioners and patients.

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RESEARCH ARTICLE

How to encourage intrinsic motivation in the clinical teaching environment?: a systematic review from the self-determination theory

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Abstract

Purpose: Internalization of students' motivation towards an intrinsic form is associated with increased interest, commitment, learning, and satisfaction with education. Self-Determination theory postulates that intrinsic motivation and autonomous forms of self-regulation are the desired type of motivation; as they have been associated with deep learning, better performance and well-being. It claims three basic psychological needs have to be satisfied in order to achieve intrinsic motivation. These are the needs for autonomy, competence and relatedness. This study aims to provide a review on how these basic psychological needs are encouraged in undergraduate students so they can be transferred to the clinical teaching environment. **Methods:** Electronic searches were performed across four databases (Medline, Embase, PsycINFO, and ERIC), relevant journals, and retrieved bibliography of selected articles. In total, searches produced 4,869 references, from which 16 studies met the inclusion criteria. **Results:** Main themes were coded in three categories: The support of autonomy, competence and relatedness. The research-based evidence appears to be of reasonable quality, and indicates that teachers should work to satisfy students' basic psychological needs to foster internalization of self-regulation. Our findings suggest that teachers should interact with students in a more 'human centred' teaching style, as these actions predict motivational internalization. Several themes emerged from different contexts and further investigation should expand them. **Conclusion:** This review identified actions that clinical teachers could implement in their daily work to support students' self-determination. Autonomy supportive teaching in health professions educations would benefit students and may actually result in more effective health care delivery.

Key Words: *Achievement; Learning; Motivation; Personal autonomy; Personal satisfaction*

INTRODUCTION

Over the last decade there has been increased research on motivation in health professions education [1,2]. Clinical teaching has been suggested as an important factor influencing students intrinsic motivation and performance [3,4]. A number of studies have found that internalization of students mo-

tivation towards an intrinsic form is associated with increased interest, commitment, effort, learning, and satisfaction with education [5-7]. In contrast, a poor quality of learning occurs when students are not willing to learn [6]. It is suggested that students in higher education, especially in health professions education, have natural tendencies to learn and to know the environment that surrounds them, they have a self-concept of being responsible for their own decisions, and learn things they need to know for real life situations [1,8,9]. However, these behaviours can be supported or diminished by internal or external factors [9]. Self-determination theory [6] supports the idea of students' innate curiosity and desire to learn. This is

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achieved by internalizing and integrating psychic components to build an integrated and unified sense of the self [8]. It posits three quality types of motivation: amotivation (i.e. lack of motivation), extrinsic motivation (i.e. driven by external control or demands) and intrinsic motivation (i.e. free engagement in an activity for inherent satisfaction). An internalization process, from external to internal regulation, influences the type of motivation adopted. This relates to how self-determined an individuals' behaviour is and can lead to internalization of habits and motives in order to generate feelings of autonomous self-regulation and value.

Self-determination theory claims three basic psychological needs that have to be satisfied in order to achieve intrinsic motivation and internalization of autonomous self-regulation. These are the needs for autonomy, competence and relatedness [2,8]. The needs for autonomy refers to making decisions by your own will, based on one's own needs and values [9]. The need for competence refers to the desire of feeling capable of performing a determined task and it is related to seek challenges that are optimal to one's abilities [6]. Relatedness is described as the need for belongingness or connectedness with significant others, as well as with a significant community [10]. It means being accepted and valued by people surrounding us. The clinical learning environment can promote these needs and foster intrinsic motivation through an autonomy-supportive teaching style, making students feel autonomous, competent and supported by their teachers and peers. This opposes to the traditional controlling style in which behaviour is usually regulated by punishments and rewards [6], leading to extrinsic motivation. Evidence suggests that if teachers support students' autonomy, competence and relatedness, they will thrive in educational settings [9], they will take responsibility for their learning [1] and also act in a more autonomy supportive way in their interactions with patients [11]. Therefore the aim of this systemic review is to describe and analyse how the teaching environment supports students' needs for autonomy, competence, and relatedness and consequently supports undergraduate students to achieving intrinsic motivation and

engagement in academic activities.

