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Correlation between Personality Traits, Learning Approaches and Academic Performance of Dental Students

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DECLARATION

This thesis describes research carried out at the Faculty of Dentistry, The University of Sydney under the supervision of Associate Professor Tania Gerzina BDS, MDS, FRACDS, PhD (*Syd*), GradCertEdStud (Higher Education), (University of Sydney, Faculty of Dentistry) and Professor Greg Murray BDS (*Hons*), MDS, FRACDS, PhD (*Tor*), (University of Sydney, Faculty of Dentistry) from the Jaw Function and Orofacial Pain Research Unit, Faculty of Dentistry at the University of Sydney.

The research presented in this thesis is, to the best of my knowledge, original and entirely the product of my own scholarly work, except as acknowledged in the text. This thesis has not been submitted in part or whole for the award of a higher degree at any other university. Full acknowledgement has been made where the works of others has been used or cited.

Wael Mousa Mohammad Al-Omari

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ABSTRACT

Introduction

Dental educators are required to acquire the necessary knowledge about the diversity of their students in relation to their preferable learning strategies and their personality dispositions. These constructs may have significant impact on students' academic achievements. Thorough understanding of these constructs will assist teachers to design better teaching tactics, assessment methods and more conducive curriculum to maximize the learning outcomes. The present study investigated the correlation between personality traits and approaches to learning in an international project. Aims were (i) to examine the influence of both measures on the academic achievement of dental students, and (ii) to provide recommendations for educators.

Materials and methods

Student volunteers from the Jordan University of Science and Technology (JUST) are reported in this stage of this international project. Personality traits of dental students were determined using the NEO Five-Factor Inventory (Costa & McRae, 1985). These students were also asked to complete Bigg's revised two-factor version of the study process questionnaire (R-SPQ-2F) (Biggs, Kember & Leung, 2001) and provide their grade point average (GPA). The de-identified data were analysed using zero-order correlation, Student t-test and multiple regression procedures.

Results

Of the 170 students who volunteered, a total of 115 (67.6%) students showed deep approach (DA) to learning. Moreover, a significant positive relation between GPA and DA was found, whereas negative relation between GPA and surface learning

approach (SA) was reported. Two of the five personality traits, namely conscientiousness and openness were positively related to deep learning approaches. Conscientiousness and DA were the best predictors of GPA. Results from zero-order correlation also revealed that openness significantly predicted deep learning approach and GPA. On the contrary, neuroticism was positively related to surface learning approach and negatively related to GPA. Neuroticism was significantly higher in female students, and Arab students were more open to new experiences than their Malaysian counterparts.

Discussion and conclusions

The results indicated that openness to experience and intellectual curiosity in combination with purposefulness, discipline and an achievement-oriented attitude would predict deep approach to learning. Possession of those traits in addition to a deep learning approach tends to collectively enhance academic performance. Educators have a scholarly responsibility to have understanding of student learning when developing their teaching skills and so optimise educational investment by both student and educator.

An informed understanding of the general personality traits of students and the relationships of this to deeper learning and assessment performance can provide insight to the path to better teaching. Educators should consider the importance of student learning approaches, conscientiousness and openness to ideas in developing and renewing their teaching methods to improve students' performance.

ABBREVIATIONS

BDS	Bachelor of Dental Science
JUST	Jordan University of Science and Technology
GPA	Grade point average
FFM	Five-factor model
NEO-PI-R	Revised NEO-Personality Inventory
NEO-FFI-3	Neuroticism-Extraversion-Openness-Five Factor Inventory-3
N	Neuroticism
E	Extraversion
O	Openness to experience
A	Agreeableness
C	Conscientiousness
PAR Inc	Psychological Assessment Resources Incorporated
R-SPQ-2F	The Revised two-Factor version of the Study Process Questionnaire
DM	Deep Motive
DS	Deep Strategy
SM	Surface motive
SS	Surface strategy
DA	Deep approach
SA	Surface approach
DL	Deep learners
SL	Surface learners
MBTI	Myers-Briggs Type Indicator

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

The understanding that the approach students adopt to learn in any learning environment is subject to influential factors, has emerged as a prominent pedagogical issue in educational literature. Individual students respond differently to delivered education (Pashler *et al.*, 2008) and they also differ in their approach to learning of the same teaching context. Student learning approach has been conceptualised as an intricate interaction of attitude or disposition to the learning and its context, and is modifiable. This supports the scholarly effort of educators who design teaching context to modify the approaches to learning taken by students to a more desirable Deep Approach and, concomitantly, to discourage a Surface Approach. Deep Approach is related to in-depth understanding of the teaching material and a more fluid, agile relating of new knowledge to both real life scenarios and past learning experience (Biggs & Tang, 2003). A Surface Approach on the other hand, is characteristic of an approach that is more dependent on retention of information, rote learning and memorisation where the learner is often unreflective about their learning experience (Biggs & Tang, 2003). An understanding and knowledge of learning approach can be utilised by both student and educator to promote self-awareness of strengths and weaknesses in learning and can augment the educational process. Students can be encouraged to employ the most effective learning strategies to maximise their learning outcomes (Romanelli *et al.*, 2009).

Personality has been distinguished as one of the factors that relate to learning approach (Biggs, 1993). Some researchers, in fact, also claim that learning approaches can be fully explained by personality traits and that there are significant correlations between both aspects (Jackson & Lawty-Jones, 1996). One of the major drivers for exploring learning approaches of students is the reported direct link of learning approach with academic performances (Zhang, 2000; Komarraju *et al.*, 2011; Al-Saud, 2013; Teoh *et al.*, 2014).

The predictive power of personality traits, as measured by the five factor model (FFM) (Costa & McCrae, 1992), on both academic performance and learning strategies has been reported (Busato *et al.*, 2000; Lounsbury *et al.*, 2003; Zhang, 2003; Komarraju *et al.*, 2011). Further, non-cognitive factors, such as personality traits, have been considered by some authors as additional information that can be used to predict professional and academic success of students and also to assist administrators in selecting the most suitable candidates for various programs (Jones *et al.*, 1997). In fact, psychometric test results of student applicants are often used to justify their selection, or not, to professional programs.

In clinical health professions such as dentistry, the behavioural and interpersonal skills of the clinician can play an equally important role to cognitive ability whilst cognitive ability is always essential for successful academic performance. In dental education, some few studies have investigated the interrelation between the personality traits with academic performance of dental students (Smithers *et al.*, 2004; Chamberlain *et al.*, 2005). Even fewer studies have considered the association

between learning approaches and academic performance of students (Jayawardena *et al.*, 2013; ALQahtani & Al-Gahtani, 2014). In addition, there is little reported on the interaction between the big five personality traits, approaches to learning and academic performance of culturally mixed cohorts of dental students.

Whilst little information is available about the learning approaches preferred by dental students and how personality traits may predict the approaches to learning and the academic performance, we might assume dental students to be little different to other university students in these measures. An organised study, however, of the relationship of personality with academic achievement of students in health professions could help educators to communicate better with their students in the classroom and also encourage curriculum design academics to enhance instructional and assessments methods to be more conductive to better performance from students. Meeting the expectations of the community of its health professionals, is probably above all a commitment that weighs heavily on educators and academic institutions alike. These points are elaborated in the review of literature.

1.2 Structure of this thesis.

This thesis reports on a study by presenting five main chapters, each with subsections that are described below.

Chapter 1: The introduction, in which a general background of the tested variables have been stated. A rationale to the current study leading to the hypothesis is also presented here in addition to the main objectives of the current study.

Chapter 2: This chapter provides a critical review of the literature relevant to personality traits of dental students, most commonly used instruments to measure the these traits, the relationship of personality traits with gender and ethnicity, the learning approaches of students and the value of the questionnaire used to measure this variable.

Chapter 3: This chapter details the research methods employed in the current study. In particular the following aspects are considered: study design, sampling and setting, measurement instruments for personality traits and approaches to learning, administering and scoring the measurement instruments, confidentiality, academic performance and statistical analysis methods.

Chapter 4: This chapter outlines the results and analysis of the outcomes of the collected data. Descriptive statistics are presented. Correlation between personality traits and approaches to learning, relationship between personality traits and academic performance, and the correlation between personality traits, approaches to learning and academic performance are calculated and statistically tested.

Chapter 5: This chapter provides an analytical discussion about the results. This chapter presents a discussion of comparisons and contrasts between the findings of the current study with findings in the relevant literature. The chapter also presents rationale for the research methodologies used and will explain the results in the light of their educational significance.

Chapter 6: This chapter presents a summary of the major conclusions, in addition to their significance for dental curriculum designers and educationalists. Areas for future research are also presented.

1.2.1 Objectives

A thematic and analytical consideration of the literature has allowed the identification of a number of objectives for our study. Firstly, the prevailing learning approaches adopted by dental students will be identified and a determination of how widespread the different approaches predominate in the student cohort will be calculated. Secondly, the prevailing personality traits shown by dental students will be identified and a determination of how widespread different personality traits predominate in the student cohort will be calculated. Thirdly, correlations if any, between approaches to learning, personality traits and academic performance of dental students will be calculated and the significance of these correlations determined. Finally, the data discovered in the first three objectives will be considered together in the light of further demographic characteristics of the students to more deeply explore the extent to which personality traits and learning approach influences and shape our dental students in their educational progress and how these factors can influence their vocation as a dental clinician.

1.2.2 Research design

The current study employed a correlative study design in which two pre-validated measuring instruments (inventories/questionnaires) were used. The participants in the study came from the natural setting in a dental school and provided voluntary self-reported responses to the study questionnaires. The available demographic data and

the responses to the questionnaires by the participants were subjected to descriptive, correlative and regression statistical analysis. Pearson-product moment was used to examine the linear correlation coefficient between the investigated variables. To reveal any potential causal relationship between variables and prediction power of each variable over variables, the collected data were also examined using multivariate and hierarchical regression analysis.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

Effective communication supporting effective interpersonal relationships are generally of importance for the felicitatious progress of any community in society, but are of prime importance in the healthcare environment and in the educational environment where complex learning occurs. Human ability to communicate is a resilient function of personality theory and recurrently is considered in any consideration of personality traits. In fact, the community places confidence in effective health professionals who provide intelligent, empathic and competent care which is verbally and physically presented in the personality of that professional. Therefore, the exploration of various personality traits continues to be a focus in health care and health professional education because of the strong, abiding and essential requirement of health professionals to effectively communicate across a plethora of forums. The most important of these forums is in the provision of safe patient care and in the clinical setting, but effective communication is also crucial for the assessment of student applicants to health care programs, for the determination of student clinical placements, for summative assessment of students in their provision of clinical patient care to name a small number.

According to the Oxford Dictionary, personality is considered to be a consistent trait of an individual's distinctive character qualities (Oxford Dictionary, 2010) and has

been proposed to depict consistent emotional and motivational differences between individuals (Costa & McCrae, 1992). Personality may formulate human behaviour which may shape the responsiveness and interactions with various life activities and adjustment of individuals to the environment (Morris, 2000).

Human personality continues to be the subject of deep consideration and enquiry crossing the boundaries of art, science, health and philosophy and this endeavour has given rise to a range of theories that aim to advance and elaborate our understanding. These well-known considerations include those of incorporating psychoanalysis, behaviouralist theory, social cognitive theory, humanistic theory, biopsychological theory, evolutionary theory and trait theory.

It is in this last consideration, trait theory, that the current work is nested following a predominant trend of its use in contemporary health educational research in dental education. It is outside the aim of this work to advance psychological theories of human behaviour. It is the focus of this work to contribute to the advance of understanding and awareness amongst educators and faculty educators in dental and oral health education of aspects of dental student behaviour and how these correlate to learning styles, in this lay-person's investigation. This is designed to inform, provoke and stimulate the dental and oral health educational community to reflect, consider and then develop learning experience that better supports the development of the lasting student learning and promotes our elaboration as educators.

2.2 Personality inventories

In general terms, a personality inventory is a questionnaire designed to reveal the respondent's personality traits. A considerable number of inventories and instruments have been designed to measure and assess personality. However, the most common inventories utilised in the study of personality in educational research include the following:

1- Eysenck Personality Inventory (Eysenck & Eysenck, 1975).

2- Myers-Briggs Type Indicator (Myers *et al.*, 1998).

3- Five-Factor Inventory or Model (FFM, also at times referred to as the Big Five) including the Neuroticism-Extraversion-Openness Personality Inventory-Revised (NEO-PI-R, Costa and McRae, 1992) and its modifications (McCrae & Costa, 2010).

The Eysenck Personality Inventory will not be described further here as this inventory was not used in the current study. The FFM is probably amongst the most popular instruments used for personality assessment. It comprehensively measures the major personality dimensions (Costa & McCrae, 1992) and will be described in more detail in a succeeding section in this chapter.

2.2.1 Myers Briggs Type Indicator (MBTI)

The MBTI was originally developed by Myers *et al.* (1985) and constructed in accordance with Carl Jung's theories of psychological types (Myers *et al.*, 1985). This theory comes from the Swiss psychiatrist Carl G. Jung (1875-1961) who wrote that "what appears to be random behaviour is actually the result of differences in the way people prefer to use their mental capacities" (Jung, 1971). He observed that

various psychological types of personality derived from the combination of two basic attitudes (introversion and extraversion) and four separate functions (thinking, feeling, sensing and intuiting) (Jung, 1971). Thus the MBTI was designed to determine personality types and preferences as categorized into four dichotomous pairs of mental functions or attitudes.

This indicator measures the variations between individuals based on their differences in the use of perception and judgment (Myers *et al.*, 1998).

In the MBTI, mental functions are categorised to irrational functions including 'sensing' or 'intuition' that relate to perception of gathered information; and rational functions including 'thinking' or 'feeling' which assess the way judgement is made based on available perceptions (Jessee *et al.*, 2006). A person determined as predominantly 'sensing' prefers tangible and concrete information. On the other hand, a person determined as predominantly 'intuition' is interested in understanding the underlying meanings and relationships in their abstract or theoretical annotations. Similarly, 'thinking' individuals are disposed to compose rational, causal, and consistent reasonable decisions. 'Feeling'-type individuals are inclined to make a judgement derived from their personal ideals and empathy and tend to greatly consider the needs of other people.

In addition to the mental functions, individuals have four opposite mental attitudes: extroversion versus introversion, which determines the way individuals react to the world around them (Myers *et al.*, 1998). Persons considered to be 'extroverts' direct their energy toward people, objects and the external real world, while 'introverts' are considered to focus their energy on ideas and concepts and the inner subjective world.

Myers and Briggs added another dimension to Jung's psychological types in the forms of two opposite attitudes: 'judging' and 'perceiving' when relating to outside world (Myers *et al.*, 1998). Those who prefer 'judging' align to a preference for decision-making and are inclined to deal with the world in a logical orderly manner whilst those who prefer 'perceiving' are inclined to be spontaneous and adaptive to the exterior world. Personality preference appears to result from an interaction of these attitudes and functions according to Jessee and co-workers (2006). A total of 16 personality types are yielded from the combination of these four 'mental attitudes' (extroversion, introversion, judging, perceiving) and four 'mental functions' (sensing, intuition, thinking, feeling).

The MBTI is a relatively easily manipulated personality instrument as it contains fixed-choice questions. As such, it has been used to assess personality preferences types of dental students, though in those studies, it was found not to strongly predict academic performance of these student respondents once in dental school (Westerman *et al.*, 1989; Morris, 2000; Jessee *et al.*, 2006; Wu *et al.*, 2007). The major shortcomings of the MBTI are considered by these authors to be its relatively poor reliability and very poor predictability of future job success; thus it has not been considered reliable for selecting employees (Gardner & Martinko, 1996).

It has been suggested that the MBIT does not fully correlate with the FFM, but it has been noted that there are conceptual similarities between the FFM and the MBTI in that the four MBIT scales are subsumed within the FFM personality constructs (Smithers *et al.*, 2004). These similarities were presented by Dachowski (1987) who stated that "the MBIT measures four dimensions, two of which are parallel to the

factors identified by McRae and Costa (1986) and two of which are very close"
(McCrae & Costa, 1986; Dachowski, 1987). Extraversion is clearly similar in both
instruments. 'Openness to experience' is considered parallel to 'Intuition' vs.
'Sensing'. The Openness trait description is comparable in one hand to the sensing
type as characterised by being realistic, detail oriented, and conservative, and in the
other hand to the Intuitive type as identified by being imaginative, abstract in
thinking, and future oriented. These descriptors are obviously close to those
describing the Openness continuum. The thinking-feeling dimension on the MBTI,
though not similar, but it clearly exhibits similarity with Agreeableness trait.
Individuals scoring highly on the thinking scale abided by rules and may be less
sympathetic to others; those who score highly on the Feeling scale are more
concerned relationships with other peoples (Dachowski, 1987). As "Agreeableness"
suggests both positive versus negative values, the thinking-feeling scale contrast two
positive aspects at each end of a continuum and the trait of Perception on the MBTI is
parallel with Conscientiousness. A Judging trait is similar to Conscientiousness as
being organised, self-disciplined and well-oriented, whereas Perceptive is more
flexible, spontaneous, adaptable (rather than disorganised, careless, weak-willed)
(Dachowski, 1987). In addition, the MBTI lacks a measure for the emotional stability
(Neuroticism) dimension of the FFM, which is a core personality trait (McCrae &
Costa, 1989). Unlike the FFM which describes personality as a continuous dimension,
the MBTI provides distinct personality types preferences. Thus, the FFM is
considered a universal instrument that encompasses comprehensive understanding of
personality traits, and contemporary models are now often based on the dimensions
on the FFM (Costa & McCrae, 1992).

2.2.2 NEO PI-R Personality Inventory (NEO)

The NEO inventories were developed as an operational tool for the FFM of personality, representing a comprehensive framework for structure of traits evolved as a result of many years of elaborate development and research (McCrae & Costa, 2010). The FFM stemmed from the lexical hypothesis of Allport and Odbert (1936). The adjectives that commonly describe personality in English language and other natural languages were analysed to form the basis for the evolution of the FFM (Allport & Odbert, 1936). Elaborate factor analysis of these descriptors identified the presence of a recurrent five factors that comprehensively describe personality (John *et al.*, 2008). As these factors were familiar to personality psychologists, the NEO inventories demonstrated the comprehensiveness of these recurring personality factors (Costa & McCrae, 1992).

The NEO inventories include a series of closely related instruments that were developed, modified, and based on the original NEO Inventory. The various versions of the NEO inventories include: the revised NEO Personality Inventory (NEO-PI-R); the modification, the NEO Personality Inventory-3 (NEO-PI-3); and the short form NEO Five-Factor Inventory (NEO-FFI), and the revised version of NEO-FFI, the NEO Five-Factor Inventory-3 (NEO-FFI-3).

The revised NEO inventories permit a comprehensive evaluation of personality by measuring its five major factors (Costa & McCrae, 1992). The NEO inventories embody a conceptual model on the structure of personality used for decades. An evidence of scale reliability, stability, and construct validity of the revised NEO has been presented in numerous number of publications summarised in the NEO

Professional Manual (McCrae & Costa, 2010). The inventories measure general personality traits that demonstrate an applicable utility in clinical, applied and research settings. This instrument is self-administered. Administration and scoring can be performed by individuals who do not have any formal training in clinical psychology, personality analysis, or related fields of clinical psychology (Costa & McCrae, 1992).

The FFM of personality measured by this instrument consists of 'measurement' of the following five main domains:

Neuroticism (N)
Extraversion (E)
Openness (O)
Agreeableness (A)
Conscientiousness (C)

The following is a brief description of each domain and its facets taken from (McCrae & Costa, 2010):

Neuroticism (N): Neuroticism or maladjustment is the contrast of emotional stability or adjustment. The core of this pervasive domain is the general tendency to experience negative feelings such as fear, sadness, embarrassment, anger, guilt, and disgust is the core of this domain. High scores are expected to be more irrational, more disruptive, less adaptive to stress, and less able to manage their impulses. Individuals who score low in N are more emotionally stable, usually calm, adapt well to stressful situations and more relaxed.