METHODS

The search for relevant literature was performed during November and December 2013. The inclusion and exclusion criteria are outlined in Table 1. Electronic searches were performed across four databases (Medline, Embase, PsycINFO, and ERIC), relevant journals, and retrieved bibliography of selected articles via the Science Citation Index (SCI). All selected articles were exported to a reference manager for further and detailed review.

We designed a three main theme search strategy based on the concepts of '*Clinical Teaching AND Intrinsic Motivation AND Undergraduate Students*'. These concepts were expanded and adapted specifically for each database thesaurus. The core strategy for Medline, which was accessed via Ovid, is presented in Table 2. The results from the database search provided key journals for hand searching. Journals were searched through their electronic websites using their advanced search option. Search criteria included articles available in English and Spanish because of the bilingual characteristics of the authors, and considered a 20-year time frame search in order to assess current tendencies. Two reviewers independently assessed whether the abstracts were eligible for full article review. Any differences of opinion were debated and consensus was reached on which papers to include/exclude. Afterwards the selected abstracts were exported to the reference manager and duplicates were removed. Subsequently, related articles were searched throughout the reference manager's library, and finally, of the selected articles, an ancestry search of their references through the Web of Science® was performed. A summary of the literature search and review process is presented in Fig. 1.

The selected articles that met the inclusion criteria were analysed and read as full text. A word processing file was created for each article in order to extract information about their methods and outcomes. The 'Critical Appraisal Skills Programme' was used as a guide to critically analyse the articles' methods

Table 1. Setting the scope of the search: inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
1. Studies/reviews/meta-analysis focusing on the encouragement of undergraduate students' intrinsic motivation.	1. Studies not empirical in nature like view- points, editorials, papers expressing opinion and books.
2. Studies/reviews/meta-analysis within Health Professions Education or General Higher Education.	2. Studies on populations other than undergraduate students or teachers in health professions education or General Higher Education.
3. Quantitative research studies with well-formulated definitions, operationalization of concepts and analysis of data.	3. Studies not referring to motivation in higher education.
4. Qualitative research studies with well-defined concepts, reliable methods, well-reasoned conclusions and analysis.	4. Studies focusing on motivation in education for specific issues not regarding teaching.
5. Articles available in English and Spanish Language, published from year 1993.	5. Studies focused on instrument construction/validation.

Table 2. Identifying and expanding essential concepts (Medline Search Strategy)

- Search 1 (words with OR): *Clinical Teaching*
 - *Mesh Terms*: exp Teaching/ - Mentors/ - exp faculty/ - clinical clerkship/
 - *Keyword Search (free text)*: tutor\$ - clinical adj2 (tutor\$ OR teach\$) - teach\$ - facilitator\$ - lecturer\$ - Teach\$ adj1 development- (chairside or bedside or effective) adj1 teach\$ - Instructor\$
- Search 2 (words with OR): *Intrinsic Motivation*
 - *Mesh Terms*: exp motivation/ - personal autonomy/ - internal-external control/ - professional autonomy/
 - *Keyword Search (free text)*: (intrinsic\$ OR extrinsic\$ OR controlled OR autonomous) adj2 motivation\$ - self adj1 determination - self adj1 regulated adj1 learning - SRL - autonomy - competence - relatedness - (Autonomy or competence or relatedness) adj1 Support - learner adj1 autonomy - motivat\$ - Incentive\$ - motive\$
- Search 3 (words with OR): *Undergraduate Students*
 - *Mesh Terms*: students, dental/ - students, medical/ - exp education, dental/ - education, medical, undergraduate/ - Education
 - *Keywords Search (free text)*: (Dental or medical) adj1 student\$ - dentist\$ - dental - Undergraduate adj1 Student\$
- Search 1 AND Search 2 AND Search 3

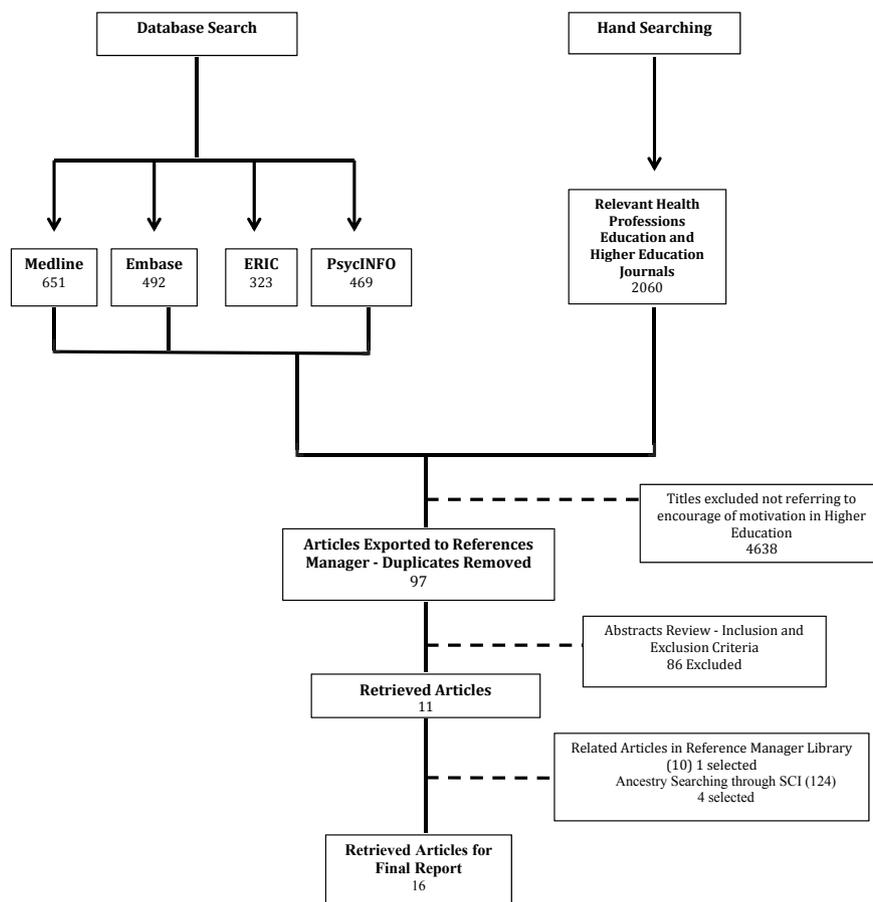


Fig. 1. Summary of literature search and review process.

[12]. Afterwards, three main themes were used to describe how teachers encourage intrinsic motivation. These themes referred to the three psychological needs mentioned earlier: the needs for autonomy, competence and relatedness. Each relevant idea regarding one of these ‘needs’ was registered as a topic with a brief description. Subsequently, all the data collected was used to create a table that summarised the infor-

mation extracted, including the study reference, research topics, type of study, sample, data collection method, data analysis and selected findings and comments. Finally, and attempting to make sense and integrate the extracted data, a thematic analysis was performed. The most relevant themes from each article, referring to the ‘three psychological needs’ were identified and grouped in a new table. Two reviewers independently

analysed the selected articles following the described steps and posteriorly met, compared their results, and agreed in the final report. The review was organised following the reporting guidelines of the PRISMA statement [13].

RESULTS

The database, manual, and retrieved bibliography search produced 4,869 references to the encouragement of intrinsic motivation in undergraduate students. Of those, 16 met the eligibility criteria and were included in the final review (Fig. 1). Articles were excluded mainly because they were not empirical in nature (i.e. view- points, editorials, papers expressing opinion and books), they involved other populations, were not referring to motivation in higher education, they focused on motivation for specific issues not regarding the encouragement of the three basic psychological needs to foster Intrinsic motivation in higher education, or were focused on instrument construction/validation. Table 3 provides a summary of the key findings from the 16 articles reviewed.