Extraversion (E): Extraversion is a measure of sociability. Extraverts like people, work in large groups, prefer gatherings, active, and talkative. They are also energetic,

cheerful and optimistic. However, introverts are reserved, independent, and even-paced.

Openness (O): Openness is a measure of "active imagination, aesthetic sensitivity, attentiveness to inner feelings, preference for variety, intellectual curiosity, and independence of judgment". Open individuals are unconventional, curious and are open to new ideas and novel experiences. Openness is not equivalent to intelligence but rather related to some aspects of intelligence that contribute to creativity. Closed people on the other hand tend to be conservative and have narrower scope of interests.

Agreeableness (A): Like Extraversion, Agreeableness is a dimension of interpersonal tendencies. It is a measure of altruism, sympathy to others, and eagerness to help them. Low scorers tend to be self-centered and disbelieving of others.

Conscientiousness (C): Conscientiousness is the control of impulses. High scorers tend to be well organized, focused at task in hand and achievement oriented. It is a measure of purposefulness, strong will, and determination. High scores are usually achieving individuals both academically and occupationally, meticulous, punctual, ethical and reliable. Low scorers are lethargic, carelessly lazy, and unenthusiastic.

The robustness of the FFM is supported by research, including meta-analytic studies (Poropat, 2009), that demonstrated that the major dimensions of personality that continue to recur are presented in this model (Goldberg, 1990; Digman, 1994). The framework of the FFM (Costa & McCrae, 1992) has been developed and proved as a robust instrument for understanding personality. The FFM has also emerged as a tool

to understand the correlation between personality traits and academic behaviours (Poropat, 2009).

The 60-item NEO Five-Factor Inventory (NEO-FFI) is a short version of the original NEO-PI inventory which provides a concise and handy measure of the five basic personality domains (Costa & McCrae, 1989). The uniformity of the five scales of the NEO-FFI has been confirmed by two-week reliability test/retest experimental methodologies (Robins *et al.*, 2001). The differences in the scales were minimal with a reported correlations of 0.86 (Extraversion), 0.86 (Agreeableness), 0.90 (Conscientiousness), 0.89 (Neuroticism) and 0.88 (Openness). Murray *et al.* (2003) furthermore, has reported 6-30 month range of (6, 12, 18, 14 1nd 30 months) test-retest reliability results (Murray *et al.*, 2003). All five scale scores clearly decreased over time, except for O (from 87 to 86), but the medium-term (30-month) reliabilities remained substantial. Six-month reliabilities ranged from .80 (A) to .87 (O), with a mean correlation across scale scores of .83 (SD = .03). Medium-term (30-month) reliabilities ranged from .73 (A) to .86 (O) with mean correlation of .79 (SD = .05). These findings were considered to provide evidence that the NEO-FFI can be reliably used to measure the FFM. The NEO-FFI is considered one of the most widely used measures of the FFM (McCrae & Costa, 2004).

Some of the items in the NEO-FFI-3 are keyed differently from the items they replaced in the NEO-FFI. Although short-term reliability re-testing of NEO-FFI-3 has not been yet been thoroughly examined, the scales show good approximations of the full domain scales of the NEO-PI-3 (McCrae & Costa, 2010). In addition, research that validated the FFM, has shown that this personality measure should be

psychometrically sound and reflect the properties of the FFM when used in student learning research.

2.3 Personality and academic performance in dental students

It is imperative for dental students in clinical settings to establish professional relationships with colleagues and communicate effectively with patients. Understanding personality traits of students can therefore have impact on teachers supporting and shaping student interactions with their clinical surrounding and their valuable engagements with patients (Belsi *et al.*, 2011). Persons with different personality types have been found, for example, to be attracted to different careers (Chamberlain *et al.*, 2005). Dental students have demonstrated personality characteristics that were different from those of students in business, social work, engineering and medicine (Silberman *et al.*, 1982). This finding has been supported by Belsi *et al.* (2011) who investigated the personality variations by type of entry to university. Wu *et al.* (2007) found that Chinese postgraduate dental students showed personality types different from other comparative Chinese professional student groups such as business, social work, psychology and other fields.

Generally overall personality profiles of dental students follow norms of the population (Chamberlain *et al.*, 2005). However, the overall personality profile of dental students may differ in two main dimensions compared with the general population; dental students are more intelligent and more self-sufficient (Reeve & Watson, 1985).

Significant differences in personality profile of students entering dentistry, hygiene/therapy and dental nursing have also been reported (Belsi *et al.*, 2011). Medical graduate entrants to the dental program appeared more extroverted and self-assured than hygiene/therapy students to this program, and were more open to experiences. Dental nursing trainees, however, appear to be more emotional than the medical entrants. Graduate entrants to dentistry, on the other hand, appear more open to new experiences than both the dental nursing trainees and the undergraduate entrant. Graduate students appear to be inclined to further their educational experiences which suggested a higher level of self-assurance, probably due to the fact that they have already completed another degree before dental school entry (Belsi *et al.*, 2011).

These differences in personality types might influence the form of relationships between future dental team members and may affect how the team members communicate with patients in the clinical environment (Belsi *et al.*, 2011). The potential association between a student's personality type variations and their performance in a dental program has inspired interest to explore the variable constructs within this context (Smithers *et al.*, 2004). Personality variations have been shown to have apparent impact on performance of students in the observation that students with high scores for anxiety factors demonstrated higher chance for failing their courses; however, neither high school results nor interview grades nor intelligence were reliable predictors of success (Reeve & Watson, 1985).

Generally non-cognitive factors, such as personality measures, have been observed to predict success and enhance students' selection process into various programs of study

thus providing an additional instrument to assist educators and administrators to admit the most suitable candidates (Jones *et al.*, 1997).

When investigating the factors that may potentially predict success of a student in a dental program, there appears to be a need to distinguish between academic and clinical performance or success. Cognitive ability is related to success in academic performance but may not be the only requirement for success in dental programs or practice as the nature of patient care requires other non-cognitive related abilities. As a result, personality instruments have been only partly employed in the process of dental student selection to the dental school admission. Barkley (1976) recommended that applicants who exhibit tendency to develop successful interpersonal relationships and value those relationships should be selected and trained as dentists rather than that the process rely on top academic performance only (Barkley, 1976).

Smithers *et al.* (2004) showed that predictors for success in academic courses (ie theory-based, without practical components) and in clinical courses are different. Noncognitive behavioural and interpersonal skills of a student may play a more important role than cognitive ability in successful progress through clinical courses, though cognitive ability would be necessary for successful academic performance. Clinical grades may predict academic success of the student but may not capture the student's professional behaviour during patient care.

Conscientiousness has been linked to success in almost every professional field (Barrick & Mount, 1991), because this is considered to be a strong indicator of an active process of planning, organising, determination and carrying out tasks (Costa &

McCrae, 1992). Smithers *et al.* (2004) however, did not show a correlation between conscientiousness of a student and their performance in dental school. This finding concurs with the findings of Evans and Driks (2001). Evans and Driks (2001) however suggested that "overly-occupied" dental students may not be provided the adequacy of time for deliberation prior to making decisions and so such highly conscientious dental students may not outperform less conscientious students

On the other hand, Chamberlain *et al.* (2005) confirmed that Conscientiousness and its facets predicted both academic and clinical performance. The five major personality dimensions are sometimes subdivided into component facets. Both the five factors and their component facets together have value in predicting dental school performance. Smithers *et al.* (2004) found Openness was a predictor of academic success but did not find this true for Conscientiousness. In contrast to this, Chamberlain *et al.* (2005) found that the factor Conscientiousness predicted both first- and third-year academic performance and professional behaviour. The component facets of Conscientiousness namely, persistence, organisation and motivation, might therefore be asserting different influences explaining these different observations, but this would need to be experimentally explored.

Although, other studies (for example, (Evans & Dirks, 2001; Chamberlain *et al.*, 2005) demonstrated a significant correlation between Agreeableness and performance, Smithers *et al.* (2004) did not find this to be so. Similar with both Chamberlain (2005) and Evans and Dirks (2001), Smithers *et al.* (2004) found that 'straightforwardness', a narrow facet of 'Agreeableness', had a significant positive relationship with grades. However, contrary to Evans and Dricks (2001), Smithers *et*

al. (2004) reported a negative relationship between two facets of 'Agreeableness', namely 'compliance' and 'tender mindedness' and the third-year dental school coursework. Chamberlain *et al.* (2005) did not find evidence supporting correlation for either facet.

Although, 'Openness to experience' has been linked to aspects of 'intelligence' (Costa & McCrae, 1992), it has been negatively related to 'performance' in work by Smithers *et al.* (2004). They showed low scorers in 'intelligence' performed better in both academic and clinical work. Remarkably and perhaps counter-intuitively, this implied that students who were less imaginative, less intuitive, not open to new experiences and less intellectually curious, performed better than students who scored higher on the openness to experience factor.

One of the Agreeableness facets (positive emotions) and Openness facets (open to ideas) improved prediction of performance by 11 percent in clinical studies (Smithers *et al.*, 2004). However, these studies (Evans & Dirks, 2001; Smithers *et al.*, 2004; Chamberlain *et al.*, 2005) did not find a positive correlation between the broad domain of 'Openness to experience' and 'performance' in dental laboratory courses and clinical courses. It may be though, that the comparison between different studies is not highly reliable as Evans and Dricks (2001) tested performance of students in dental laboratory whereas Smithers *et al.* (2004) investigated performance in both academic and clinical courses combined. In addition, Chamberlain *et al.* (2005) evaluated a different measure related to variations between individuals in both studies and, the relatively small sample size in the study also impacts confidence in the meaningfulness of the findings. Consideration of the broad dimension of Neuroticism,

though, showed non-significant association of this quality with coursework performance, the narrow facets of 'neuroticism, such as in angry hostility, fearfulness, proneness to worry and depression and having feelings of guilt or sadness, all showed negative and moderate correlation with first-year coursework assessment performance. Further, although lack of Neuroticism was seen to indicate emotional stability, it was seen to also appear to be an important predictor of positive professional behaviour (Chamberlain *et al.*, 2005).

Chamberlain *et al.* (2005) further suggested that to measure the effect of personality dimensions of a student on their success in dentistry as a career, normative personality data from practicing dentists should be compared with data from dental students. This was also an attempt to address shortcomings of the Smithers *et al.* (2004) study. Chamberlain found that dentists scored higher in Agreeableness and thus tended to be more empathetic and helpful to others. Dentists however scored lower in Neuroticism than dental students. Dentists also tended to be more organised, disciplined and 'achievement oriented', as they scored higher in Conscientiousness. On the other hand, dental students were more social, outgoing, and active than dentists as suggested by higher scores in Extroversion. Dental students scored also higher in Openness to experience which indicated their preference for novelty, higher curiosity and Intuitiveness than dentists. However, despite the differences outlined, the overall student personality profile of students was found to be of a similar type to the average profile of dentists (Chamberlain *et al.*, 2005). There are however, noticeable limitations in this study which may reduce the generalisability of its findings such as the relatively small sample, differences in gender composition: 56 percent of the dental students were females compared to 30 percent of the practicing dentists, and

the variable homogeneity amongst subjects in both groups. The authors also pointed to the fact that the normative data had come from dentists practicing in only one Canadian province thus the sample might not be fully representative even of the Canadian population.

The negative link noted between Openness to experience in comparison of academic and clinical work may partly reflect the nature of the dental education environment, which may not be appropriately designed to foster to creativity or even allow it. The dental school curriculum is probably highly conservative with well defined technical clinical procedures created within very fine parameters that students are required to follow thus favouring less creative students who were comfortable using established methods and techniques. In fact, in strictly controlled laboratory settings, Evans and Dricks (2001) concluded that dental students do not have much opportunity to be creative or intellectually curious.

The reported results in the literature related to Openness to experience (that is, found in high levels amongst dental students) may stimulate dental schools to reassess their study plans and curricula and thoroughly revaluate the different aspects of the dental teaching environment and so exploit this students' characteristic to enhance learning. Dental schools should be encouraged to distance themselves from traditional curriculum and embrace more non-didactic teaching processes, such as case or problem-based approach in which Openness to experience might be more valued and support successful learning.

2.4 Personality and ethnicity

It has been demonstrated that there are personality differences both within and across cultures (Costa *et al.*, 2001; McCrae & Terracciano, 2005; Schmitt *et al.*, 2008). However, no differences in personality traits across ethnic groups of dental students in UK were detected (Belsi *et al.*, 2011). However, not all main ethnic groups were equally represented, and though the participants were ethnically diversified most were largely home students and well integrated in westernised societies. The westernised influences might have shaped their personality development.

Despite the fact that Chinese dental postgraduates display their special personality characteristics, they demonstrate significant similarities with the dominant personality types in dental students and dentist in studies taken place in western countries (Silberman *et al.*, 1982; Westerman *et al.*, 1994; Jessee *et al.*, 2006). Wu *et al.* (2007) has since referred to such interesting cross-cultural consistency as a "true reflection for the particularity of the dental profession".

The beliefs and values of societies might be considerably influenced by a number of culture-level variables (Hofstede & Hofstede, 2001). Cultures whose members thought to rate "high" in Extraversion had democratic values and this has also been demonstrated in correlations with Smith *et al*. (1996) egalitarian commitment scale (Smith *et al.*, 1996). Extraversion is seen to associate with a significant degree of individualism, with emphasis on self-expression, stronger belief in logic and reality and a "high" demonstration of subjective well-being. Western beliefs and values are considered closely related with these notions; consistent with research showing that

extraversion is demonstrated in "highest" levels in democratic societies such as in Europe and the Americas (McCrae, 2004).

Cultures whose members demonstrate "high" levels of openness were also characterized by high individualism, unconventional, value intellectual autonomy and egalitarian commitment. It is thought that individuals in open societies adopt secularly rational approach to life. Although Agreeableness is also associated with individualistic values (Roccas *et al.*, 2002), it is not significantly related to Smith *et al.,* (1996) egalitarian commitment. Similarly, Conscientiousness was not related to values and beliefs (McCrae & Terracciano, 2005).

One account of the broad Extraversion factor would be that, historically the "extraverted" peoples of democratic societies in Europe and the Americas have entered a postmaterialist era that encouraged a number of new values that values individualism, tolerance, and sense of competence (McCrae & Terracciano, 2005). Cultures similar in personality profiles tend to be historically and ethnically related. The evidence that Europeans, on average, are more extraverted than Asians or Africans is quite strong (McCrae, 2004).

Openness is considered the domain mostly correlated with cultural variables. Demonstration of 'high" level openness is associated with individuals who are progressive, humanistic, and free-thinking. Conversely those with lower "levels" of Openness are considered to be more conservative, traditional and religious in orientation (McCrae & Terracciano, 2005).

2.5 Personality profile and gender

Differences in personality profiles by gender amongst dental students (Smithers *et al.*, 2004; Chamberlain *et al.*, 2005; Belsi *et al.*, 2011) and dental auxiliary students (Belsi *et al.*, 2011) were generally supportive of what has been reported in the literature for general populations (Costa *et al.*, 2001). Females were reported to show higher ratings in neuroticism, agreeableness and openness to feelings; males are reported to show higher ratings in assertiveness and openness to ideas. Using the Myers-Brigs Type indicator, Wu *et al.,* (2007) however, found no significant differences of distribution of the four groups (two mental attitudes and two mental functions) between result from female and male dental postgraduate students. Significant differences, though, were found between the genders on the distribution of judging/perceiving personality type. A significantly higher percentage of male respondents was "categorised" as judging, and the percentage of females "perceiving" was far greater than among males. Wu *et al.,* (2007) attributed the gender differences to the effect of the Confucian culture and philosophy that encourages a "middle-of-the-road"- way of interaction with the environment, which may arguably, influenced females more than males.

Personality trait differences between men and women may arise from biologically based innate temperamental or hormonal differences (Matthews *et al.*, 2004). A similar suggestion attributed those differences to the fact that men and women may class themselves into gender roles even from an early age (Costa *et al.*, 2001).

Schmit *et al.,* (2008) found that increasing development of human society will increase differences between men and women in their personality traits. They

indicated that human development variables related to long and healthy life and access to education; economic wealth may play a primary role in creating the existing differences between men and women in their personality traits. Most other correlations, as reported in other work, appear to be mediated by a general level of development in health, education, and economy (Costa *et al.*, 2001). In underdeveloped societies with poor health, low opportunities for a good education, and economic hardship, the development of an individual's inherent personality traits is more constrained in range. In these underdeveloped societies, only a smaller variation around the mean level of personality traits might be noticed, and it is more likely that all individuals are similar and alike which means that an average man is more like an average woman in basic personality tendencies (Costa *et al.*, 2001).

On the other hand, while an act of kindness by a woman in individualistic, democratic 'free-thinking' societies may be naturally perceived as expression of a free choice, a similar act by a woman in a conservative country might be understood as mere compliance with sex role norms. Thus, real differences in behaviour might be related to role rather than traits in traditional cultures (Costa *et al.*, 2001).

2.6 Personality and learning styles of dental students

In the literature, various problems have been discussed in relation to current dental curricula contents. Dental curricula reform advocates have recommended that reforms should be related to both content of courses and methods of teaching to address problems including congested, outdated curricula with inadequate links to medicine and an inability to prepare and stimulate students to be lifelong learners (Jessee *et al.*, 2006). In fact, the Institute of Medicine (IOM) report (Field, 1995) recommended modernising learning strategies in order to promote critical thinking and increase

problem-solving capabilities within undergraduate dental curricula in order to prepare students to be lifelong learners.

Some work has been done by educational researchers investigating the implications of dental student personality types on dental education outcome and attempted to relate those variables to individual achievement and satisfaction. They have generally suggested that personality type may be used to identify associated learning styles or preferences.

Previous studies using the Myers-Briggs Type Inventory) MBTI in the evaluation of undergraduate dental student personality types have found that there was a relatively strong preference for Sensing and Thinking (ST) as well as Sensing and Feeling (SF) combinations where it was also noted that a preference for Judging (J) was overly favoured over Perceiving (P) in approximately two-thirds (Silberman *et al.*, 1982; Erskine *et al.*, 1986; Silberman *et al.*, 1992; Jessee *et al.*, 2006) to 94% (Morris, 2000) of student respondents. This implies that the attitude of dental students suggests preference for order, planning and uniformity. Previous studies reported ESTJ (Extraversion, Sensing, Thinking, and Judging) and ESFJ (Extraversion, Sensing, Feeling, and Judging) as the two most common personality types, differing slightly in the subsequent order of personality preference (Silberman *et al.*, 1982; Erskine *et al.*, 1986; Silberman *et al.*, 1992; Morris, 2000). These dominant personality types (ESFJ and ESTJ) found in this study appear to possess many of the characteristics necessary to cope with the technical and specialised work encountered in dentistry (Morris, 2000). In contrast, Jessee *et al.,* (2006) found that ISTJ personality type in the first- and second-year dental students population tested was the most frequently occurring

type. The reason behind this marked difference is unknown; the fact that the latest study investigated the entry-level students of a completely different generation, including cultural, social, and educational factors, might have contributed to this disparity (Jessee *et al.*, 2006). The findings of Jessee *et al.,* (2006) were supported by Wu *et al.,* (2007) who tested first year Chinese dental students. (Morris 2000) found a similar percentage (63%) of Chinese and American dental students favoured judging (J) over perceiving (P), which was markedly smaller than the percentage (93.6%) of English students.

Jessee *et al.,* (2006) stated that although each person might be inclined to prefer one of the four 'mental attitude' and function pairs identified by the MBTI, virtually everyone uses all eight preferences every day. This highlights the importance of some understanding of mental attitudes of dental students in the process of developing any curriculum. Information should ideally be presented in a manner that will effectively allow students to express their natural learning approach preferences to maximize understanding and application of knowledge and to optimise the learning outcomes. Presentation methods compatible with general but effective student learning preferences may facilitate the transfer of knowledge and achieve the teaching objectives. These workers also pointed out that although a minority of students favoured intuition (N) to sensing (S) (Jessee *et al.*, 2006), their learning approach preferences should also be addressed. Individuals favouring "intuition" prefer learning by contemplation and discussion rather than memorising and such individuals are considered to generally have an imaginative and creative nature. Their personality types are stimulated by research and the academic setting.

Westerman *et al.,* (1989) found that 90 percent of dental students who 'dropped out' during the first year of dental school had a preference for intuition (N) over sensing (S). The reason for dropping out was not clearly known but speculated to be either due to realisation of the students that dentistry did not match their professional preference, or possibly the educational environment was not conducive for them to express their learning preferences. The latter explanation may strengthen the view of MBTI proponents that individuals prefer learning styles and teaching formats that allow for an expression of their individual preferences. Another aspect may be the specific nature of the generation of these students, that is generation Y or millennials, sometimes considered as a generation to be confident and tolerant, but also considered to be narcissistic with strong senses of entitlement (Twenge, 2009). It is beyond the intent of this thesis, though, to discuss this in greater detail.

Interestingly, using the MBIT instrument, the personality types of undergraduate dental students remained fairly constant from entry to graduation (McDaniel *et al.*, 1985; Silberman *et al.*, 1992). Proponents of the MBTI who believe that a person's personality type does not change over time but, rather, changes with the acquisition of new knowledge and skills, also suggest that an increase in confidence leads to a more well-rounded, diverse individual (Myers IB. MBTI® manual, 1998).

Jones *et al.,* (1997) used the Myers-Briggs Type Indicator reporting that 'extrovert' dental students appear to perform better in *clinical* components of their dental programs compared with 'introvert' students who achieved better in the *academic* disciplines of the program. Similarly, students high in 'judging' and 'sensing' received a higher class ranking over the course of their education in dental programs.

2.7 Learning approaches and academic performance of dental students

Students process information in different ways and demonstrate different preferential styles of thinking, incorporating diverse types of information and acquiring knowledge (Zhang, 2003; Komarraju *et al.*, 2011). The original work of Marton and Säljö who studied the way students perceive a reading task and how they approach it introduced the idea of 'student approaches to learning'. This was considered a departure point for the origin of a conceptual framework known generically as 'student approaches to learning' (SAL) theory (Entwistle & Waterston, 1988; Biggs, 1993). The SAL theory emphasises the central association between the process of learning and the perception of information and various learning-related activities (Entwistle & Waterston, 1988; Biggs & Moore, 1993). Based on the model that defines behaviour as the result of interaction between the person and the environment, Biggs formulated a learning approaches 3P model schematised as Presage-Process-Product model (Biggs, 2011). This model reflects a dynamic interaction between the student, teaching context and task. 'Presage' refers to the way student intends to handle a task prior to actual engagement with it. Presage is relevant to student factors such as prior knowledge and ability, and preferred approach to learning and to the teaching context factor such the nature of context, method of assessment, and learning environment. 'Process' level is the core of the learning system where learning-focused activities took place aiming to 'produce' the desired learning/teaching outcomes. Thus presage shape the ongoing approach to processing the task, and the

way of processing of task affects the learning outcome. The reversible arrows (Figure 2.1) show that each factor affects every other factor.

Furthermore, in addition to learning environment, student's learning style could be influenced by their personality characteristics (Newble & Entwistle, 1986). Due to the fact that learning approaches are the result of interaction between individual perceptions and contextual characteristics, they tend to change markedly over time in response to changes in learning environment variables, changes in teaching methods, and modifications of assessment tools (Newble & Entwistle, 1986).

Based on previous investigations, two predominant learning approaches have been identified (Marton & Säaljö, 1976a; Marton & Säljö, 1976b; Pask, 1976; Newble & Entwistle, 1986; Biggs, 2011): Surface and Deep. 'Deep' processing involves understanding the ideas, meaning, seeking evidence to support conclusions and understanding underlying structure (Lindemann *et al.*, 2001). The motive for deep processing is generally intrinsic derived for powerful innate desire of knowledge rather than a simple urge to perform better than competitors. However, in the 'surface' approach learners reproduce the materials to meet the minimal requirements without deeply analysing them. Students with a surface approach aim to rote study materials with the primary aim of reciting them and rote memorising facts merely in response to examination questions. This approach is motivated extrinsically by the educational environment elements such as requirements and assessment. Surface learners are usually anxious about academic outcomes and driven by requirements for success rather than by desire to understand (Lindemann *et al.*, 2001). A third approach has also been described as a 'strategic' or "achievement' approach where

Figure 2.1: The '3P' model of teaching and learning (Biggs, 2001)

PRESAGE   PROCESS   PRODUCT

STUDENT FACTORS
prior knowledge
ability
Preferred approaches to learning

LEARNING-FOCUSED ACTIVITIES
Ongoing approaches to learning

LEARNING OUTCOMES
quantitative, facts, skills
qualitative, structure, transfer
Contextual approach to learning

Teaching context
objectives
assessment
climate/ethos
teaching
institutional procedures

students are acutely aware of task demands and accurately manage time to meet those demands. They seem to be influenced by a desire to master the material and to meet the performance expectations. A similar group of students are identified as 'self-regulated' learners who demonstrate the capability to adjust their learning approaches to meet changes in educational circumstances demands (Vermunt & Van Rijswijk, 1988). An approach that has been specifically linked to Chinese students is called an 'intermediate approach'. Students preferring this approach utilise mixed deep and surface approaches of learning. They tend to attempt to understand the material and memorise it to meet the examination requirements. Those students may have the preference for seeking deep understanding of the underlying material but also recognise the importance of surface approaches in memorising material to maximise their examination performance (Kember & Gow, 1990; Leung *et al.*, 2008).

Dental students are adult learners who differ in processing and transfer of information. In-depth knowledge of these processes by educators may facilitate the understanding of the capability of learners to develop various competencies (Jayawardena *et al.*, 2013). Some students are inclined to be more thoughtful and intuitive learners than others who may superficially reproduce the learned information perhaps without deep understanding of the knowledge.

The way students absorb and reflect on learning context is inferred as an influential factor on the quantity and quality of teaching and also may be related to the academic achievement of students (Jayawardena *et al.*, 2013).

The preferred strategies of, or approaches to learning are considered to be linked to personality traits which are, like as learning approaches, stable and endurable features of an individual. Both personality traits and learning approaches may notably affect academic performance of students and complex link between both measures and performance has been previously demonstrated (Komarraju *et al.*, 2011).

Students in higher education seem to embrace a deep approach of learning as they progress through a programme and mature, and as they face the demands of abstract content and more specialised or complex material (Svensson, 1977), whilst a surface learning approach is more common in young inexperienced learners (Aaron & Skakun, 1999). 'Overloaded' and 'packed' curriculum could also drive students to utilise surface approaches to meet the course requirements, and especially when assessment methods focus on the superficial materials (Lindemann *et al.*, 2001). However, it appears likely that dental and medical students prefer deep approaches to learning that as a quality, remain unaltered over four years of their programme in spite of the densely packed curriculum. It is worthy to notice, though, that most professional students learn to adapt their learning approaches to the demands of the situation (Lindemann *et al.*, 2001). Nevertheless, positive correlation between deep approach of learning and exam results has been notified in medical education (McManus *et al.*, 1998).

In studies that utilised the revised study process questionnaire (Biggs *et al.*, 2001), it has been reported that more than 80% of the Sri Lankan first-year dental students showed higher deep approach scores than surface approach scores and a positive significant correlation was observed between deep approach score and marks of these

students in short answer questions in anatomy (Jayawardena *et al.*, 2013). Although no strong relationship was observed between learning approaches and academic performance, the median marks of many examination components were highest amongst students who scored highly in deep approach.

2.8 Background to the hypothesis

The Big Five personality traits are considered to describe the FFM. Previous research investigated the influence of Big Five personality traits on academic performance and the effect of learning approaches on academic performance of students (Chamberlain *et al.*, 2005; Komarraju *et al.*, 2011; Jayawardena *et al.*, 2013). However, no research has been carried out to investigate the correlations of the aforementioned constructs with each other and with the academic performance of dental students. Only a single study has correlated the academic performance of Sri Lankan dental students with their marks in different exam components and with the learning approaches of these students utilising the Biggs study process questionnaire (Jayawardena *et al.*, 2013). A correlation between personality traits, learning approaches and academic performance has been studied amongst undergraduate university students of varied majors such as liberal arts, business, education, science, engineering; the learning approach was measured using the inventory of learning processes (ILP) (Komarraju *et al.*, 2011). The study process questionnaire has been used together with the NEO Five-factor inventory in studies looking at psychology, mathematics, physics and arts students (Zhang, 2003), but the correlation with academic achievement was not assessed. A few studies however, have correlated personality traits of dental students with their academic performance (Evans & Dirks, 2001; Smithers *et al.*, 2004; Chamberlain *et al.*, 2005; Poole *et al.*, 2007). However, to our knowledge, no studies have been

published for personality, learning approaches and academic performance of Jordanian students.

This study therefore aims to focus on dental students to test the following hypotheses. Firstly, that there is a positive correlation between some personality traits, such as openness to experience and conscientiousness, with deep learning approach and academic performance. Secondly, that other traits are negatively associated with deep learning approaches and that gender and ethnicity may have some small effect on personality traits and learning approaches.

CHAPTER 3

MATERIALS AND METHODS

3.1 Introduction

Discerning which educational environment best supports our students to adopt effective learning styles is often listed as a goal in curriculum vision statements. A starting point for this discernment is better understanding of student motivation, aptitude and characteristics that determine student choice of learning style. Research has shown that personality is related to some general aspects of learning (for example, Zhang, 2003). The current project has been designed to explore the relationship between personality traits and learning style preferences amongst dentistry students to provide insight for dental educationalists. Despite the known complexity of knowledge, cognitive, professional, clinical and technical knowledge and practice that characterises dental education, this area of exploration in dental students is not well represented in the literature**.** Another important value of such a study is the assurance of the community of the quality of dental education and therefore confidence in the competency of graduates.

This chapter will present the methodology of the research project by describing the research design, the setting and participants in the research, the instruments, resources and ethical consideration employed in the project. Validated methodological instruments designed by specialist researchers were used to streamline implementation of the methodology and support analysis by the researcher. Interpretation of the correlations discovered in the project, by the researcher, a dental

academic, and his team aimed to promote the authentic application of the analysis to the unique context of dental education for the use of educationalists and curriculum designers in dental education. The procedural timeline used to carry out the project will be presented followed by description of the methods and instruments used for data gathering processing and analysis including the conditions of internal and external validity.

3.2 Research Design

The quantitative educational research methodology chosen for the project was a correlative, non-experimental, single subject design using two pre-validated questionnaires. Participants invited to the project were chosen from a natural setting that provided situational context. Participants provided self-reported responses in two pre-validated questionnaires (inventories). These data, participant responses, together with pre-existing data provided by participants and demographic data about participants were used. The aim of the project was to determine the nature and extent of relationships between student learning styles, personality traits and academic performance for entry to university with the purpose of observing and recognizing trends and patterns for dental students in the context of their dental education. Though correlation does not imply causation, consideration of the findings by regression analysis for modelling of causation was made for the purpose of enhancing value of the project for dental curriculum designers and educationalists. As the inventories were used without emendation, the reliability and validity provided by the authors for their inventories were accepted as published. Descriptive data relationships were identified and studied and variables were naturally analysed and not manipulated. Cronbach's alpha coefficients were determined for data collected in

the project. Strength of the linear association between studies variables were measured using Pearson product-moment correlation coefficient. Multivariate and hierarchical regression analysis was then used to explore causality amongst the variables examined in the study.

3.3 Sample and setting

The project was conducted in 2014 at the Jordan University of Science and Technology (JUST)[1] JUST is a comprehensive, state-supported university located on the outskirts of Irbid, at Ar-Ramtha in northern Jordan. It was established in 1986 and is constituted of 12 faculties, over 21,000 students and over 700 academic staff. The Faculty of Dentistry at JUST offers dental speciality programs and so is strongly invested in both research and educational excellence. The five-year Bachelor of Dental Surgery (BDS) dental program commences with its first two years covering basic sciences given by the Faculty of Science and Arts and Faculty of Medicine. The pre-clinical third year, which prepares the students for clinical aspects of the curriculum, is spent in the dental training laboratories. The courses in the fourth and fifth years are clinical and patient care is given in the teaching clinics of the Dental Teaching Clinics[2].

Final (fifth) year students enrolled in the Bachelor of Dental Sciences (BDS) programme of the Faculty of Dentistry in 2014 at JUST were invited to participate in the project. The invitation was extended by the researcher in a face-to-face communication with students at the completion of clinical sessions during the second

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[1] www.just.edu.jo.
[2] http://www.just.edu.jo/FacultiesandDepartments/FacultyofDentistry/Pages/Default.aspx.

term of their final year. An explanation of the purpose of the study was given to the students and their questions about the project were invited and were answered. Each student was also given a written explanation about the rationale, methodology and objectives of the project including contact details of the researcher for any further enquiries (Appendix 1-2). A written formal consent was handed to every student for his/her approval for the purposes of participation in the project (Appendix 3). No student was excluded from participation by the investigators. It was presented to the students that participation in the project was entirely voluntary and participants were not obliged to participate but - if they did participate - they could withdraw at any time. Ethical approval for the project was achieved from the Research and Ethics Committee of JUST. No pilot study was deemed necessary in the project as the methodological instruments used were pre-validated. Demographic data collected from each student were their gender, age, ethnic background and grade point average (GPA). A GPA is the calculated average of the grades a student earns in their assessments either during high school or college or undergraduate studies in order to support a student's application to a university program enrolment[3].

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[3] http://edglossary.org/grade-point-average/

3.4 Measurement instruments

Two questionnaires were given to each participant to complete and these were,

1- The Neuroticism-Extraversion-Openness -
   Five-Factor Inventory-3 (NEO™-FFI-3) (Costa and McCrae, 1992).

2- The Revised two-Factor version of the Study Process Questionnaire
   (R-SPQ-2F) validity (Biggs *et al.*, 2001).

3.4.1 Instrument 1: The NEO-Five-Factor Inventory-3 (NEO-FFI-3)

The NEO inventories were designed to concisely measure major personality dimensions or domains or traits. These domains are considered to comprehensively and concisely describe adolescent and adult personality that have strong influences on behaviour (Costa & McCrae, 1992). Studies have demonstrated that the inventory has been valuable in predicting a range of aspects of academic performance including examination performance and academic success (Busato *et al.*, 2000), learning strategies that emphasize critical thinking (Lounsbury *et al.*, 2003) (Lounsbury *et al.*, 2003), academic performance (Chamorro-Premuzic & Furnham, 2003), grades (Farsides & Woodfield, 2003), and study methods (Entwistle & Entwistle, 1970). Over a period of 30 years refinement of the original inventory has resulted in a series of interrelated inventories modified from, but related to, the original NEO inventory. This includes the Revised NEO-Personality Inventory (NEO-PI-R) which comprises 240 items. The NEO-PI-3 has replaced 37 items of the previous version of the inventories (NEO-PI-R) to make it more user-friendly and enhance its psychometric properties and be applicable to wider range of respondents.

The inventory employed in the current study, the NEO-Five-Factor Inventory-3 (NEO™-FFI-3), is a revised version of the NEO-FFI. This shorter 60-item instrument

is used to assess the five major dimensions or domains of personality traits, namely, neuroticism, extraversion, openness, agreeableness and conscientiousness. Table 3.1 presents examples of inventory items used for each of these domains.

Neuroticism (N) is an indicator for the degree of emotional stability, impulse control, and anxiety. People with high N score are considered to tend to be distressed, less adaptive, may have irrational ideas, and may experience negative feelings and low self esteem. Extraversion (E) is a display of sociability and assertiveness. Extraverts are considered to tend to like gatherings, working with people, be cheerful in disposition and optimistic. Openness to experience (O) is a reflection of intellectual curiosity, innovation, independency of judgment, and persons with high scores for this domain are considered to be less conventional in behaviour. Agreeableness (A) is characterized by altruism, helpfulness, sympathy to others, trustfulness of other's intentions, and respectfulness of others beliefs, and persons with high scores for this domain are considered to be cooperative. Persons with high scores for Conscientiousness (C) are considered to be purposeful, organised, punctual, determined, trustworthy and achievement oriented. The NEO-FFI-3 is suitable for respondents of 12 year age and older.

Table 3.1: Examples of items for each domain from the NEO-FFI-3 instrument.

Personality Domain	Item examples
Neuroticism	1- I am not a worrier. 16- I rarely feel lonely or blue. 31- I rarely feel fearful or anxious.
Extraversion	2- I like to have a lot of people around me. 7- I laugh easily. 52- I am a very active person.
Openness	8- I think it's interesting to learn and develop new hobbies. 13- I am intrigued by the patterns I find in art and nature. 53- I have a lot of intellectual curiosity.
Agreeableness	4- I try to be courteous to everyone I meet. 19- If someone starts a fight, I'm ready to fight back. 54- I don't like people, I let them know it.
Conscientiousness	10- I'm pretty good about pacing myself so as to get things done on time. 30- I waste a lot of time before settling down to work. 60- I strive for excellence in everything I do.

For this study, NEO-FFI-3 materials were purchased from Psychological Assessment Resources Incorporated (PAR Inc), Lutz Florida, USA[4], and were purchased for the purpose of research and not for diagnostic applications. The NEO-FFI-3 packet included item booklets (that is, the questionnaire forms), answer sheets, and a Professional Manual. There are two forms of the item booklet: Form S for self-reports, and Form R for observer ratings. There are also two types of answer sheets: hand-scorable (HS) sheet and scannable-scorable (SS) sheet. In this study, Form S item booklets, and hand-scorable answer sheets were used.

The item booklets are four-page, two-part carbonless forms. The first page displays instructions for completing the form. The second page presents spaces for recording basic demographic information namely, name, age, sex, identification number and date of completion. The NEO-FFI-3 item booklet and the answer sheet are found in Appendix 4 of this thesis.

Three validity check items are included in the item booklet and these are included in Appendix C. Validity check responses, demographic data and the item responses are reproduced onto the bottom sheet. The template for scoring domain scales, which provide profile areas for converting scores into *T* scores, is also included in Appendix 4. The instrument is self-administered and thus administration and scoring can be performed by individuals who do not have any formal training in clinical psychology, personality analysis, or related fields of clinical psychology. In this project, scoring of all validly completed participants questionnaires was completed by the researcher.

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[4]http://www4.parinc.com/products/Product.aspx?ProductID=NEO-FFI-3

3.4.1.1 *Administering and scoring of the NEO-FFI-3*

The 60-items of the NEO-FFI-3 are equally distributed over the personality domains thus 12-items were allocated for each domain. For each item, there is a five-point Likert scale response ranged from 0-4 or from 4-0. The respondents are instructed to fill in the correct box for each item **SD** if they *strongly disagree* or the statement is definitely false; **D** if they *disagree* or the statement is mostly false; **N** if they are *neutral* on the statement, if they cannot decide, or if the statement is about equally true or false; **A** if they *agree* or the statement is mostly true, and **SA** if they *strongly agree* or the statement is definitely true. The scoring for the items is performed in both directions. For example where "strongly agree" answer yields a score of "4" for some items, it results in a score of "0" for others. The total score for the personality domain is the sum of the scores earned for the 12 items of that domain.

At the end of a clinical session, the researcher described the project to each group of 25 dental students and a consent form and a list of the meanings for some words in the NEO-FFI-3 were distributed to those students who volunteered to participate. After consent to participate was provided by each student, the NEO-FFI-3 item booklet and a pencil were provided to each participant. The testing environment was comfortable, free of distraction, was adequately lit and participants were allowed to complete the inventory on a flat desk. Participants were instructed to ask about the meaning of words that they did not understand and were encouraged to make use of the list of meanings delivered to them with the inventory (Appendix 5). The participants were also directed to carefully read the instructions for completing the NEO-FFI-3 and were clearly instructed to write the responses to the items across the rows of the response grid.