The majority of the studies stated clear objectives or research questions, consistent with the study's development and were found to be relevant for the encouragement of motivation in higher education and particularly to the health professions field. Four studies were centred in overviewing motivation and its applications through the self-determination theory concept [2,8,9,11], meanwhile the rest focused either on supporting autonomy, competence, or relatedness. Although one study was oriented to dental education [3], most studies examined the encouragement of intrinsic motivation in medical education [2,9,11], psychology education [14-17] and general higher education contexts [8,10,18-22]. One study combined medical and nursing education [1]. Most studies were design as quantitative [10,15-22], only two studies reported mixed methods [3,14] and one a qualitative design [1]. Cross-sectional studies were predominant. Two studies employed longitudinal designs [20,22] with two and three data collection points during a one semester period. No control groups were included. One study made a cultural comparison between German and United States students [10]. Participants were all undergraduate students. Modest sample sizes were selected ranging from 117 to 222 participants, with two exceptions. One study collected 1,289 reports from students [10], and a qualitative study recruited 31 students [1]. Student recruitment was through advertisement, email and paper-based invitation. Not surprisingly, self-administered questionnaires were the most popular data collection method, although in several papers more than one was used, these measured different variables. One study used three data collection sources for the same variables (i.e. open and close questions, semi-structured interviews

and focus group), increasing data triangulation [3]. One study used only focus groups [1].

Data analysis was consistent with the studies objectives or research questions. Statistical analysis (i.e. descriptive an inferential), thematic and content analysis were performed. Studies with qualitative components showed rigorous and credible analysis [1,14]. More than one author examined the collected information separately, and then crosschecked listed categories and made adjustments. These studies were also characterised by transparency about methods, one Swedish study asked students to check the final list of categories created and completed a forward and backward translation of results to English, in order to increase dependability and make findings transferable [1]. Most studies did not establish causal relations, instead providing correlations between variables. Three studies reported self-criticism in this aspect [16,18,20] arguing that manipulating these 'needs of satisfaction' variables in real group contexts would be difficult and perhaps unethical to conduct.

How to encourage the three basic psychological needs?

The majority of the studies stressed the importance of autonomy supportive teaching to encourage students' intrinsic motivation. Through the variety of contexts revised, the main approach to promote intrinsic motivation was adopting the principles from the self-determination theory that stress the importance of creating feelings of competence, autonomy and relatedness in students [2,8-11,15-18,20-22]. Table 4 summarises the main themes according to each psychological need. Students' perceived that an autonomy supportive teaching style increased their autonomous self-regulation, competence, interest, well-being [2,9,10,20] and predicted positive outcomes [10,11,14,15,17,18,21].

Strategies for enhancing autonomy

The needs for autonomy refer to experience behaviour as volitional and reflectively self-endorsed. For example, students are autonomous and intrinsically motivated when they freely choose to devote time and energy to their studies [8]. Three studies argued the importance of identifying what students really want [1,2,9]. Contents must be relevant and interesting for students. If teachers take the time to acknowledge students' interest, they can turn boring contents into attractive activities by changing the scenario [2]. This usually happens when learning basic science content. Students may feel uninterested, however, vertical integration incorporating clinically oriented approaches and early patient contact, could make basic knowledge useful and meaningful [1,9]. In one study comparing nursing and medical students' perceptions, both agreed that applying theoretical knowledge into practice motivated them to learn. In the same study, all students expressed that their

Table 3. Summary of studies on the encouragement of intrinsic motivation in undergraduate students

Author(s) (years, country)	Research topics	Type of study	Sample	Data collection method	Data analysis	Selected findings & comments
Ryan & Niemiec (2009, USA) [8]	Overview SDT and applications to educational practice.	Literature review	Purposive sample of articles	Electronic databases and hand search of relevant literature	Thematic analysis	<ul style="list-style-type: none"> - Enhancing autonomy includes providing choice, meaningful rationales for learning activities, acknowledging students' feelings, and minimizing pressure and control. - Enhancing competence includes providing effectance-relevant feedback and optimally challenging tasks. - Enhancing relatedness includes conveying warmth, caring, and respect to students.
Kusurkar et al. (2011, The Netherlands) [2]	Autonomy-supportive teaching and practical tips for medical teachers.	Literature review	Purposive sample, SDT related Literature	Electronic databases and hand search of relevant literature	Thematic analysis	<ul style="list-style-type: none"> - Enhancing autonomy includes nurturing what students need and want, encouraging active participation having students' internal states guide their behaviour, encouraging students to accept more responsibility for their learning, communicating value in uninteresting activities, giving choices, directing with 'can, may, could' instead of 'must, need, should'. - Enhancing competence includes providing structured guidance, optimal challenges and positive and constructive feedback. - Enhancing relatedness includes giving emotional support and to acknowledge students' expressions of negative effect
Benson, Cohen, & Buskist (2005, USA) [14]	Rapport: student attitudes and proacademic behaviours, and Instructor behaviours contributing to it.	Mixed methods	166 students	Questionnaire-based (close/open questions)	Statistical analysis, (Frequencies, t-test, ANOVA) and content analysis	Rapport-inducing teachers are likely to have students who attend class, pay attention, enjoy subject matter and engage in proacademic behaviours.
Ten Cate et al. (2011, The Netherlands) [9]	Practical applications of SDT in medical education	Literature review	Purposive sample SDT related literature	Electronic databases and hand search of relevant literature	Thematic analysis	<ul style="list-style-type: none"> - Enhancing autonomy includes giving time and opportunity for autonomous work, enquiring what students want, allowing students to choose how to learn and plan moments of assessment. - Enhancing competence includes praising quality of performance, providing constructive feedback and trust students with more clinical responsibilities, taking their role seriously. - Enhancing relatedness includes empathising, listening to and acknowledging students' perspectives.
Davies et al. (2012, UK) [3]	Student's views and perceptions of clinical teaching	Mixed methods	Three cohorts of 152 final-year students	Questionnaire-based (online/paper-open/closed questions) - Semi-structured interviews - Focus groups	Descriptive statistics and thematic analysis	<ul style="list-style-type: none"> - A friendly, non-threatening teaching environment is perceived by students to be a good learning environment. - Students appreciate the time and space to take ownership of their learning. - Learning experience is enhanced through reflective practice and feedback.
Bengtsson et al. (2010, Sweden) [1]	What students consider important for their motivation to attain knowledge	Qualitative	31 students	Focus group with semi-structured questions	Content analysis	Dedicated teachers giving performance feedback, discussions in different forms and choices of learning and assessment methods enhance enthusiasm and learning.
Hodgins et al. (1996, Canada) [18]	Reflective autonomy and interpersonal experiences with parents and with peers	Quantitative	153 students	Questionnaire-based	Statistical analysis (coefficient of correlation)	Reflective autonomy was significantly related to more positive and honest naturally occurring interaction and positive relatedness.

(Continued to the next page)