The researcher examined the response area of each completed and returned item booklet to ensure all items were scored. Respondents were asked to complete unanswered items. The researcher made sure that the validity check questions were also completed at the bottom of the third page of each returned booklet. The validity items are yes-no questions:

A- Have you responded to all of the statements?
B- Have you entered your responses across the row?
C- Have you responded accurately and honestly?

The Professional Manual instructions were followed in regard to the acceptable inclusion of completed questionnaires. These instructions are that if 10 or more items were left unanswered, the test could not be considered for scoring. If nine or fewer items left blank, they should be scored as *neutral*. If validity check questions B and/or C were answered "No" the test could also not be scored.

To calculate the scores of each domain, the top page of each completed booklet was removed revealing the answer grid. Each column in the answer grid of the items represents one of the domains. The raw score of the domain is the sum of the 12 items in that column as follows (reverse-scored items are shown in **bold**):

- The raw score for neuroticism (N) is the sum of the items **1**, 6, 11, **16**, 21, 26, **31**, 36, 41, **46**, 51, and 56.
- The raw score for extraversion (E), is the sum of the items 2, 7, **12**, 17, 22, **27**, 32, 37, **42**, 47, 52, and **57**.
- The raw score for openness (O), is the sum of items **3, 8**, 13, **18, 23**, 28, **33, 38**, 43, **48**, 53, and 58.
- The raw score for agreeableness (A), is the sum of items 4, **9, 14**, 19, **24, 29**, 34, **39, 44**, 49, **54**, and 59.
- The raw score for conscientiousness (C) is the sum of items 5, 10, **15**, 20, 25, **30**, 35, 40, **45**, 50, **55** and 60.

Each summed N, E, O, A and C score for each respondent is read from the Profile S (Adult) form table found in each inventory booklet (but not visible to the participant). Each score is corresponded with a *T* score to categorise the participant domain score into very high, high, average, low and very low that compares the attained score to the normative score for that domain. The *T* scores presented on the forms have a mean of 50 and a standard deviation of 10. According to Costa and McRae, normative scores have been derived from studies detailed in Table 3.2.

T scores of 56 or higher are considered high, *T* scores from 45-55 are considered average, and *T* scores of 44 or lower are considered low. Participants were categorised based on the *T* score of each personality domain for their gender.

In terms of determining the personality of a participant, and for a hypothetical male participant who was found to have scored N=25, E=22, O= 30, A=37 and C=31 has scored high for Neuroticism and for Agreeableness, average for Openness To Experience and for Conscientiousness and low for Extraversion, the following is report of his personality tendencies based only on his results in the questionnaire:

> " *According to the inventory, this participant tends to be sensitive, emotional, and prone to experience feelings (high N); compassionate, good-natured, and eager to cooperate and avoid conflict (high A); practical but willing to consider new ways of doing things and seek a balance between the old and the ne (average O); easygoing, not very well-organised, sometimes careless and prefer not to make plans (low for C) and be introverted, reserved, serious, preferring to be alone or with a few close friends((low for E)."*

Table 3.2: Studies providing Population-based norms for the NEO-FFI-3.

Norm	Standard		
UK Working Population (broad sample)	**Age groups**	**Neither gender- nor medium-specific**	
	up to 80 yrs.	N = 759	
Job Applicants (UK)	**Age groups**	**Neither gender- nor medium-specific**	
	up to 80 yrs.	N = 542	
Total Sample	**Age groups**	**Neither gender- nor medium-specific**	
	up to 80 yrs.	N = 1301	
Total Sample, sex-specific	**Age groups**	**Women**	**Men**
		Input method not specific	**Input method not specific**
	up to 80 yrs.	N = 353	N = 797
Financial Services Organisation	**Age groups**	**Neither gender- nor medium-specific**	
	up to 80 yrs.	N = 561	
SGAC2011	**Age groups**	**Neither gender- nor medium-specific**	
	from 16 to 80;11 yrs.		

(From the PARInc, NEO-FFI-3 Professional Manual.)

3.4.2 Instrument 2: The revised two-factor version of the study process questionnaire (R-SPQ-2F)

The original Study Process Questionnaire (SPQ) developed by Biggs (Biggs, 1987) following the notion first forwarded by Marton and Säljö (1976a, 1976b), that students' perceptions and learning-related activities are central to teaching and learning. Updating of the questionnaire to reflect the changed learning environment of the tertiary sector led to the development of the revised two-factor version of the study process questionnaire (R-SPQ-2F) (Biggs *et al.*, 2001).

This questionnaire is 20 item inventory used to assess learning approaches in terms of the two-factor form, surface and deep learning approaches, where each scale consists of 10 items (Appendix 6). Each factor is further identified into different motive and strategy subscales, and each subscale consists of five items. The questionnaire therefore has two main scales, Deep Approach (DA), and Surface Approach (SA) with four subscales, Deep Motive (DM), Deep Strategy (DS), Surface Motive (SM) and Surface Strategy (SS). Biggs considered that "student factors, teaching context, on-task approaches to learning, and the learning outcomes, mutually interact, form a dynamic system" and that the SPQ scores can be "quality indicators" that can be used to describe the preferred, ongoing, and contextual approaches to learning of students; to describe how individuals differ within a given teaching context; to describe how specific tasks are handled and to describe how teaching contexts differ from each other. Table 3.3 presents sample items from the R-SPQ-2F.

Table 3.3: Selected items from the R-SPQ-2F instrument.

Scale	Sample items with corresponding number in the SPQ.
Surface Motive	3-. I like to have a lot of people around me. 19. I see no point in learning material which is not likely to be in the examination.
Surface Strategy	4. I only study seriously what's given out in class or in the course outlines. 16. I believe that lecturers shouldn't expect students to spend significant amount of time studying material everyone knows won't be examined.
Deep Motive	5. I feel that virtually any topic can be highly interesting once I get into it. 17. I come to most classes with questions in mind that I want answering.
Deep Strategy	6. I find most new topics interesting and often spend extra time trying to obtain more information about them. 14. I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.

For each statement in the questionnaire, there is a five-point Likert scale response ranging from 1-5 defined as follows:

A (1) - This term is never or only rarely true of me

B (2) – This term is sometimes true of me

C (3) – This item is true of me about half the time

D (4) – This item is frequently true of me

E (5) – This item is always or almost true of me

Participants are instructed to fill in the answer for each item as honestly as they can and are informed that there is no right or wrong answers and that there is no right way of studying. They were also directed to give the answer that would apply to the subjects most important to each student individually if the answer depends on the subjects being studied.

To obtain main scale scores, the scores for the following items are added together as follows:

Deep Approach (DA) = 1 + 2 + 5 + 6 + 9 + 10 + 13 + 14 + 17 + 18
Surface Approach (SA) = 3 + 4 + 7 + 8 + 11 + 12 + 15 + 16 + 19 + 20

To obtain subscale scores the scores for the following items are added together as follows:

Deep Motive (DM) = 1 + 5 + 9 + 13 + 17
Deep Strategy (DS) = 2 + 6 + 10 + 14 + 18
Surface Motive (SM) = 3 + 7 + 11 + 15 + 19
Surface Strategy (SS) = 4 + 8 + 12 + 16 + 20

The average score for major scales and subscales are then calculated for the student cohort. The students scores were further divided into deep learners (DL) group, if the score of DA>SA, and surface learners (SL) group, if the scores of SA > DA.

3.5 Confidentiality

After completion of the questionnaire each student's name was decoded and the questionnaire was issued with a unique identifier for the purpose of the study and confidentiality was maintained throughout the process. Completion of questionnaires was conducted within 30-40 minutes.

3.6 Academic performance

Students were required to report their cumulative current grade point average (GPA) which is expressed as a percentage.

3.7 Data Analysis

Data were entered and analysed using SPSS v14 (SPSS Inc. Chicago, Illinois, USA). Descriptive statistics (mean and SD) were calculated for all data. A Student t-independent test was used to look for differences in the personality profile, learning approaches and GPA by sex and ethnicity, and also to examine the differences between students in the those variables based on their responses to the NEO-FFI-3 and R-SPQ-2F. A zero-order correlation (univariate Pearson correlation) test was performed to examine the correlations between learning approaches, personality domains, and between learning approaches and personality domains and between both constructs and the GPA.

Multiple regression analysis was conducted to explore to what extent the personality traits predicted each of the learning approaches. Regression analysis was also utilised to examine which personality domain and learning approaches would predict the variation in GPA. Hierarchical regression analysis was performed to examine the nature of prediction of variation in GPA on each of the Big Five personality traits and on the learning approaches that emerged as potential predictors in the previous analysis. Another hierarchical regression analysis was conducted with the addition of ethnicity and gender as predictors for the variation of the GPA besides the big five personality dimensions and learning approaches.

CHAPTER 4

RESULTS

4.1 Introduction

The following sections present the findings of the project. These data are presented matched according to that described in the thesis chapter on Materials and Methods. As previously stated the aim of the project was to determine the nature and extent of relationships between student learning approaches, personality traits and academic performance with the purpose of observing and recognising trends and patterns for dental students in the context of their dental education. Research has supported the concept of importance of students' learning approaches as determinants of academic performance and knowledge acquisition (Duff *et al.*, 2004).

4.2 Research Design

A correlative, non-experimental, single subject design using two pre-validated questionnaires (inventories) or instruments, as previously noted, was used. The two inventories were the Neuroticism-Extraversion-Openness Five-Factor Inventory 3 (NEO-FFI-3) (Costa & McCrae, 1992) and the Revised Two Factor Study Process Questionnaire (R-SPQ-2F) (Biggs *et al.,* 2001).

4.2.1 Validity and reliability

The NEO-FFI-3 is an established inventory that was used in the current project without emendation. Although the reliability and validity has been reported by Costa and McCrae (1992), for completeness in the current project, a Cronbach alpha

coefficient was calculated for each of the personality traits. These were found as follows: neuroticism 0.69, extraversion 0.63, openness 0.66, agreeableness 0.65, and conscientiousness 0.80. The alpha coefficients were reportedly lower than those reported by Costa and McCrae in the NEO-FFI-3 manual except for conscientiousness alpha coefficient which was the highest. However, the alpha coefficient for the openness was higher than that obtained in other studies conducted amongst Chinese university students (Zhang & Huang, 2001; Zhang, 2002; Zhang, 2003). The relatively low alpha coefficients could be partly attributed to variability in English language proficiency of the participants and the unavailability of reliable and valid translated Arabic version of the inventory. Moreover, different definitions for the personality traits amongst different cultures may be perceived differently (Zhang, 2003). Furthermore, the study population was not culturally homogenous. Nevertheless, the possible deficiency in the English language cannot adequately explain the high alpha coefficient of the conscientiousness scale. The alpha coefficient in the current study was however considered sufficient for statistical analysis.

The R-SPQ-2F is reported to demonstrate good reliability and validity (Biggs *et al.,* 2001). In the present study, the Cronbach alpha coefficient determined for this inventory were 0.43 (Deep Motive or DM), 0.64 (Deep Strategy or DS), 0.72 (***Deep Approach*** or DA), 0.72 (Surface Motive or SM), 0.58 (Surface Strategy or SS), and 0.80 (***Surface Approach*** or SA). These are shown in Tables 4.1 and 4.2. In the current study results for the main two scales and the four subscales of this inventory were submitted for statistical analysis. However, special emphasis was placed on result for the main two-factor forms, Deep Approach and Surface Approach as these are the

major indicators for the intended purpose for use of the questionnaire. The Cronbach alpha values for DA and SA calculated for the project were higher than those obtained for the tested final version of this inventory (Biggs *et al.,* 2001).

4.2.2 Participants Data

Of the total of 200 students recruited, 170 responded (overall response rate of 85%). 113 participants were female (66.5%) and 57 were male (33.5%) (Table 4.3). All the students have given their written consent to participate. There were only two ethnic groups amongst the respondents. Arab students (Jordanians and from different Arab countries) formed the largest ethnic group of the participants in total (140, 82.4%) followed by the Malaysians (30, 17.6%). These data are shown in Table 4.3. The mean age of the respondents was 23 (SD = 1.5) years.

4.3 Learning Approaches

The GPA values obtained were correlated with students' SA and DA scores using Pearson correlation. Mean differences were compared by two sample *t* test (p < .05 was considered significant). The students were categorized according to their score in DA and SA as shown in Table 4.4. A total of 115 (67.6%) students showed a greater DA score than their SA score. This students' group was categorized as Deep Learners (DL) group.

A greater SA score than DA score was found in 50 students (29.4 %), and they were categorized as Surface Learners (SL) group. However, in 5 students (2.9 %) DA and SA scores were equal. The mean value and the standard deviation of students' DA

score were 28.08 and 5.8, respectively, and those for the SA score were 24.01 and 6.88 (Table 4.4).

The correlation between scores of deep and surface approaches was negative and statistically significant (r = -0.17, p < 0.05) (Table 4.5).

Interestingly, larger number of deep learners was females (81, 48%) compared to their male counterparts (34, 20%) (p < 0.05). Female students scored significantly lower in surface approach and surface motive scales than male students (Table 4.6). However, the differences in GPA between females and males were not statistically significant. Moreover, the differences between ethnic groups were not significant with regard to SPQ scales (Table 4.7).

Table 4.1: The Cronbach alpha coefficient of the NEO-FFI3 domains.

NEO-FFI3 Domain	Cronbach Alpha
Neuroticism	0.69
Extraversion	0.62
Openness	0.66
Agreeableness	0.65
Conscientiousness	0.80

Table 4.2: The Cronbach alpha coefficient of the 2F-SPQ questionnaires subscales.

2F-SPQ Item	Cronbach Alpha
Deep Motive	0.43
Deep Strategy	0.64
Deep Approach	0.72
Surface Motive	0.73
Surface Strategy	0.58
Surface Approach	0.80

Table 4.3: The distribution of participants based on gender and ethnicity.

Gender	Ethnicity		Total
	Arabs	Malaysian	
Male	52	5	57
Female	88	25	113
Total	140	30	170

Table 4.4: Students' categories based on the deep approach (DA) and surface approach (SA) scores (N = 170).

Student's categories	Gender	Number (% within)	Total (N = 170)
DA score > SA score	Male	34 (29.6%)	115 (67.6%)
	Female	81 (70.4%)	
SA score > DA score	Male	23 (46%)	50 (29.4%)
	Female	27 (54%)	
DA score = SA score	Male	0 (0%)	5 (2.9%)
	Female	5 (100%)	

Table 4.5: Pearson correlation coefficients for Study Process Questionnaire Scales and the Grade Point Average (N = 170).

Scale	Surface Motive	Deep Motive	Surface Strategy	Deep Strategy	Surface Approach	Deep Approach	GPA
Surface Motive	-						**-0.18***
Deep Motive	-0.10	-					0.09
Surface Strategy	**0.67****	-0.10	-				**-0.18***
Deep Strategy	**-0.164***	**0.61****	**-0.18***	-			**0.18***
Surface Approach	**0.92****	-0.11	**0.91****	**-0.19***	-		**-0.19***
Deep Approach	-0.15	**0.83****	**-0.16***	**0.91****	**-0.17***	-	**0.15***

* P < 0.05, ** P < 0.01

Table 4.6: Study process questionnaire (SPQ) scores by gender

SPQ item	Gender	Mean (SD)	
Deep Motive	Male	14.59 (3.37)	
	Female	14.23 (2.85)	
	Total		14.35 (3.03)
Deep Strategy	Male	14.28 (3.47)	
	Female	13.46 (3.42)	
	Total		13.73 (3.45)
Surface Motive **	Male	13.46 (4.74)	
	Female	9.72 (3.11)	
	Total		10.56 (3.90)
Surface Strategy ¶	Male	14.19 (3.85)	
	Female	13.06 (3.46)	
	Total		13.44 (3.63)
Deep Approach	Male	28.87 (6.38)	
	Female	27.69 (5.50)	
	Total		28.08 (5.82)
Surface Approach*	Male	26.42 (8.09)	
	Female	22.78 (6.05)	
	Total		24.01 (6.88)

* P< 0.01, ** P < 0.001, ¶ P = 0.055.

Table 4.7: Study process questionnaire (SPQ) scores by ethnicity

SPQ Items	Gender	Mean (SD)	
Deep Motive	Arab	14.26 (3.14)	
	Malaysian	14.76 (2.45)	
	Total		14.35 (3.03)
Deep Strategy	Arab	13.75 (3.42)	
	Malaysian	13.66 (3.08)	
	Total		13.73 (3.45)
Surface Motive	Arab	10.72 (4.05)	
	Malaysian	9.83 (3.11)	
	Total		10.56 (3.90)
Surface Strategy	Arab	13.50 (3.63)	
	Malaysian	13.16 (3.68)	
	Total		13.44 (3.63)
Deep Approach	Arab	28.01 (5.92)	
	Malaysian	28.43 (5.41)	
	Total		28.08 (5.82)
Surface Approach	Arab	24.22 (7.08)	
	Malaysian	23.00 (5.90)	
	Total		24.01 (6.88)

* No significant differences were found.

4.4 Personality traits

The average scores and standard deviations of those scores for the five personality traits for male and female participants are shown in Table 4.8. A t-test was conducted to identify the significance of the differences between female and males students in their personality traits. Female students scored significantly higher than their male counterparts in the Neuroticism scale (females; 25.91 and males; 23.28) ($P < 0.005$). However, no other significant differences could be detected.

Participant data were further put into very low, low, average, high and very high scale groups according to their scores for each of the five traits. In regard to the Neuroticism scale, more than 50% of the male participants scores lay within the average group score whereas the majority for female participants were amongst the high (46%) and very high (12.4%) groups. This difference was statistically significant ($P < 0.05$) (Table 4.9). The other dimensions did not show significant differences related to gender.

When a comparison between the personality scales was made based on ethnicity, it was found that Malaysian students scored significantly lower than their Arab colleagues in the Openness scale (Arabs; 29.55; Malaysians; 26.56) ($P< 0.005$) (Table 4.10).

The zero-order correlations (Linear Pearson correlation) between the NEO-FFI-3 dimensions are shown in Table 4.11. Neuroticism was negatively correlated with Conscientiousness ($r = -0.25$, $P < 0.01$). Openness was positively correlated with Agreeableness ($r = 0.23$, $P < 0.05$), and Conscientiousness ($r = 0.178$, $P < 0.05$).

Table 4.8: Personality profile of students by gender

Personality Domain	Gender	Mean (SD)	
Neuroticism *	Male	23.28 (5.69)	
	Female	25.91 (6.25)	
	Total		25.02(6.18)
Extraversion	Male	28.03 (5.15)	
	Female	28.29 (5.43)	
	Total		28.20 (5.32)
Openness	Male	28.75 (5.88)	
	Female	29.15 (5.46)	
	Total		29.02 (5.59)
Agreeableness	Male	27.78 (6.26)	
	Female	28.95 (5.79)	
	Total		28.56 (5.96)
Conscientiousness	Male	31.61 (7.30)	
	Female	31.31 (5.80)	
	Total		31.42 (6.33)

* $P< 0.005$ ($P = 0.008$).

Table 4.9: The categories of personality domains for males (N = 57) and females (N = 113) based on the reported scores.

Personality Domain	Gender	Very low	Low	Average	High	Very High
Neuroticism *	Male	0 (0%)	6 (10.5%)	30 (52.6%)	18 (31.6%)	3 (5.3%)
	Female	0 (0%)	13 (11.5%)	34 (30.1%)	52 (46%)	14 (12.4%)
	Total	0 (0%)	19 (11.2%)	64 (37.6%)	70 (41.2%)	17 (10%)
Extraversion	Male	3 (5.3%)	7 (12.3%)	32 (56.1%)	14 (26.6%)	1 (1.8%)
	Female	5 (4.4%)	26 (23%)	52 (46%)	26 (23%)	4 (3.5%)
	Total	8 (4.7%)	33 (19.4%)	84 (49.4%)	40 (23.4%)	5 (2.9%)
Openness	Male	1 (1.8%)	11 (19.3%)	30 (42.6%)	13 (22.8%)	2 (3.5%)
	Female	3 (2.7%)	15 (13.3%)	62 (54.9%)	28 (24.8%)	5 (4.4%)
	Total	4 (2.4%)	26 (15.3%)	92 (54.1%)	41 (24.1%)	7 (4.1%)
Agreeableness	Male	12 (21.1%)	19 (33.3%)	19 (33.3%)	12 (13.2%)	0 (0%)
	Female	14 (12.4%)	34 (30.1%)	54 (47.8%)	9 (8%)	2 (1.8%)
	Total	26 (15.3%)	53 (30.2%)	73 (42.9%)	16 (9.4%)	2 (1.2%)
Conscientiousness	Male	3 (5.3%)	18 (31.6%)	19 (33.3%)	16 (28.1%)	1 (1.8%)
	Female	7 (6.2%	31 (27.4%)	51 (45.1%)	22 (19.5%)	2 (1.8%)
	Total	10 (5.9%)	49 (28.8%)	70 (41.2%)	38 (22.4%)	3 (1.8%)

* $P < 0.05$

Table 4.10: Personality profile of students by Ethnicity

Personality Domain	Gender	Mean (SD)	
Neuroticism	Arab	24.89 (6.32)	
	Malaysian	25.66 (5.49)	
	Total		25.02(6.18)
Extraversion	Arab	28.22 (5.56)	
	Malaysian	28.10 (5.56)	
	Total		28.20 (5.32)
Openness*	Arab	29.55 (5.36)	
	Malaysian	26.56 (6.07)	
	Total		29.02 (5.59)
Agreeableness	Arab	28.17 (6.01)	
	Malaysian	30.36 (5.44)	
	Total		28.56 (5.96)
Conscientiousness	Arab	31.82 (6.43)	
	Malaysian	29.50 (5.53)	
	Total		31.41 (6.32)

* $P< 0.005$ (P = 0.008).

Table 4.11: Pearson correlation coefficients for the NEO Five-Factor Inventory-3 Scales (N = 170)

Scale	N	E	O	A	C
Neuroticism	-				
Extraversion	-0.103	-			
Openness	-0.121	0.091	-		
Agreeableness	-0.305	0.036	**0.232***	-	
Conscientiousness	**-0.255****	0.0104	**0.178***	0.09	-

* $P < 0.05$, ** $P < 0.01$.

4.5 Correlations between the NEO-FFI-3 and R-SPQ-2F scores

Initially, the Linear Pearson correlation was performed to reveal the correlations between scores achieved on the NEO-FFI-3 personality traits and learning approaches scores achieved on the R-SPQ-2F (Table 4.12). Students who scored higher on the Neuroticism domain scored significantly lower in deep strategy and deep approach scales. On the other hand, Openness and Conscientiousness dimensions correlated positively and significantly with deep motive, deep strategy, and deep approach. Furthermore, participants who scored higher in Conscientiousness domain scored significantly lower on all surface approach subscales. Moreover, Agreeableness also demonstrated significant direct proportional relationship with surface motive scale. As for the Extraversion, the results indicated no significant correlations with learning approaches scales.

The participants data were categorised according to scores for each of the personality traits into low (that is, sum of very low and low in Table 4.9), and high (that is, sum of high and very high in Table 4.9) score groups. This data is shown in Table 4.13. The significance of differences in participant learning approach scales in these groups was detected by performing t-independent tests. Similarities with the results of Pearson correlation was observed with some exceptions: the significant negative relationship between Neuroticism and surface motive, surface strategy and surface approach scales obtained by t-test were not revealed by the zero-order correlation. However, exact similar significant relationships between Openness trait scores and learning approaches scales was obtained by both the Pearson correlation and t-test procedures. The significant negative correlation between Agreeableness and surface approach unveiled by zero-correlation failed to appear when t-test was applied. For

the Conscientiousness scale data, no significant differences between both methods of statistical analysis was found, except that the significance level obtained by t-test was high (P < 0.001 compared to P < 0.01). Both procedures failed to find significant correlation between Extraversion and learning approaches scales.

Moreover, when participant scores were categorised based on learning approach as deep learners (that is, participants who scored higher in deep approach) and surface learners (that is, participants who scored higher in surface approach), the t-test revealed significantly higher score in Openness and Conscientiousness scales amongst the deep learners (Table 4.14).

Table 4.12: Pearson correlation coefficients for the NEO-FFI-3 and R-SPQ-2F Scales and the Grade Point Average (N = 170)

Scale	Surface motive	Deep Motive	Surface Strategy	Deep Strategy	Surface Approach	Deep Approach	GPA
N	0.12	-0.07	0.14	**-0.19***	0.14	**-0.16***	**-0.19***
E	-.118	0.02	0.01	0.139	-.06	0.093	0.10
O	-0.07	**0.32****	-0.145	**0.29****	-0.12	**0.34****	**0.16***
A	**-0.16***	0.06	-0.094	0.09	-0.142	0.09	0.01
C	**-0.24****	**0.34****	**-0.24****	**0.436****	**-0.27****	**0.453****	**0.29****

* P < 0.05, ** P < 0.01.

Where, N=neuroticism, E= extroversion, O= openness to experience, A= agreeableness and C= conscientiousness.

Table 4.13: Mean scores (SD) and t values for learning approaches and Grade Point average by personality domains.

Scale		Surface Motive	Deep Motive	Surface Strategy	Deep Strategy	Surface Approach	Deep Approach	GPA
N	Low(N=19)	8.69	14.58	11.42	15.95	20.11	30.53	75.53
		(2.47)	(2.4)	(3.43)	(3.97)	(5.37)	(5.2)	(3.31)
	High(N= 87)	10.52	13.89	13.64	13.05	24.16	26.93	72.05
		(3.57)	(2.9)	(3.36)	(3.59)	(6.13)	(5.98)	(4.90)
t value		**-2.12***	**1.09**	**-2.59****	**3.13****	**-2.67****	**2.42***	**2.95****
E	Low(N = 40)	11.6	13.33	13.68	12.4	25.28	25.73	72.17
		(4.45)	(2.73)	(3.46)	(3.05)	(7.26)	(5.08)	(4.41)
	High(N= 45)	10.11	14.18	13.73	13.78	23.84	27.96	74.20
		(3.73)	(3.03)	(3.531)	(3.93)	(6.58)	(6.22)	(5.11)
t value		1.67	-1.35	-0.07	-1.78	0.95	-1.79	-1.95
O	Low(N = 30)	10.60	12.97	13.97	12.17	24.57	25.13	72.06
		(3.57)	(2.82)	(3.68)	(3.16)	(6.24)	(5.06)	(5.21)
	High(N= 48)	9.85	15.48	12.42	15.06	22.23	30.55	74.5
		(3.80)	(3.08)	(3.61)	(3.75)	(6.76)	(6.13)	(5.63)
t value		.86	**-3.6****	1.83	**-3.51****	1.50	**-4.04****	**-1.94***
A	Low(N = 79)	11.16	14.36	13.73	13.71	24.89	28.07	72.16
		(3.99)	(3.03)	(3.78)	(3.45)	(7.06)	(5.64)	(5.18)
	High(N= 19)	9.84	15.26	13.63	15.36	23.47	30.63	71.63
		(5.23)	(2.71)	(4.54)	(3.41)	(9.52)	(5.79)	(4.84)
t value		1.217	-1.179	.102	-1.887	.735	-1.735	.407
C	Low(N = 57)	11.42	13.29	14.35	12.22	25.77	25.52	70.47
		(3.97)	(3.22)	(3.75)	(3.45)	(6.98)	(6.08)	(4.48)
	High(N= 41)	9.21	15.65	11.78	15.48	21.00	31.14	74.88
		(3.43)	(2.80)	(3.46)	(3.52)	(6.24)	(5.48)	(5.03)
t value		**2.85****	**-3.7****	**3.45****	**-4.56****	**3.48****	**-4.69****	**-5.2****

*P < 0.05, ** P < 0.01, *** P < 0.001.

Where, N=*neuroticism,* E= *extroversion,* O= *openness to experience,* A= *agreeableness and* C= *conscientiousness.*

Table 4.14: Mean scores (SD) and t values for personality domains and Grade Point Average (GPA) by students' categories based on learning approaches scores.

Category	N	E	O	A	C	GPA
DA > SA	24.68	28.44	30.12	29.15	32.72	73.33
	(6.26)	(5.01)	(5.06)	(5.78)	(5.57)	(5.15)
SA > DA	26.20	27.48	26.70	27.70	28.26	71.06
	(5.96)	(5.83)	(5.06)	(6.11)	(7.154)	(5.37)
t value	-1.45	1.07	**3.712***	**1.46**	**4.32***	**2.57***

P < 0.05, ** P < 0.01, *** P < 0.001.
Where, N=neuroticism, E= extroversion, O= openness to experience, A= agreeableness and C= conscientiousness.

4.6 Correlations between NEO-FFI-3, R-SPQ-2F and GPA Scores

The differences in GPA between females and males were found to be not statistically significant. Although, the differences between ethnic groups were also found to be not significant with regard to the GPA, but the significance level was marginal

(p = .056).

The GPA showed a significant negative Pearson correlation with surface strategy learning approach (SS) ($r = -0.18$, $p < 0.05$), surface motive learning approach (SM) ($r = -0.18$, $p < 0.01$) and surface approach (overall) learning approach (SA) ($r = -0.20$, $p < 0.01$) and significant positive correlation with deep approach (DA) ($r = 0.15$, $p < 0.05$) (Table 4.5). 'Deep learners' (DLs) were seen to have achieved significantly higher GPA than 'surface learners' (SLs) ($t = 2.57$, $p = 0.011$) (Table 4.14).

The univariate correlation analysis also revealed a significant negative correlation between Neuroticism and GPA ($r = -0.19$, $P < 0.05$) and significant positive correlation between both Openness ($r = 0.16$, $P < 0.05$) and Conscientiousness ($r = 0.29$, $P < 0.01$) and GPA (Table 4.12). Similar results were confirmed by t-test (Table 4.13).

4.7 Regression analysis

Regression analysis was performed to determine which personality trait might predict each of the learning approaches. Multivariate analysis indicated that Openness and Conscientiousness predicted the 21% of the variance in deep motive ($P < 0.001$). Openness and Conscientiousness explained 25% of the variance in deep strategy ($P < 0.001$). Moreover, 27% of the variance in deep approach was attributed to Openness scales were predicted only by Conscientiousness, where 21% of the variance in

surface motive and surface strategy, and 23% of the variance of surface approaches was explained this personality domain. Interestingly the significant relationships between Neuroticism and Agreeableness and learning approaches as indicated by zero-order correlation and/or t-test procedures were not significant as shown by regression analysis (Table 4.15).

Further multivariate regression analysis was then performed to examine the degree of prediction of each Big Five personality traits and each learning approaches scale on the variation in GPA through the R^2 values resulting from the test. The personality trait explained 14% of the variance in GPA with only Conscientiousness outlined as the only significant predictor (Beta = 0.29, P < 0.001). Learning approached predicted 8% of the variance in GPA with only deep strategy serving as the significant predictor (Beta = 0.19, P < 0.05) (Table 4.16).

Hierarchical regression analyses were used to determine the relative contribution of scores for the personality trait over and above learning approaches scales in predicting the variations in academic performance by reported GPA. In the first step the learning approached emerged as a significant predictor in univariate and multivariate analyses. In the second step, only three of the personality traits emerged as significant predictors previously learning approaches predicted 6% of the variance in GPA (with only Conscientiousness as the significant predictor) with a total of 12% variance in GPA may be explained by both learning approaches and personality factors collectively (Table 4.17).

Another hierarchical regression analyses was conducted to explore the prediction of academic performance by personal factors gender, and ethnicity, over and above personality traits and learning approaches. The least influential variables were entered in the first step (gender and ethnicity). In the second step the learning approaches were entered and emerged as significant predictors previously. In the third step, scores for the personality trait were found as significant as predicted by previous analysis. Ethnicity predicted only 4% of the variance in GPA. An additional 6% in variance was explained by the learning approaches with deep strategy found to be the only significant predictor, and further 5% in variance was predicted by big five personality trait with Conscientiousness as the only significant predictor). Ethnicity, deep strategy and Conscientiousness together explained 15% of the variance in GPA ($P < 0.05$) (Table 4.18).

Table 4.15: Multiple regression analysis with the big five traits regressed on each of the learning approaches.

Factor	Predictor	Beta	R2	Adjusted R2
Deep Motive	Openness	**0.27***		
	Conscientiousness	**0.34***		
			0.21	0.18
Deep Strategy	Openness	**0.20**		
	Conscientiousness	**0.37***		
			0.25	0.22
Deep Approach	Openness	**0.26***		
	Conscientiousness	**0.40***		
			0.27	0.25
Surface Motive	Conscientiousness	**0.21**		
			0.09	0.06
Surface Strategy	Conscientiousness	**0.21**		
			0.08	0.06
Surface Approach	Conscientiousness	**0.23**		
			0.09	0.07

* P < 0.05, ** P < 0.01, *** P < 0.001.

Table 4.16: Multiple regression analysis with the GPA regressed on the big five traits and on each of the learning approaches.

Factor	Predictor	Beta	R2	Adjusted R2	Std. Error of the estimate
GPA	Neuroticism	-0.08			
	Extraversion	0.05			
	Openness	0.13			
	Agreeableness	0.-0.04			
	Conscientiousness	**0.29****			
			0.14	**0.11**	**5.06**
GPA	Surface Motive	-0.06			
	Deep Motive	-0.05			
	Surface Strategy	-0.08			
	Deep Strategy	**0.19***			
	Surface Approach	-0.12			
	Deep Approach	0.17			
			0.08	**0.05**	**5.21**

* P < 0.05, ** P < 0.01.

Table 4.17: Hierarchical regression analysis with the GPA regressed on the big five traits and on each of the learning approaches.

Step	Predictor	Beta	R2	Adjusted R2	Std. Error of the estimate	Significance
1	**Deep Strategy***	**0.23**				**0.015**
	Surface Strategy	-0.01				
	Surface Approach	-0.12				
			0.06	0.04	5.13	
2	Neuroticism					
		-0.09				**0.002**
	Openness	0.08				
	Conscientiousness*	**0.17**				
			0.12	0.09	5.02	

* P < 0.05, ** P < 0.03.

Table 4.18: Hierarchical regression analysis with the GPA regressed on the control variables (gender and ethnicity), big five traits and on each of the learning approaches.

Step	Predictor	Beta	R2	Adjusted R2	Std. Error of the estimate	Significance
1	Gender	1.535				**0.031**
	Ethnicity*	**-2.359**	**.041**	.029	5.17	
2	**Deep Strategy***	**0.256**				**0.004**
	Surface Strategy	-0.046				
	Surface Approach	-0.089				
			0.10	.072	5.05	
3	Neuroticism	-.114				**0.001**
	Openness	0.041				
	Conscientiousness*	**0.145**				
			0.148	.106	4.96	

* P < 0.05.

CHAPTER 5

DISCUSSION

5.1. Setting and participation

Jordan University of Science and Technology (JUST) is one of only two academic institutions that offer an undergraduate course in dental science in Jordan. Enrolled students successfully complete a five-year program leading to a degree of Bachelor in Dental Sciences (BDS). The students who participated in the current study reflect the JUST multicultural environment where local Jordanian students join with students from other culturally and ethnically coherent Arab countries. Malaysian students, who constituted approximately 17% of the participants in the current study, are considered a distinctive ethnic group at JUST.

The high response rate (85%) for this study reflects the cooperativeness and motivation of the participants to being involved. The method of questionnaire distribution was effective in enhancing the response rate as each small group of 25 students was approached at a time that was convenient to students and allowed questions to be addressed to the researchers. Explanation of the study's methodology, aims, rationale and implications was also likely encouraging for students to voluntarily participate. An emphasis on confidentiality and voluntary participation was made clear to the students. Students were also informed that they could request their own results of the personality inventory and learning approaches from the investigator via personal communication but that no diagnostic comment would be provided. Some of the participants were enthusiastic about having an insight about

their personality traits and the learning methods they prefer. Students were also informed that they are integral element of the process of continuous appraisal and development of educational methods and they are as responsible as educators for improving the dental educational environment to produce the desired outcomes.

One of the limitations of the current study was that the personality inventory used to assess the personality dimensions of students was not readily available in the Arabic language; the native language of the majority of the participants. To overcome this potential barrier which could have impacted validity of participation for the students, a list of words in the NEO-FFI-3 translated into simple commonly used English words was distributed alongside the questionnaire and participants were instructed to inquire about any ambiguous or difficult word that need further explanation during the completion of the questionnaires. Other studies have used this strategy to validly support the conduct of their studies (McCrae & Costa, 2010). However, it is noted that at JUST, English is the language in which all lectures, instructions and examinations are conducted and students are required to have English language proficiency to successfully pass their courses. Therefore, the language of the inventory does not seem to have had significant impact on the responses of students.

5.2 Learning approaches of dental students

The term "learning approach" refers to how students prefer to learn different types of information in different ways (Pashler *et al.*, 2008) and this term can designate a student's stable approach to processing information (Snyder, 1999). The concept of learning approaches has increasingly gained attention in educational research in addition to being of interest to other members of society like parents and the general

public (Pashler *et al.*, 2008). Academic institutions have proudly noted, at times, the ability of their educators to customise their instructional styles to be compatible with both the educator's own knowledge of educational evidence and student's wide range of learning approaches.

Different models have been conceptualised aiming to explain a student's learning approach in terms of motives and values (Biggs *et al.*, 2001). This has been mediated by different learning approach inventories or questionnaires. Marton & Saljo (1976 a) classified learning approaches according to level of information processing into surface or deep-level processing. Craik & Lockhart (1972) adopted the idea of effective information processing and memory as by-product of active thinking to categorize learning approaches into synthesis-analysis, elaborative processing, fact retention and methodical study (Craik & Lockhart, 1972; Schmeck *et al.*, 1977; Schmeck, 1983). Another learning approach inventory has been based on Experiential Learning Theory (ELT) where experience plays a central role in the learning process (Kolb, 1976; Kolb, 1984). Kolb's theory defines learning as a perceiving and processing continuum. The combination of both creates four learning approaches: diverging, assimilating, converging and accommodating (Kolb, 1976; Kolb, 1984). Vermunt (1992) also identified four distinctive learning approaches: undirected, reproduction-directed, application directed and meaning directed (Vermunt, 1992).

The Revised two-Factor Study Process Questionnaire (R-SPQ-2F) used in the current study was developed in response to an increasing demand to improve inventory usage, working and application by updating the original SPQ into a shortened version. This version deals only with deep and surface approaches to learning to envisage the

effectiveness of teaching methods, assessing the preferred learning approaches of students and enhancing the development of educators (Biggs *et al.*, 2001). R-SPQ-2F scoring is based on a five-point Likert scale response ranged from 1-5 (A-E). Thus, participants who achieved higher scores for the Deep Approach (DA) items can be considered deep approach learners for the purposes of the study. "Pure" deep approach learners obtain a maximum score of 50 for the DA items and the minimum score for the Surface Approach (SA) item of 10. The converse applies for participants with "pure" SA who obtain higher scores in SA at a maximum of 50, and lower score for the DA at a minimum of 10.

No student obtained the maximum score for either DA or SA; as such participants in the current study represented a mixture of deep learners and surface learners, according to their scores on the R-SPQ-2F. Thus, it is likely that student use both approaches to learning probably under different physical and cognitive conditions and challenges. These finding agree with findings in previous studies where students were shown to adopt different approaches to learning depending on the task and method of evaluation (Biggs *et al.*, 2001; Leung *et al.*, 2008; Jayawardena *et al.*, 2013).