Table 3. Continued

Author(s) (years, country)	Research topics	Type of study	Sample	Data collection method	Data analysis	Selected findings & comments
Brewer & Burgess (2005, USA) [19]	Teachers' role in motivating students to come to class.	Quantitative	156 students	Questionnaire-based	Statistical analysis (Descriptive, t-test, MANOVA)	Teachers should maintain a positive attitude toward students, maintaining a flexible class environment and use a variety of alternative teaching methods to capture students' attention and curiosity.
Williams, Saizow & Ryan (1999, USA) [11]	Importance of SDT for medical education	Literature review	Purposive sample, SDT related literature	Electronic databases and hand search of relevant literature	Thematic analysis	Enhancing autonomy and competence includes considering students perspective, provide relevant contents, making students responsible for their learning and giving choice. Enhancing relatedness includes to dialogue, listen, give advice, and care about students
Black & Deci (2000, USA) [20]	Students' self-regulation and perceptions of their instructors' autonomy support	Quantitative	137 students	Questionnaire-based	Statistical analysis (Descriptive, factor analysis, t-test, coefficient of correlations, Multiple regression, ANOVA)	Teachers should provide support for students' autonomy and active learning to improve their autonomous self-regulation, competence, enjoyment, and decrease anxiety.
Boggiano et al. (1993, USA) [15]	The effect of controlling strategies and restricted choice on students' performance	Quantitative	117 Students	Questionnaire-based	Statistical analysis (Descriptive, ANOVA)	An "expert" teacher using controlling techniques undermines the nonexpert's perceptions of autonomy, sense of responsibility for process and performance.
Beachboard et al. (2011, USA) [21]	Feelings of relatedness and learning outcomes improvement	Quantitative	2,000 records of NSSE survey	Questionnaire-based	Statistical analysis (Descriptive, t-test, linear and block entry regression)	Increased relatedness to peers and faculty and increased higher order thinking assignments are substantial predictors of educational outcomes relevant to literacy, critical thinking and job preparation
Sheldon & Bettencourt (2002, USA) [16]	Relation of need-satisfaction constructs and affect, intrinsic motivation and commitment	Quantitative	134 Students	Questionnaire-based	Statistical analysis (Descriptive, regression and coefficient correlation)	Group inclusion predicted positive outcomes and may be the most important need to satisfy within group contexts
Ciani et al. (2011, USA) [22]	Particular achievement goal profiles of students and SDT	Quantitative	184 students	Questionnaire-based	Statistical analysis (descriptive, correlation and comparative fit index)	Teacher autonomy support buffered against the general decline in students' mastery-approach goals over the course of the semester and predicted initial self-determined motivation.
Kaufman & Dodge (2009, USA) [17]	Factors that influence relatedness and value in an academic setting	Quantitative	222 students	Questionnaire-based	Statistical analysis (descriptive and linear regression)	Enhancing relatedness includes providing students with more choice in their curriculum and fostering a sense of mastery goals. Such improvements can be targeted at both the structural or policy level, as well as at the classroom level.
Levesque et al. (2004, USA) [10]	The relevance of the needs for autonomy and competence toward University	Quantitative	1,289 students	Questionnaire-based	Statistical analysis (descriptive, covariance structure analysis)	Positive informational feedback and lower perceived pressure were positively associated with greater perceived autonomy and competence.

motivation was mostly driven by curiosity, being in charge of their studies and contents, and if these contents were connected to their own personal situation [1]. On the other hand, not

every activity will be interesting for everyone. When this happens, students can be very discouraged [2]. Teachers give value to uninteresting contents by informing students how these

Table 4. Main themes for supporting intrinsic motivation and satisfying the three basic needs

Supporting autonomy	Supporting competence	Supporting relatedness
Identify what students want	Provide optimal challenges	Respect students
Provide different learning approaches		
Give value to uninteresting tasks	Provide structured guidance	
Promote active participation		Give emotional support
Give choice	Value students work	
Give learning responsibility		Acknowledge students' expressions of negative effect
Provide freedom	Give positive and constructive feedback	
Avoid external reward	Feedback	

subjects are important for their professional future, consequently internalizing an originally externally regulated behaviour [8,9].

Brewer concludes that college teachers should use a variety of alternative teaching methods to capture students' attention and curiosity [19]. In his findings, lectures were ranked by students as the number one "amotivational reason to skip class"; therefore, teachers should avoid relying only on them. When using lectures as a teaching strategy in the clinical setting, teachers should demonstrate vast knowledge of the subject, as students perceived "knowledge of the subject matter" as the number one reason to attend class. Using case studies, role plays, experiments, and group activities made learning easier for medical and nursing students [1]. The use of alternative teaching methods was supported by two studies which argue that turning a passive student into an active learner may hold promise for enhancing students' achievement and psychological development [8,20]. Being an active learner involves having time and space to take ownership of the learning process. In two studies, nursing, medical and dental students expressed the value of clinical freedom [1,3] and complained about too much work and too little time to deepen in their areas of interest.

Traditionally, many teachers and schools have relied on controlling strategies for teaching and curriculum development. Contrary to this, six studies supported giving choice to students, so they could identify and integrate contents [1,2,8,9,15,22]. Boggian et al. found that students under controlling directives conditions performed significantly worse than students in no controlling directives conditions [15]. Students felt comfortable when being in charge of their own behaviour. Teachers can enhance this by giving choices of learning methods, exercises and task, leading to intrinsic motivation [1,2]. An environment that provides choices and freedom for students also needs them to take more responsibilities in their learning process, this has been shown to stimulate students' motivation [2,11]. Davies et al. stressed the importance of facilitating the empowerment of dental students in clinical teaching [3]. Students should determine their learning path and plan their own

moments of assessment when they feel ready [9]. In order to do this, students must know what is expected from them since the beginning of the semester.

Strategies for enhancing competence

The need for competence refers to the desire of feeling effective in whatever actions one pursues and performs. Competence is not meant as an attained skill or ability per se, but rather a perception of confidence and effectance [9]. Two studies argued the importance of providing optimal challenges for students feeling competent and enhancing intrinsic motivation [2,8]. Activities shouldn't be too hard, but neither too easy for students to test and expand their capabilities. Medical students considered that too easy tasks made them feel insecure and that the level of demands should be appropriate for their learning stage [1]. The idea of an autonomy and competent student does not imply an independent and 'free from the government of others' learner. Teachers should provide a structured guidance, delivering the necessary tools for students' success [2,8], but also seriously valuing their work and making them feel an important part of the clinical environment [3,9]. Five studies revealed the importance that positive and constructive feedback has when promoting intrinsic motivation [2,3,8-10]. This feedback should be oriented on the task, not on the person so that it doesn't feel like a threat but as a suggestion on how to improve what went wrong. Dental students and medical students from different cultures, valued positive feedback at the end of sessions, relating it with greater autonomy and competence [3,10].

Strategies for enhancing relatedness

In order to achieve an autonomous self-regulation behaviour, students must feel connected with teachers and peers [9]. Supporting this concept, Beachboard et al. claimed relatedness as a mediating variable for the relationship between students' participation and educational outcomes [21]. Teachers have a fundamental role when establishing rapport with students. Brewer et al. suggests that teacher's personal qualities

were more important in motivating students than were the teaching methods and classroom management practices [19]. The most frequently rapport-inducing teachers qualities stated by students were: encouraging, open-mindedness, creative, interesting, accessible, happy, having a “good” personality, promoting class discussion, approachability, concern for students, and fairness [14]. Four studies stressed the importance of respecting and having a positive attitude towards students, providing a non threatening environment, and feeling cared [1, 3,9,19].

Dental students stated that working together and for the teacher to know them, made them feel ‘part of the team’ [3]. On the other hand, nursing students felt that sometimes lecturers treated them like teenagers instead of adults, affecting their motivation [1]. Teachers should support an environment where students feel emotionally supported, comfortable and free to express opinions, leading them to be more interested in subjects and to the internalization of tasks [2,8]. Not acknowledging students’ expressions of negative effect undermines motivation. Students claimed that when saying something critical, teachers sometimes acted defending themselves instead of listening and discussing [1]. Autonomy supportive teaching also includes being empathic when reasonable students’ opinions criticise teachers work [2,9].