The students in our study, being final year students, have attained a range of competencies that support their regular involvement in the challenges of clinical training such as conducting clinical examination, applying theoretical critical decision-making and providing complex care for patients, in addition to successfully meeting demands of professional behaviour and assessments. During the junior years of the course, however, students are expected to be developing these competencies in processing information and acquiring specific fine motor skills, in addition to meeting

the challenge of higher education instruction. Both senior and junior students are also variably challenged with the nature of English language instruction. Final year students, like those in our study, have matured academically and experientially acquired strategies for success. In addition, the complexity of the assessment methods at JUST for the dental students has also had an impact. In the clinical years, assessment involves comprehensive written examinations, oral examinations, Objective Structured Clinical Examination (OSCE), short case presentation, clinical case management in addition to continuous clinical assessment for all the treated cases over the academic year. The school also invites external examiners to evaluate the students via oral examinations. Students are instructed therefore to be equipped to answer questions from educators who have come from institutions with different teaching approaches and strategies, exhibiting wide experience in assessment methods that will assess their ability to reflect and understand. Students therefore are encouraged to not be fully reliant on adopting surface learning, such as active memorising of information. Learning in complex clinical environments likely necessitates the efficient ability to recall, comprehend, rationalise and apply relationships between different fragments of memorised information applying this to a new clinical scenario. It is likely that all these factors have an effect on learning approaches developed and refined by students.

The capacity of the majority of our students to succeed academically despite the demands described above may be explained by the finding in the current study that the majority of students (115, 68%) are deep learners. This finding compares with the results of Jayawardena and co-workers who used the same instrument, the R-SPQ-3F, and reported that the majority of first year Sri Lankan dental students (80.65%)

showed greater reliance on deep learning approaches as demonstrated by the reported greater mean score of DA than SA for the student cohort. These workers also noted an absence of "extreme" values for both SA and DA indicating, similar to our findings that students are inclined to adopt a combination of learning approaches probably dependent on the task in hand or the nature of context aimed to be learned. Previous studies in health sciences courses such as medicine and nursing, using the same inventory, RSPQ-2F, have also shown these findings. These studies were conducted on Australia (Pandey & Zimitat, 2007; Leung *et al.*, 2008), and Hong Kong (Tiwari *et al.*, 2006; Leung *et al.*, 2008). However, Leung and co-workers found that there were differences in the mean scores for DA and SA between the Sydney and Hong Kong students where the Hong Kong students scored higher (that is, approaching "extreme" scores) on both deep and surface approach scores, suggesting a greater propensity to use intermediate or combinations of approaches.

An interesting observation reported in the literature has been that students as a whole adopt a deep approach to learning after implementation of problem based learning in clinical education (Newble & Clarke, 1986; Tiwari *et al.*, 2006). This contextual effect on learning approach was also demonstrated in a study by Tiwari *et al.* (2005) in which students adopted a surface approach to learning as an apparent response to a heavy learning workload and the need to maintain good grades. It was concluded from this that students had insufficient time for effective or deep learning and developed anxiety as a result (Newble & Entwistle, 1986; Tiwari *et al.*, 2005). Furthermore, Tiwari *et al.* (2005) also highlighted the pronounced negative or positive influence of assessment requirements on student's learning approach. At JUST, most of the courses written components of assessment in the faculty of dentistry are

executed in multiple-choice questions (MCQ) examinations. In regard to performance in multiple questions scores, Mattick *et al.* (2004) using statistical modeling, found a direct correlation between scores achieved and deep learning approaches taken by medical students. Students are therefore encouraged to adopt deep learning strategy to ensure better chances of examination success.

5.2.1 Ethnicity and learning approaches

Educators are often challenged by the learning needs of their community of learners that can encompass a diversity of cultural backgrounds. The cultural diversity that predisposes varied learning approaches by students may result from the direct influence of cultural factors on the shaping of the student's learning environment. Mitchell *et al.* (2009) found that students of similar cultures adopted similar learning approaches (Mitchell *et al.*, 2009). Different *perspectives* of learning have also been revealed amongst students from different cultures (Jin & Cortazzi, 1998; Mustafa *et al.*, 2013). Such findings provide evidence for educators to seek better understanding of cross-cultural diversity amongst students in learning approaches and so develop more appropriate and sophisticated educational methods and strategies to improve teaching outcomes and meet educational needs.

Ethnic differences did not appear to have an effect on their learning approaches in the current study. It may be that students, though of different cultural backgrounds, experience similar educational environments and similar contextual teaching and assessment methods in a similar way. If so, this may also explain the lack of variations in learning approaches between the Arab and Malaysian students. Despite this, a previous study has shown some difference between Jordanian and Malaysian

medical students in regard to their proficiency in learning human anatomy (Mustafa *et al.*, 2013). This may reflect the necessity for students to adopt different and strategic learning cultures to equal the norms of a culturally diversified student community. However, the Mustafa *et al.* (2013) study used a self-designed questionnaire that cannot be directly compared to the findings in the current study.

Asian or South East Asian students have been perceived as "surface learners" in some studies (Leung *et al.*, 2006; Leung *et al.*, 2008). These studies argue that these students are reliant on instructors and "cook book" curricula and that these students are less self-directed learners and less interactive, as a broad generalisation (Kember, 2000; Leung *et al.*, 2006; Fung, 2010). A paradox, though of the "Chinese learner" has been described that sheds light on the apparent dependence of Chinese students on surface learning approaches in that their major motive is considered to be achieving the perhaps sensible short term goal of successfully passing the assessment (Leung *et al.,* 2006; Leung *et al.*, 2008).

Fung (2010) studied Malaysian secondary and undergraduate students and described these students as "surface rote learners", somewhat unfamiliar with deep approaches to learning. These findings were apparently confirmed by Ming and Alias (2007) and by Smith (2001) which together rather more valuably reflected the adverse influence of traditional methods of "spoon fed teaching" on Malaysian students' approaches to learning that is teacher-centred and "reproductive" (Smith, 2001; Ming & Alias, 2007). The findings of our study disagree with these studies as the majority of Malaysian participants were shown to be deep learners and were not significantly different in this to their Arab colleagues in this respect. However, the current findings

do concur with the findings of Ling *et al.* (2005), who compared approaches to learning between Australian and Malaysian undergraduates (Ling *et al.*, 2005). Despite the finding that Malaysian students scored slightly higher as a group in SA (surface approach), there was no significant difference in deep approach score for the group.

A more recent study by Teoh et al., (2014) using a modified SPQ instrument found that most of the Malaysian undergraduate students preferred an "achieving approach" rather than a "deep approach" or a "surface approach" (Teoh et al., 2014). According to Biggs & Moore (1993), "the achieving approach is like the surface approach in that it is focused on the final product". High scorers in the "achieving approach" tended to focus on obtaining high grades and winning prizes rather than just avoiding examination failure (Biggs & Moore, 1993). However, cluster analysis in Teoh's study revealed that a majority of Malaysian students showed a relatively higher tendency to adopting an achieving approach that is more associated with deep approach than a surface approach.

A comparison between the current study and the previous literature should be considered with caution. Most of the previous studies used different instruments to assess the learning approaches of students and none has investigated the dental students but usually students from other majors. To our estimate, our study is the first to that explore the learning approaches of Malaysian and Jordanian and other Arab dental students' approaches to learning using the R-SPQ-2F questionnaire.

5.2.2 Gender and learning approaches

In the current study no significant differences between male and female students were seen in regard to scores for deep motive, deep strategy and deep approach. However, significant differences were revealed on surface motive and surface approach scales, where female students significantly scored lower than their male counterparts. There were differences in the GPA based on gender (male, 71.81; female, 73.02) but these were not significant statistically. The findings contrast with findings in a study about Chinese students (Zhang & Sternberg, 2000). In a more recent study amongst first year Saudi Arabian dental students, though, no differences in learning approaches were reported based on gender (Al-Saud, 2013).

It is noteworthy that the majority of studies reviewed do not report a difference in learning approaches based on gender. The Zhang and Sternberg (2000) study found that male Chinese students scored significantly higher on the deep motive subscale than their female counterparts and also that Hong Kong-native female students scored significantly higher on their Achieving Strategy subscale than their male counterparts when the original SPQ questionnaire was used. The conclusion though, was that it was hard to come to any conclusion as to the impact of gender on learning approaches due to obvious differences between different cultures.

5.2.3 Learning approaches and academic performance

The prediction of academic performance of students in university studies, especially course completion rates, has both theoretical and practical value for educational institutions because the performance measurement of a cohort can hold significance in an economic sense in terms of impact on regional educational benchmarks,

government funding and higher education goals (Poropat, 2009). These observations in turn, directly can affect curriculum design and educational development of assessment methods of academic performance.

Investigating the association of learning approaches of students with their academic achievement is of significant interest as the way students prefer to learn has been directly linked with their academic performance (Biggs & Moore, 1993; Zhang, 2000; Al-Saud, 2013; Jayawardena *et al.*, 2013; Teoh *et al.*, 2014). It is conceptualized that surface learning is concomitant with poor information processing and undesirable outcomes. On the contrary, deep learning is perceived to be related to high quality learning and preferable learning outcomes (Biggs & Moore, 1993). "High academic performers" tend to utilise deep approaches more than "low performers" (Zeegers, 2001; Komarraju *et al.*, 2011). Thus a deep approached is highly encouraged by educators because it is linked with the development of lifelong, self-directed learning strategies possibly sustained beyond the experience of tertiary education (Mattick *et al.*, 2004).

The GPA has a criterion validity due to its relatively good reliability and its consistent correlation with other variables, such as intelligence (Strenze, 2007), work performance (Roth *et al.*, 1996) and occupational status and prestige (Strenze, 2007). As such, GPA remains a preferred measure of academic performance as evident by its frequent usage as a main measure in many countries, in the literature (Kuncel *et al.*, 2005).

The current study assessed the academic performance by student self-reported accumulative GPA for the first four years of the BDS course. The accuracy of this self-reported GPA might be confounded by mistaken recalls or inaccurate estimates. A positive correlation between reported GPA and self-reported GPA, though, has been documented (Noftle & Robins, 2007), but it is acknowledged that a most accurate determination would be from student's records.

The findings of the current study revealed that both Jordanian and Malaysian dental students embraced deep approaches to learning as indicated by the majority of students showing scores equivalent to their being deep learners. This was confirmed statistically (p =0.01) in that deep learners showed higher GPA (73.34 ± 5.16) compared with surface learners (71.06 ± 5.36). Zero-order correlation confirmed this with a significantly positive correlation between GPA and deep strategy subscale ($r = 0.18$, $P < 0.05$), and deep approach scale ($r = 0.15$, $P < 0.05$), and a statistically significant negative correlation with surface strategy subscale ($r = 0.18$, $P < 0.005$) and surface approach scale ($r = 0.19$, $P < 0.005$). This calculation was based on the guidelines developed by Cohen (1977), but we note that, although significant, the correlations reported may represent only a moderate effect (Cohen, 1977).

The current results also agree with findings of previous studies that associated high academic performance with deep approaches to learning (Biggs & Moore, 1993; Zhang, 2000; Zeegers, 2001; Komarraju *et al.*, 2011; Al-Saud, 2013; Jayawardena *et al.*, 2013; Teoh *et al.*, 2014). These authors concluded that students who are more thoughtful, analytical, reflective and inclined to understand the context are more likely to academically perform well.

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Studies that investigated dental students, as particiapants, however, have provided conflicting results. In a recent study by Al Qahtani & Al-Gahtani (2014), using Kolb's learning approach inventory, no significant relationship was found between learning approaches and academic achievement; possibly because GPA was the single indicator of academic performance in a group of undergraduate dental students and interns in Saudi Arabia. Conversely, in another study that employed the Visual, Aural, Read-write, and Kinesthetic (VARK) questionnaire, a statistically significant association was found between the GPA of first year dental students in Saudi Arabia and their learning approach preferences. Al-Saud, (2013) found a lower mean GPA amongst students who preferred a single mode of learning, while a higher mean GPA was found among students who preferred multiple (quad-modal) learning approach preferences. Direct comparison of these studies with the current study, though, is limited due to differences in the nature of the study population and the variations in the learning approaches measurement inventories utilised.

Another study that investigated first year dental students, and using the R-SPQ-2F revealed an inconsistent correlation between learning approaches and academic performance (Jayawardena *et al.*, 2013). Although a correlation was not found, the median of marks of student participants in several examination components were higher for students who also scored high in deep approach. A positive and significant correlation was observed between deep approach and scores in short answer questions in anatomy was seen. The authors concluded therefore that a deep approach should be enhanced amongst dental students. They also recommended that courses should be organised to improve the retention of information because students used a mixture of

deep and surface approaches to learning. It is worth noting that both medical and dental students have been found to use deep approaches to learning which perhaps reflects the similarity in the demands of both schools curricula (Lindemann *et al.*, 2001).

In another study that used the R-SPQ-2F questionnaire with medical students, a significant correlation was reported to exist between the raw marks of students in some components of the anatomy examination and the deep approaches and surface approaches scores of the same students (Pandey & Zimitat, 2007). However, although these studies showed a significant correlation between approaches to learning and theoretical components of anatomy examinations it did not reveal a correlation of approach with raw marks in practical components. Moreover, a previous study failed to find significant correlation between academic performance of pharmacy students as evaluated by the GPA and learning approaches (Lobb *et al.*, 2006).

Interestingly, the learning approach of dental students as measured by the Myers-Briggs Type Indicator was not found to predict success in the National Board Dental Examination which seems to highlight the importance of students' aptitude and cognitive attributes over a longer timeline than the time of the board exams (Behar-Horenstein *et al.*, 2011). These authors thought that the findings in this study would be important for educators in curriculum design focusing on outlining the correlation between methods of learning and teaching. Such information can be therefore used to improve teaching practices. Direct comparison between our study and this study is not possible due to wide variations in methods, study subjects and the variables assessed.

Our findings do confirm previous findings indicating a positive influence of synthesis-analysis and methodical learning approaches, suggestive of deep approach to learning, on the academic performance of undergraduate students from different schools (Komarraju *et al.*, 2011). These authors hypothesised that educators who foster and nurture elaborative and analytical information processing amongst students are more likely to enhance better academic achievement in those students.

Rapidly advancing technologies, such as eLearning and disruptive media, enhance the ability of health care professionals to keep updated on evidence and knowledge. Thus it is essential that students develop commitment to self-directed life-long learning (Biggs & Moore, 1993). Furthermore, deep approaches to learning are desirable as it enhances in-depth understanding and analytical capabilities of the learners. Surface approaches should be limited, on the other hand, to restrict reliance merely on memorisation and lack of deep understanding to small circumstances. It is also essential for educators to reflect on the interaction between context and assessment on their teaching strategies. Assessment practices should also be formulated to exert positive influence on deep learning (Biggs, 1993; Tiwari *et al.*, 2005).

5.3 Personality traits of dental students

The five-factor model (FFM) is an instrument that is a sensitive measure of variance in personality traits in the use of a simple set of dimensions (Poropat, 2009). The comprehensiveness of the NEO inventories is an advantage that has led researchers to use it in educational and personality studies and meta-analysis of such studies has demonstrated consistent association of the five factor model of personality measures with workplace performance criteria (Barrick *et al.*, 2001). Other studies have

revealed a significance influence of personality traits, as measured by the five factor model, on academic performance and learning strategies (Busato *et al.*, 2000; Lounsbury *et al.*, 2003; Zhang, 2003; Komarraju *et al.*, 2011).

The original NEO inventory has a number of refinements and modifications over few decades reflecting a move to extend its application and practical utility, for example, the Revised NEO-Personality Inventory (NEO-PI-R) comprises 240 items. The version used in the current study was the NEO-Five-Factor Inventory-3 (NEO-FFI-3) which is a revised version of the NEO-FFI.

This shorter 60-item inventory, used in the current study, was concise user-friendly whilst retaining the measures required for the projects aims (Costa & McCrae, 1989). Uniformity of use across different samples, a major advantage of the five scales NEO-FFI, was confirmed by studies using a two-week reliability retest (Robins *et al.*, 2001) and a 6-month correlation (McCrae & Costa, 2004). The scales of the NEO-FFI-3 showed sound approximations of the full trait scales of the NEO-PI-3 (McCrae & Costa, 2010).

One of the major advantages of the NEO-FFI-3 is its use by self-administration and that scoring and analysis does not require the researcher to have formal professional training in clinical psychology, personality analysis, or related fields of clinical psychology when the inventory is not used diagnostically for individual participants (Costa & McCrae, 1992).

Students in small groups were invited to participate in the study to support common communication and to minimize unambiguity about the study. An English language version of the questionnaire was used supported by a list of meanings of possibly troublesome words. A list of meanings of questionnaire words from the NEO manual was provided and in addition, the author was able to supplement this list being a Jordanian academic himself.

In general, the blend of personality traits of participants in the study generally lay within an average provided by original NEO developers, as shown in Table 5.8. This implied that the students validly comprehended the questionnaire and were apparently not confounded by the effect of questionnaire language. Taken together these measures showed validity and gave the investigators confidence in the ability of participants to provide valuable questionnaires.

Unlike scores for other personality traits in the current study, scores for Neuroticism were an exception to the NEO average in that with only 37% of participants in the current study exhibited an average score. The reason for this might be that a larger proportion of female participants (46%) showed "high" scores for this trait which may have skewed the whole sample result. A total percentage of 58.4% of females scored higher than the average score in the Neuroticism trait. Scores for the other traits did not show such a "polar" distribution within the low or high score categories. Unfortunately, the investigators could not find valid norms for Jordanians, Arabs or Malaysians in the literature to compare with the current findings, whether or not this might be explain our scores for Neuroticism. Further, comparison of our findings in this with the norms of the NEO-FFI-3 documented by McCrae & Costa (2007) for

American adults of 21 Y and above, and with mixed ethnic backgrounds, revealed differences with our current study (McCrae & Costa 2007). In the current study, dental students scored highly in the Neuroticism trait for both males and females as previously shown in Table 4.9.

Based on this comparison, it can be suggested that dental students at JUST might be less emotionally stable, and more anxious than American adults. On the contrary, McCrae & Costa (2007) found that American adults scored highly in Agreeableness compared to dental students at JUST. Based on this comparison, it can be suggested that our students are not as friendly, compassionate and helpful to others as American adults. Moreover, again based on this comparison with the NEO-norms (average values) shown in Tables 5.1, it can be suggested the dental students at JUST are not as purposeful, assertive, determined, punctual and goal oriented as American adults as shown by the high scores of Conscientiousness dimension obtained by the subjects of McCrae & Costa's (2007) study. However, male dental students in our study might appear to be more social than Americans as indicated by their higher score in Extraversion. It is very tempting but equally hazardous to make this generalization. Further, the direct comparison between the findings of our study and the norms of the NEO-FFI-3 is of interest but not conclusive due to differences in study populations, age groups, ethnic backgrounds and sample size. Furthermore, the differences might be explained by cultural variables modifying personal choices. Personality differences both within and across cultures have been shown to impact on measures of students

Table 5.1: Means and standard deviations of personality traits for students in the current study compared to norms for NEO-FFI-3 reported for adults 21+ years (McCrae & Costa 2007).

Personality Trait	Gender	Current Study	Norms for NEO-FFI-3 (McCrae & Costa, 2007)
Neuroticism	Male	23.3 (5.7)	19.1 (7.1)
	Female	25.9 (6.3)	22.2 (7.9)
Extraversion	Male	28.0 (5.2)	27.2 (6.1)
	Female	28.3 (5.4)	29.0 (6.2)
Openness	Male	28.8 (5.9)	27.3 (6.3)
	Female	29.2 (5.5)	29.3 (6.2)
Agreeableness	Male	27.8 (6.3)	30.0 (5.7)
	Female	29.9 (5.8)	33.7 (5.7)
Conscientiousness	Male	31.6 (7.3)	32.2 (6.0)
	Female	31.3 (5.8)	32.8 (6.5)

learning and personality (Costa *et al.*, 2001; McCrae & Terracciano, 2005; Schmitt *et al.*, 2008).