DISCUSSION

The research-based evidence for the encouragement of intrinsic motivation in undergraduate students appears to be of reasonable quality, and indicates that clinical teachers should work to satisfy students’ basic psychological needs to foster internalization of self-regulation. Several themes emerged from different contexts referring to satisfying those needs and further investigation should expand them. Autonomy supportive teaching in health professions education would benefit students and may actually result in more effective health care delivery [11]. This review identified actions that teachers could implement in their daily clinical teaching work to improve students self-determination. Independent of the context, these actions could be transferred to a broad of educational settings.

Our results suggest that clinical teachers should interact with their students in a more ‘human centred’ teaching style, as these actions predict motivational internalization. Findings illustrate that research on academic motivation has been focused in general higher education, psychology education and to a lesser extent in medical, dental, and nursing education. Self-determination theory represents one of the most referred theories in psychology, however, its application in health professions education is not so common [9]. Further research applying self-determination theory principles should be under-

taken in health professions education, and especially in clinical teaching settings that represents a very important venue for students’ development. As motivation represents a universal truth, cultural differences may also influence the implementation of an autonomy supportive teaching style. Although one study established cultural comparison between students from Germany and United States [10], future research in academic motivation should take into account this differences between students in order to generalize findings in other cultures.

Most of the studies were based on quantitative methods, and relying only on students’ point of view. Only few studies used mixed or qualitative methods and none of them focused on teachers’ perceptions. There is no denying of the valuable data emerged from quantitative studies, but the richness and depth of qualitative and mixed methods constituted the core of the extracted data. For further understanding of teachers’ practices, qualitative and mixed methods should be considered, and students’ perceptions should be combined with tutors’ opinions. Teachers are in charge of supporting students’ motivation; therefore, knowing their opinions and apprehensions would add rich information to the data provided by the students. The majority of the studies relied on one method for data collection, primarily questionnaire-based instruments. Future research should consider combining multiple sources of data, therefore increasing data triangulation and credibility of results. On the other hand, two studies were based on six and seven questionnaire-based instruments to collect information and, as it would be expected, response rates were lower than studies that used fewer instruments. Students fatigue to respond and time value should be taken into account.

Intrinsic motivation and autonomous forms of self-regulation are the desired type of motivation in students, as they have been associated with deep learning, better performance and well-being, in comparison with extrinsic motivation and controlled forms of self-regulation (i.e. under external control) [5,6,9]. Teacher behaviours and teaching styles can influence students motivation [8,19], either in classroom or in clinical environments. Students’ own curiosity and interests are potent tools by which teachers can promote their desire to learn. In contrast, teachers that rely on external factors (e.g. rewards), risk students internal learning aspirations, compromising the quality of the process [8]. An autonomy-supportive teaching style is characterised by providing options and opportunities for self-directed decisions minimising external pressures [6,23].

The reviewed articles considered the autonomy supportive teaching style to be important for learning, as it aids students’ self-motivation and relatedness with significant others [1]. Therefore, many successes and failures in clinical education could be understood through self-determination theory. In

addition, intrinsic or extrinsic motivation are not permanent characteristics, thus, stressing the point about paying attention to the influences of learning environments [6].

Finally, a number of important limitations need to be considered. First, several sources of bibliographic data were used to identify eligible articles. Though important material was found, it was limited to the sources included and important papers could have been ignored. Second, journals searched were predominantly from the United Kingdom and USA, and in English. Even though Spanish articles were included in database search, language and demographic criteria was also counted as limitations. Lastly, most of the reviewed articles were design as cross-sectional studies. Prospective research is needed to examine if the satisfaction of the three psychological needs in fact predicts changes in the internalization of behaviour and the fostering of intrinsic motivation towards academic activities.

It is not difficult to engage in an autonomy-supportive teaching style, it can be learned through practice and self-reflection. By providing an educational environment based on the self-determination theory principles, clinical tutors may be successful in their teaching. Therefore it is important that future research considers what educators and clinical tutors are actually doing to enhance student's motivation and how they can incorporate new teaching and learning strategies.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

SUPPLEMENTARY MATERIAL

Audio recording of abstract.

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