As mentioned earlier, females participants in the current study, attained scores that were significantly higher than those of their male counterparts in Neuroticism (P=.008). No significant differences between males and females were seen in scores for the other personality traits. The fact that the majority of the participants (66.5%) were in fact females may explain the Neuroticism finding. This general finding agrees with previous reports related to dental students (Smithers *et al.*, 2004; Chamberlain *et al.*, 2005; Belsi *et al.*, 2011) and dental auxiliary students (Belsi *et al.*, 2011). It also accrues with findings reported for general populations (Costa *et al.,* 2001). However, Smithers *et al.* (2004) found females to be higher also in agreeableness, and openness. The findings of Chamberlain *et al.* (2005) confirms our findings as the only significant relationship revealed was between gender and neuroticism, where female students were significantly less emotionally stable higher in this term. However, unlike the current study which employed the 60-item NEO-FFI-3 inventory, the latter two studies utilized the NEO-PI-R inventory which is a 240-items scale. An interesting study used the NEO-FFI inventory to compare the personality traits of Jordanian patients with and without aphthous ulcers and showed no differences based on gender amongst the controls (Al-Omiri *et al.*, 2012). Based on the finding in our study, we might suggest that females students are more anxious, less emotionally stable, experience more negative feelings and less adaptive than their male colleagues, again this is a hazardous conclusion and not a rational direct conclusion without further independent evidence. It does however alert educators to the idea that student

personality traits are real characteristics of their students, and some traits can be present in many of their students.

5.3.1 Personality and ethnicity

When ethnicity was considered in the current study, scores for personality traits of Malaysian participants was comparable to their Arab counterparts with the exception of Openness to new ideas, where Arab dental students scored significantly higher. This does not agree with previous study which found no differences in personality traits across ethnic groups of dental students in the United Kingdom (Belsi *et al.*, 2011) where the ethnic groups in the current study and in the Belsi study were equally represented. In the Belsi study, the student participants belonged to different ethnic groups, were largely home students and well integrated socially and culturally. The Malaysian students in the current study, though, were not home students, and although the majority of them share similar religious beliefs with the Arab students, the Malaysian participants substantially differ in their history, culture and traditions.

Malaysian students are generally viewed as traditional, conservative and a culturally unique group with a relatively "introvert" attitude. As such it was expected in the current study to perhaps find differences in scores for the Extraversion trait between the Malaysian participants and others, but this was not demonstrated. McCrae & Terracciano (2005) suggested that members of cultures in democratic societies and democratic "values" or "freedoms" are likely to score highly in Extraversion, Openness and Agreeableness trait scores. Conservative religious culture however, may suppress the influence of individualistic values on personality fostered by democratic societies and reduce Extraversion, Openness and Agreeableness trait

scores. In the current study, Malaysian students scored higher than other participants in Agreeableness, but their scores were similar to those participants from other cultures in Extraversion and significantly lower in Openness. This all suggests that there is a complexity in the effect of cultural variables in a unique society that embraces open free democratic values beside conservative religious beliefs, that form personality traits. The sample of dental students in our study could not be considered wholly representative for the Malaysian community culture but the findings are striking and provoking.

Compared with the norms of the NEO-FFI-3 derived from American populations, some of the current findings corroborated with the "egalitarian commitment" suggested by Smith *et al.,* (1996). For example, the noticeably higher average score in Agreeableness amongst Americans compared with a lower average score of the sample population in the current study. On the other hand, a comparison of scores in our study related to the two "egalitarian-related" traits, namely Openness and Extraversion and those in the Smith *et al.,* (1996) study showed no real difference. It is reasonable though to note that the scores obtained from a sample of dental students located in a "non-democratic" community might not be simply compared with the norms derived from large representative population sample of democratic society. We might also consider the impact that closer intercultural ties and improved cross-cultural communications have on enhancing an individual's choice of personality expression. A group of dental students who are arguably an elite sub-society of intellectuals with exceptional access to information technology and exposed to the values of western cultures, may not truly represent the majority of the population and culture in the Arab countries or Malaysia. This limits the extrapolation of our findings

to general Jordanian society, let alone dental students as a whole. The current study, and others like it, may drive interest to further explore cross-cultural influence on personality expression by our students deepening our appreciation of how sensitive our educational approach and methods need to be to optimise each student's educational success.

5.3.2 Personality and learning approaches of dental students

It is hypothesised that the heavy and often complex academic demand placed on our students, as described earlier, impacts both the expression of their personality traits and their approaches to learning. The relationship between data derived from personality traits and from a learning approach inventory was investigated in our study via the application of 3-relevant statistical analysis tests. First, the correlation between personality traits and learning approach was computed by the zero-order correlation coefficient. Secondly, the Student t-test was conducted for these two measurements of interest where student approach to learning (R-SPQ-2F) was compared with responses in the NEO-FFI-3 inventory. Thirdly, regression analysis was performed with the five personality dimensions as one set of variables and the major R-SPQ-2F questionnaire 2 scales plus the 4 subscales as the second set of variables. Regression analysis was used to envisage the predictability of one set of variables over another, that is, the predictive power of personality traits for the learning approaches of students.

One of the objectives of the current study was to explore whether personality traits might predict learning approaches of dental students. The collected data were subjected to statistical tests of progressive strength to detect potential predictors of the independent variables. Occasionally some significant findings demonstrated by one

test failed to be confirmed by another test. Although, distinct statistical relationships were established and affirmed, mixed results however were also produced by different statistical tests. Despite the fact that the zero-order correlation established significant negative relationship between Neuroticism and Deep Approach and its subscales, it could not reveal a predicted positive relationship with the Surface Approach and its subscales. However, a more stringent test such as the t-test confirmed one of the suggested hypotheses of the study. No prediction of the Neuroticism trait relative to any learning approach, however, was shown by regression analysis testing. These results may indicate that the effect of Neuroticism is mediated by other personality traits or that the relationship between Neuroticism and learning approaches can substantially modified by other variables. Thus we believe no definitive conclusions about this trait based on our results can be made but further research is warranted.

Our statistical tests did determine a consistent positive relationship between Openness and Deep Approach to learning and all of its subscales of Deep Motive and Deep Strategy, but no significant relationship between Openness and Surface Approaches to learning and its subscales was found. Regression analysis confirmed the positive relationship of Openness with Deep Approaches to learning, but also revealed a negative relationship with Surface Approaches to learning.

The only consistent relationship shown by all the statistical tests used was the positive correlation between Conscientiousness and Deep Approaches to learning and the negative relationship of Conscientiousness with Surface Approaches to learning. Moreover, another finding was the lack of a statistically significant relationship between Extraversion and all the approaches to learning. Agreeableness was

negatively associated with only Surface Motive scale as indicated by the results of the zero-order correlation procedure, but this relationship could not be confirmed by either t-test or regression analysis. This may suggest weak and/or inconsistent relationship.

There are not many studies that correlate big five personality traits with learning approaches to learning amongst dental students. The majority of studies that have investigated dental students have used the Myers-Briggs Type Indicator (MBTI) for assessment of personality and learning preferences (Silberman *et al.*, 1982; Erskine *et al.*, 1986; Silberman *et al.*, 1992; Morris, 2000; Jessee *et al.*, 2006; Wu *et al.*, 2007). The NEO personality inventory utilised in the current study was considered a comprehensive measurement and highly relevant for the major personality constructs involved in assessments conducted by other personality measures such as the Myers-Briggs Type Indicator (Myers *et al.*, 1998). This inventory has also been used regularly in studies with health profession students and was chosen for this reason. It is noted that some authors argue that the MBTI personality types do not coincide with personality dimensions measured by the FFM (Gardner & Martinko, 1996). Hence, direct comparison with the current study and other studies using the Myers-Briggs Type Indicator may lack relevance.

The importance of studying the relationship between approaches to learning and personality is nested in the concept that one of the major factors related to students learning and characteristics is personality (Biggs, 1993). Although, contentious argument has been raised about the difficulty to conceptualise the relationship between learning approaches and personality (Zhang & Sternberg, 2000), Jackson and

Lawty-Jones (1996) stated that evidence exists to support the conclusion that learning approaches could be fully explained by personality scales and that all learning approaches had at least one significant correlation with one personality trait (Jackson & Lawty-Jones, 1996). Conversely though, other researchers have concluded that learning approaches were only partially explained by personality (Duff *et al.*, 2004).

The relationship between both constructs, personality traits and learning approach, is likely to be complex and multifactorial. Unlike personality, which is considered stable trait through life, learning approaches are considered situation-dependent and may be changed according to subject and academic task (Ramsden, 2003). An explanation of the intricate relationship between learning approach and personality attempted through the concept of the mediatory role of learning approach between cognition and personality; studies have demonstrated that learning approaches may have mediator effects between personality and learning outcomes (Diseth, 2003; Zhang, 2003; Swanberg & Martinsen, 2010; Komarraju *et al.*, 2011).

However, based on the substantial evidence supporting the existence of a strong correlation between learning approaches and personality, Swanberg & Martinsen (2010) considered approaches to studying and learning under the general approach construct and they described approaches as a "partially stable and coherent trait-like personal attribute rather than as a fully situationally determined strategic construct".

The findings of our study agree with some of the findings of Zhang (2003) who correlated learning approaches, measured with the SPQ questionnaire, and personality traits, assessed by the NEO-FFI inventory, in students from different academic fields namely, psychology, mathematics, physics and arts. As in the current study, their

results clearly indicated that Conscientiousness and Openness contributed most in the prediction of learning approaches. Conscientiousness contributed to the use of the Deep (both motive and strategy) approaches to learning. In our study, Conscientiousness also negatively related to Surface Approaches (both Motive and Strategy). Furthermore, Zhang (2003) found that Openness was significantly positively related to a Deep Approach to learning, but negatively to a Surface Approach to learning. In our study, multiple regression analysis did not show relationship between Openness and Surface Approaches.

Neuroticism was found as a good predictor for a Surface Approach to learning in Zhang's study. Our study revealed a negative relationship between Neuroticism and Deep Approaches of learning but showed a positive relationship with Surface Approaches to learning as indicated by t-test but, unexpectedly, this was not confirmed by regression analysis. Similar to our findings, Zhang (2003) did not find that the Extraversion trait showed a direct relationship to any of the learning approaches.

The significant relationship between the Conscientiousness scale and the deep approach to learning in our study was hypothesised. It may be that students who are hard working, disciplined, punctual and strong willed may develop strong motivation towards adopting Deep Approaches to learning and use deep strategies to achieve their goals. A similar argument can be made for the positive relationship of Openness to Deep Approaches to learning in that students who are intuitive, open minded, open to new experiences and curious might be expected to seek in-depth understanding of taught materials and seek new understandings.

The inconsistent findings related to Neuroticism as suggested by different relevant statistical tests, may imply that although students with a "strong" Neuroticism personality trait are more inclined to use the Surface Approach to learning. Such students however, may not necessarily have a tendency for avoiding a Deep Approach to learning (Zhang, 2003). Diseth (2003) and Duff *et al.,* (2004) found approaches to learning to be predicted by a mixture of personality factors and not by a single trait. These authors found that a Deep Approach was, however, mainly related to Openness, the Surface Approach was mainly related to Neuroticism, and the Strategic Approach was mainly related to Conscientiousness (Diseth, 2003; Duff *et al.*, 2004). Data related to Conscientiousness and Openness to experience and their strong positive relationship with Deep Approaches were corroborated by Swanberg & Martinsen, (2010), who also found a strong relationship between Neuroticism and a Surface Approach to learning. This strong clear relationship between Neuroticism and Surface Approaches to learning, however, could not be confirmed by our study.

In a more recent study that employed the NEO-FFI and Inventory of Learning Processes, Conscientiousness and Openness were found to be positively and significantly associated with all four learning approaches of that inventory (synthesis-analysis, elaborative processing, methodical study, and fact retention) and Neuroticism was found to be negatively related to all learning approaches (Komarraju *et al.*, 2011). The current study is partly consistent with those findings relevant to Conscientiousness and Openness.

In conclusion, the current study concurs with findings from studies in the literature related to university students (but not dental students) which limits direct comparison

with our study. No study to our knowledge has investigated dental student responses using the measurement instruments used in the current study. In our study, Conscientiousness and Openness to new experiences clearly related to learning approaches of students. Both traits seem to be closely related to in-depth and effective learning strategies. In general, this suggests that students who are organised, disciplined, determined, purposeful, exert more effort on the task and are intellectually curious are more likely to use Deep Approaches to learning. Students scoring highly in Neuroticism on the other hand, are likely to be more erratic, and tend to adopt Surface Approaches to learning, and are likely to be more dependent on rote learning and fact retention to meet the requirements of passing examinations; they also are likely not to relate what they currently learn to previous knowledge.

5.3.3 Personality, learning approaches and academic performance of dental students

Another objective in our study was to uncover a relationship between the big five personality traits, approaches to learning, and academic performance of dental students. The analysis yielded a number of relationships that hold practical implications in educational settings and may equip educators with insightful understanding in regard to the interplay between learning and personality traits of students. This study was a good opportunity to explore the above mentioned educational variables among dental students. The majority of relevant studies in the literature investigated students in other professional disciplines and therefore provided limited value for dental educators.

The influence of personality on academic achievement has been a strong area of research interest. Different factors have been found to be related to academic performance and have been historically labeled as the "*w*" factors representing the will of an individual; a contemporary equivalent concept is perhaps Conscientiousness (Webb, 1915). The general intelligence factor also labeled factor "*g*" has also been considered a major contributor to academic performance (Flemming, 1932).

This study aimed at describing the influence of non-cognitive factors on academic achievement as academic achievement holds strong social and economic potential and, ultimately, social success. Any influence on academic performance is understandably highly valued, especially in advanced economies.

Unlike intelligence measures, it is argued in the literature that personality measures have not been traditionally considered to predict academic performance (Poropat, 2009). However, it is believed that the theoretical basis of the FFM provided by the historical and lexical hypothesis of Allport & Odbert (1936) provides strong justification for use of the five factor model in predicting academic performance. The development of natural language is a true reflection for the development of increasingly valued personality features. The more valued the features, the more descriptors will be evolved in the language. Thus, the lexical hypothesis provides an original framework for the factorial analysis and lends support to the comprehensiveness of big five personality measuring instrument. This theoretical basis supports the lofty perception of academic performance in society, further

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supporting the use of academic performance as a major variable for investigation in the current study.

The current findings revealed the relationships of individual big five personality traits with approaches to learning and academic performance as measured by the GPA. Analysis by Pearson product moment procedure showed that three traits stand out as predictors of academic performance; Neuroticism relates negatively with academic performance, and both Openness and Conscientiousness related positively with academic performance. Multiple and hierarchical regression analysis, however, revealed significant relationship of only the Conscientiousness trait with academic performance which explained 14% of variance in the GPA.

The current findings disagree with Smithers *et al.* (2004) who reported that only Openness to experience was a trait that was significantly related to academic performance of dental students. Surprisingly though, in Smither's study, the relationship between Openness and academic performance was negative, and also Conscientiousness failed to predict either academic or clinical performance of students. These findings suggest that students whose scores suggest they are apparently less intellectual and less imaginative performed better in dental school. The authors attributed those unexpected findings to the traditional, didactic curriculum that perhaps does not encourage deep thinking and reflection and does not reward students who are intellectually curious. Although the curriculum at JUST, the setting of the current study, is also traditional, multiple forms of tasks and assessment methods are used designed to require in-depth thinking for successful completion.

Our results concur with the results of Chamberlain *et al.* (2005) who found that Conscientiousness was a good predictor of academic and clinical performance of dental students. Although scores for the broad trait of Openness did not predict academic performance,, one of its narrow facets did predict academic performance, (Chamberlain *et al.,* 2005). These two studies (that is, Smithers *et al.,* 2004; Chamberlain *et al.,* 2005), conducted in Canada, are the only studies that have investigated the relationship of personality of dental students using the Five Factor Inventory with their academic performance, found in the literature. A direct comparison with the current study however holds some limitation due to difference in versions of NEO inventories used, as the current study used the NEO-FFI-3 and the Canadian studies used the NEO-PI-R inventory, the different measures of academic achievement used and the fact that the participants enjoyed different cultures and ethnicities.

Findings in the current study do support findings in other studies in relation to the positive correlation between Conscientiousness and academic performance (De Raad & Schouwenburg, 1996; Busato *et al.*, 2000; Chamberlain *et al.*, 2005; Swanberg & Martinsen, 2010; Komarraju *et al.*, 2011). High scoring in Conscientiousness appears to be independent of either Deep or Surface approaches to learning but rather had a closer relationship to academic performance. In our study, academic performance was shown to have a strong relationship with Deep Approaches to learning and a negative relationship with Surface Approaches suggesting a potential moderating effect of learning approaches on academic performance. However, despite the inclusion of learning approaches into the hierarchical regression analysis model, the trait Conscientiousness stood out as the only personality trait that significantly related to

academic performance strongly suggesting this trait's independent influence on learning approach. Interestingly, others have shown that the relationship between Conscientiousness and academic performance might be moderated by *Strategic* approach to learning (Diseth, 2003; Swanberg & Martinsen, 2010). The results of our study supports the findings of a meta-analysis by Poropat (2009) that indicated, that, of all the Big Five traits, Conscientiousness had the strongest association (or predictor) with academic performance. In Poropat's study (2009) Conscientiousness also had a direct relationship with work performance, and that association was similar in magnitude to the relationship of Conscientiousness with intelligence, though this was not found in participants in primary education. In fact, the effect of personality traits on intelligence is reduced as the academic level rose, with one exception-Conscientiousness (Poropat, 2009). Our findings also supported the conclusion of the importance of personality traits in predicting academic performance; this supports the lexical hypothesis as a theoretical basis for the FFM personality model (Poropat, 2009). This suggests the value of utilizing "strength" in Conscientiousness as a confirming measure for selecting candidates to tertiary education entry, rather than relying on academic performance alone.

De Raad & Schouwenburg (1996) also concluded that the big five factors of Extraversion, Openness to experience and Conscientiousness were educationally relevant (De Raad & Schouwenburg, 1996). Our study demonstrated a positive relationship between Openness to experience and GPA and Deep Approaches to learning when this relationship was tested with the Pearson correlation order and Student t-test. The relationship with all Deep Approaches scales was confirmed by multiple regression analysis. Hierarchical analysis, however, did not reveal a

significant relationship between Openness and GPA. This may indicate that the effect of Openness is potentially modified by learning approaches and so may not have a direct effect on academic performance in our sample of dental students. This modifying effect of learning approach especially in regard to Openness to experience was also demonstrated in previous studies (Diseth, 2003; Furnham *et al.*, 2008; Swanberg & Martinsen, 2010; Komarraju *et al.*, 2011).

A negative relationship between Neuroticism and learning approaches and GPA was confirmed when tested by the Student t-test, but was not shown when tested by either the multiple or hierarchical regression analysis. This inconsistency may suggest relationships are weak or that larger sample numbers are required. Inconsistencies are also seen across the published literature, as while our findings coincide with the results of Smithers *et al.,* (2004), they are not in agreement with Chamberlain *et al.,* (2005) who *consistently* demonstrated a negative relationship of Neuroticism with academic performance of Canadian dental students. Taking the findings across all these studies, we can suggest that students with high level of negative emotions and anxiety and low level of emotional stability, coinciding with a high Neuroticism score, may academically perform with less success. Emotional stability is general is positively associated with successful academic performance (Chamberlain *et al.*, 2005; Poropat, 2009; Swanberg & Martinsen, 2010).

In our study, Agreeableness did not demonstrate a direct relationship with academic performance and learning approaches. This finding is in disagreement with previous studies (Chamberlain *et al.*, 2005; Komarraju *et al.*, 2011) who found Agreeableness to be a predictor for successful academic performance of dental students. However,

our study agrees with Smithers *et al.,* (2004) and the dental students in the current study scored lower in Agreeableness compared with norms reported for Americans (Table 5.1)

In our study, Extraversion did not demonstrate any relationship with learning approaches and academic performance. Extrovert students are arguably expected to perform better academically due to their supposedly positive attitude towards the learning environment (De Raad & Schouwenburg, 1996). However, the present research findings concur with Chamberlain *et al.,* (2005) and Swanberg & Martinsen (2010).

The importance of personality traits and approaches to learning and their close association with academic performance of dental students, as demonstrated in the finding in the current study, provides an insightful message to the educators and administrators in dental education to more closely attend to admission criteria of applicants to dental school. Whilst cognitive abilities play a vital role in academic achievement, dental students are profitably encouraged to adopt deep and strategic strategies in learning and be guided to be more professional, deliberate, industrious, and strong willed. Willing commitment to hard work, discipline and goal orientation are attitudinal elements that contribute in an equal way to intelligence, as a path to success in tertiary education.

5.4 Study Limitations

The current study has its merits in revealing relationships between learning approaches, personality traits and academic performance in dental students. However, we must also acknowledge limitations of our study.

The lack of a body of literature sufficiently similar to our study to render it comparable suggests that further work is warranted to include other dental student populations. The relatively small sample size allows only limited extrapolation of the results to the dental student population lacking the required power to detect small or moderate effects in variables. Moreover, ethnic groups in the present research were not equally represented.

The sample was convenient and the academic performance was self-reported. Furthermore, despite the fact that the Big Five model has been confirmed as a reliable instrument and possesses sound psychometric properties, the possibility that a student may confound or fabricate their responses cannot be ruled out. Self-reported GPA, for example, is not as reliable as that obtained from students' records. It is more reliable if GPA is obtained from students' records in future studies.

The gender blend of the participants in our study must be considered when interpreting results based on gender, as studies have shown the impact of this aspect, on results. The majority of dental students at JUST are females from both ethnicities involved in the study.

The reported findings are based on a sample from a final year dental student population. Despite the strong relevance of this selection for the objectives and the aims of the current study, the restriction of range is apparent. This is illustrated by a somewhat inconsistent relationship between intellectual curiosity, active imagination, and openness to new ideas and academic performance. We recommend that future research should be done with students from different disciplines and at different academic levels to expand the range of study.

CHAPTER 6

CONCLUSIONS

This is the first study, to the best knowledge of the investigators, to be conducted evaluating dental students' personality, approaches to learning, and academic performance. Despite the fact that numerous studies in the literature have reported on the relationship between learning approaches, personality constructs and academic performance of students from various departments and specialties scarce information is available about dental students. The role of personality and learning approaches in academic achievement of students is an area that has attracted extensive research generally due to the high value and central role of academic excellence in the community, especially those with advanced economies. However, a value is not as predominant in developing economies where education receives only modest consideration as a field of research.

In spite of the characteristics of this context, the current study contributes to our understanding of personality, learning approaches and academic achievement in an important but underreported population, dental students. Our results produced a number of indications and established a number of links between the big five personality traits, learning approaches and academic achievement among dental students. These all hold value for those involved in dental education at the delivery, curriculum design and governance levels.

The following conclusions are based on the findings from this study and taken in the light of a critical review of the literature.

The present study provides clear evidence on the significant role of personality and approaches to learning in predicting academic performance of dental students.

Our results demonstrated that several personality traits predicted different learning strategies. Regression analysis revealed that Conscientiousness and Openness were positively and significantly associated with all Deep Approaches to learning scales and Conscientiousness was also negatively and significantly associated with all Surface Approaches to learning scales. Neuroticism was negatively associated with Deep Approaches to learning and positively with Surface Approaches to learning as demonstrated by the t-test analysis. Thus, Conscientiousness and Openness appear to facilitate Deep learning Approaches. Neuroticism to lesser extent appears to facilitate Surface Approaches to learning.

Surface motive (that is, a sub-scale of Surface Approach) correlated significantly and negatively with Deep Strategy (that is, a sub-scale of Deep Approach) and positively with Surface Strategy. Deep Strategy also correlated negatively with Surface Strategy and positively with Deep Motive. Deep Approach scores significantly and negatively correlated with Surface Approach.

Conscientiousness correlated significantly and positively with Openness and negatively with Neuroticism.

Female participants were found to score significantly higher in Neuroticism compared with male participants.

Male participants scored significantly higher in Surface Motive and Surface Approach than female participants.

A majority of students scored higher in Deep Approach to learning scale than in Surface Approach. The majority of deep learners were female participants (47%) compared with male participants (20%).

Arab participants were more open to new experiences than their Malaysian colleagues in that Arab participants scored significantly higher in Openness compared with their Malaysian their Malaysian colleagues.

Deep learners scored significantly higher in Conscientiousness, Openness and GPA than surface learners.

No significant difference in GPA was found based on gender and ethnicity.

A significant correlation was found between GPA and Surface Strategy, Surface Motive and Surface Approach to learning, and positive correlation with Deep Strategy and Deep Approach to learning.

Testing our data using Pearson's coefficient of correlation also revealed a negative relationship between GPA and Neuroticism, and a positive relationship with both Conscientiousness and Openness.

Multiple and hierarchical analysis revealed that in regard to the personality traits Conscientiousness and Openness, high scores in the scale of Deep Approach were the only significant predictors of academic performance as measured by GPA. Conscientiousness and Openness contributed equally to the prediction power of GPA.

Further hierarchical analysis (when gender and ethnicity were entered in the model) revealed that Ethnicity contributed to the prediction of GPA besides Conscientiousness and Openness although this was at 4%. The effect of Ethnicity could have mediated by Openness trait.

Scores for Extraversion and Agreeableness did not demonstrated consistent relationships with learning approaches or GPA.

Apparently, conscientiousness appears as a central personality trait that predicts both the learning approaches of students and their academic performance. These results suggest that dental students who are persistent, organised, deliberating, purposeful and goal oriented can be predicted to excel academically. Conversely, we might conclude that those students who are careless, not hard working and do not study systematically are more likely to achieve only a poor performance at assessment.

Openness was also positively associated with GPA and Deep Approaches to learning. On the other hand, the negative correlation between Neuroticism and Deep

Approaches to learning and GPA (although not confirmed by regression analysis) also suggests that, besides being conscientious, students who are intellectually curious, imaginative and intuitive and who experience more positive emotions and less anxiety may perform better academically. In addition, the present results emphasised the positive influence of Deep Approaches to learning, and especially the Deep Strategy component, on the academic performance of dental students.

The current findings also suggest that students who are conscientiousness and open to new experiences, that is, are strong willed, determined, disciplined, achievement-oriented, thorough, seek underlying meanings, abstract ideas and theories and are intellectually curious are more likely to use Deep Strategy in maximising their learning outcomes.

In regard to recommendations, the following are made. The present study detected the importance of personality measures and learning approaches as predictors of academic performance of dental students. Dental educators, administrators, and selection committees would therefore wisely consider seeking and understanding these variables and then incorporating these measures in the selection criteria of candidates for dental schools. Poropat stated that "personality should take a more prominent place in future theories of academic performance and not merely as an adjunct to intelligence" (Poropat, 2009).

Educators should understand the importance of personality traits, especially Conscientiousness and Openness as strong predictors of academic performance when designing their educational modalities and strategies for dental students. Educators

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could be trained to design teaching methods and course assignments, outlines and testing methods to foster Conscientiousness, for example by drafting assignments in small parts, and to foster Openness, for example by enhancing and enforcing the imaginative capabilities of their students by linking concepts to current events. Educators should enhance their students learning about the value of being Conscientious and Open Minded in handling their learning tasks. Educators could also be qualified to diffuse stressful situations and reduce anxiety in the classroom and in the teaching and assessment processes especially amongst female students who apparently are more apprehensive, more anxious and may be more likely to experience negative emotions than their male colleagues.

Educators and curriculum designers could encourage the utilisation of deep information processing, thus adoption of Deep Approaches to learning which is likely to improve students' achievement. Dental educators are encouraged to formulate assignments that necessitate Deep Approach to learning. Komarraju *et al.* (2011) suggested that educators are advised, but not exclusively so, "to explain a concept or theory by giving personal life examples, refer to relevant current events, illustrate the material using hierarchical concepts, or organise information around meaningful themes". Scenarios-based or problem-based instruction modalities use this construct. These tactics may help students to process information more thoughtfully.

Dental educators could also consider the ethnic diversity in the classroom and take into considerations the potential differences in attitude to learning and learning strategies and also the possible personality variations amongst students stemming from different cultural and ethnic backgrounds.

Although the current study provides insight into the complex interaction between personality, learning approaches and academic performance, we hope it may also stimulate educators to broaden their discussions regarding the most effective strategies in developing dental curriculum and educational methodologies to match the students' more favorable personality traits and more preferable learning approaches choices, so as to promote Deep Approaches to learning to advance the academic achievements of learners.

The limitations of the current study may render some of the results difficult to generalize or conceptualise. Future research directions are warranted that reduce the range of limitations and minimise the effects of any confounding factors to make the results are more conclusive.

Thus, the followings are suggested directions for future research, about the interaction between personality, approaches to learning and academic performance of dental students: Firstly, it is worthwhile to extend the study to involve dental students from other years for comparison. It would also be valuable to conduct a longitudinal study that follows the same cohort of dental students throughout their progress in the course to study any changes in their learning approaches and personality traits.

Second, it would be valuable to extend the study to involve students from other health professions and other students from other departments to compensate for limitations due to the power of the study.

Third, potential moderators of academic performance and personality traits, such as age and academic level should be considered in future studies.

Fourth, future research should consider the effects of other factors including behavioural indicators of academic performance, such as attendance, self-efficacy, intelligence and socioeconomic status.

Sixth, cross-cultural studies with well representative sample size would be very valuable.

Seven, it would be interesting to consider different educational methods such traditional versus problem based learning in relation to its effect on approaches to learning of dental students.

Finally, the study has provided much insight into how our educational environment would be enhanced to excellent by educators developing a deeper understanding of their students, and we might add, the reverse may also be true.

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Appendix 1: Announcement for the study

ANNOUNCEMENT:
Opportunity to participate in an educational study:

The Correlation between Personality Traits, Learning Approaches
and Academic Performance of Dental Students

You are invited to take part in a research study about student personality traits and learning styles. The research aims are to discover the personality traits of students and its correlation with their approach to learning.

This kind of knowledge has not been explored extensively in dental education
An analysis of these factors will be made available to Faculty curriculum reviewers and developers to assist their work in enhancement of student education.

The study is being conducted by Dr Wael Al-Omari, and will require you to complete online questionnaires, where your responses to questions will be unidentifiable.

If you are interested, please contact: Dr Al-Omari on:
womari69@hotmail.com

Appendix 2: Participant information statement

RESEARCH STUDY ABOUT THE CORRELATION BETWEEN PERSONALITY TRAITS, LEARNING APPROACHES AND ACADEMIC PERFORMANCE OF DENTAL STUDENTS

PARTICIPANT INFORMATION STATEMENT

You are invited to take part in a research study about students' personality traits and learning styles. The research aims are to determine the relationship between personality traits of students and their preferable approach to learning. An analysis of these factors will be made available to Faculty curriculum reviewers and developers to assist their work in enhancement of student education.

The study is being conducted by Dr Wael Al-Omari. If you agree to participate in this study, you will be asked to participate in the completion of two questionnaires together lasting approximately 30 minutes.

All aspects of the study, including results, will be strictly confidential and only the investigators named above will have access to information on participants. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

We intend that this study will further knowledge and understanding about student approach to learning.

Participation in this study is entirely voluntary: you are not obliged to participate and - if you do participate - you can withdraw at any time. Whatever your decision, it will not affect your university results or performance if you are a student, or your professional relationship with the university.

Being in this study is completely voluntary and you are not under any obligation to consent to complete the questionnaires. Submitting completed questionnaires online is an indication of your consent to participate in the study. You can withdraw any time prior to submitting your completed questionnaire. Please note, once you have submitted your questionnaires anonymously, your responses cannot be withdrawn.

When you have read this information, and you would like to know more at any stage, please feel free to contact Dr Wael Al-Omari:

- **womari69@hotmail.com**

Appendix 3: Participation consent form

PARTICIPANT CONSENT FORM

I, ...[PRINT NAME], give consent to my participation in the research project:

TITLE: **The Correlation between Personality Traits, Learning Approaches and Academic Performance of Dental Students**

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved (including any inconvenience, risk, discomfort or side effect, and of their implications) have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s).

4. I understand that my involvement is strictly confidential and no information about me will be used in any way that reveals my identity.

5. I understand that being in this study is completely voluntary – I am not under any obligation to consent.

6. I consent to: –
   i) Receiving Feedback   YES ☐   NO ☐

If you answered YES to the "Receiving Feedback Question (i)", please provide your details i.e. mailing address, email address below:

Feedback Option

Address: ....

Email: ....

Signed: ....

Name: ....

Date: ....

Appendix 4: The NEO-Five-Factor Inventory-3 (NEO-FFI-3)

NEO-FFI-3

Item Booklet | **Form S–Adult**

SELF-REPORT

NEO Five-Factor Inventory-3

Paul T. Costa, Jr., PhD and Robert R. McCrae, PhD

Instructions

Write only where indicated in this Item Booklet. Carefully read all of the instructions before beginning. This questionnaire contains 60 statements. Read each statement carefully. For each statement, fill in the circle with the response that best represents your opinion. Make sure that your answer is in the correct box.

Fill in ⓢⓓ if you *strongly disagree* or the statement is definitely false.

Fill in Ⓓ if you *disagree* or the statement is mostly false.

Fill in Ⓝ if you are *neutral* on the statement, if you cannot decide, or if the statement is about equally true and false.

Fill in Ⓐ if you *agree* or the statement is mostly true.

Fill in ⓢⓐ if you *strongly agree* or the statement is definitely true.

Note that the responses are numbered in *rows*.

Example

First five responses from an individual who strongly disagrees with items 1, 2, and 3, and agrees with items 4 and 5.

ENTER ACROSS ⇨ 1 ● Ⓓ Ⓝ Ⓐ ⓈⒶ 2 ● Ⓓ Ⓝ Ⓐ ⓈⒶ 3 ● Ⓓ Ⓝ Ⓐ ⓈⒶ 4 ⓈⒹ Ⓓ Ⓝ ● ⓈⒶ 5 ⓈⒹ Ⓓ Ⓝ ● ⓈⒶ

Fill in only one response for each statement. Respond to all of the statements, making sure that you fill in the correct response. **DO NOT ERASE!** If you need to change an answer, make an "**X**" through the incorrect response and then fill in the correct response.

Before responding to the statements, turn to the inside of this Item Booklet and enter your name, age, sex, ID number (if any), and today's date.

Name _____ Age _____ Sex _____ Today's date _____

1. I am not a worrier.
2. I like to have a lot of people around me.
3. I enjoy concentrating on a fantasy or daydream and exploring all its possibilities, letting it grow and develop.
4. I try to be courteous to everyone I meet.
5. I keep my belongings neat and clean.

6. At times I have felt bitter and resentful.
7. I laugh easily.
8. I think it's interesting to learn and develop new hobbies.
9. At times I bully or flatter people into doing what I want them to.
10. I'm pretty good about pacing myself so as to get things done on time.

11. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
12. I prefer jobs that let me work alone without being bothered by other people.
13. I am intrigued by the patterns I find in art and nature.
14. Some people think I'm selfish and egotistical.
15. I often come into situations without being fully prepared.

16. I rarely feel lonely or blue.
17. I really enjoy talking to people.
18. I believe letting students hear controversial speakers can only confuse and mislead them.
19. If someone starts a fight, I'm ready to fight back.
20. I try to perform all the tasks assigned to me conscientiously.

21. I often feel tense and jittery.
22. I like to be where the action is.
23. Poetry has little or no effect on me.
24. I'm better than most people, and I know it.
25. I have a clear set of goals and work toward them in an orderly fashion.

26. Sometimes I feel completely worthless.
27. I shy away from crowds of people.
28. I would have difficulty just letting my mind wander without control or guidance.
29. When I've been insulted, I just try to forgive and forget.
30. I waste a lot of time before settling down to work.

31. I rarely feel fearful or anxious.
32. I often feel as if I'm bursting with energy.
33. I seldom notice the moods or feelings that different environments produce.
34. I tend to assume the best about people.
35. I work hard to accomplish my goals.

36. I often get angry at the way people treat me.
37. I am a cheerful, high-spirited person.
38. I experience a wide range of emotions or feelings.
39. Some people think of me as cold and calculating.
40. When I make a commitment, I can always be counted on to follow through.

41. Too often, when things go wrong, I get discouraged and feel like giving up.
42. I don't get much pleasure from chatting with people.
43. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
44. I have no sympathy for beggars.
45. Sometimes I'm not as dependable or reliable as I should be.

46. I am seldom sad or depressed.
47. My life is fast-paced.
48. I have little interest in speculating on the nature of the universe or the human condition.
49. I generally try to be thoughtful and considerate.
50. I am a productive person who always gets the job done.

51. I often feel helpless and want someone else to solve my problems.
52. I am a very active person.
53. I have a lot of intellectual curiosity.
54. If I don't like people, I let them know it.
55. I never seem to be able to get organized.

56. At times I have been so ashamed I just wanted to hide.
57. I would rather go my own way than be a leader of others.
58. I often enjoy playing with theories or abstract ideas.
59. If necessary, I am willing to manipulate people to get what I want.
60. I strive for excellence in everything I do.

Enter your responses here—remember to enter responses _ACROSS_ the rows.

SD = *Strongly Disagree*; D = *Disagree*; N = *Neutral*; A = *Agree*; SA = *Strongly Agree*

ENTER ACROSS ⇨

1 (SD)(D)(N)(A)(SA)	2 (SD)(D)(N)(A)(SA)	3 (SD)(D)(N)(A)(SA)	4 (SD)(D)(N)(A)(SA)	5 (SD)(D)(N)(A)(SA)
6 (SD)(D)(N)(A)(SA)	7 (SD)(D)(N)(A)(SA)	8 (SD)(D)(N)(A)(SA)	9 (SD)(D)(N)(A)(SA)	10 (SD)(D)(N)(A)(SA)
11 (SD)(D)(N)(A)(SA)	12 (SD)(D)(N)(A)(SA)	13 (SD)(D)(N)(A)(SA)	14 (SD)(D)(N)(A)(SA)	15 (SD)(D)(N)(A)(SA)
16 (SD)(D)(N)(A)(SA)	17 (SD)(D)(N)(A)(SA)	18 (SD)(D)(N)(A)(SA)	19 (SD)(D)(N)(A)(SA)	20 (SD)(D)(N)(A)(SA)
21 (SD)(D)(N)(A)(SA)	22 (SD)(D)(N)(A)(SA)	23 (SD)(D)(N)(A)(SA)	24 (SD)(D)(N)(A)(SA)	25 (SD)(D)(N)(A)(SA)
26 (SD)(D)(N)(A)(SA)	27 (SD)(D)(N)(A)(SA)	28 (SD)(D)(N)(A)(SA)	29 (SD)(D)(N)(A)(SA)	30 (SD)(D)(N)(A)(SA)
31 (SD)(D)(N)(A)(SA)	32 (SD)(D)(N)(A)(SA)	33 (SD)(D)(N)(A)(SA)	34 (SD)(D)(N)(A)(SA)	35 (SD)(D)(N)(A)(SA)
36 (SD)(D)(N)(A)(SA)	37 (SD)(D)(N)(A)(SA)	38 (SD)(D)(N)(A)(SA)	39 (SD)(D)(N)(A)(SA)	40 (SD)(D)(N)(A)(SA)
41 (SD)(D)(N)(A)(SA)	42 (SD)(D)(N)(A)(SA)	43 (SD)(D)(N)(A)(SA)	44 (SD)(D)(N)(A)(SA)	45 (SD)(D)(N)(A)(SA)
46 (SD)(D)(N)(A)(SA)	47 (SD)(D)(N)(A)(SA)	48 (SD)(D)(N)(A)(SA)	49 (SD)(D)(N)(A)(SA)	50 (SD)(D)(N)(A)(SA)
51 (SD)(D)(N)(A)(SA)	52 (SD)(D)(N)(A)(SA)	53 (SD)(D)(N)(A)(SA)	54 (SD)(D)(N)(A)(SA)	55 (SD)(D)(N)(A)(SA)
56 (SD)(D)(N)(A)(SA)	57 (SD)(D)(N)(A)(SA)	58 (SD)(D)(N)(A)(SA)	59 (SD)(D)(N)(A)(SA)	60 (SD)(D)(N)(A)(SA)

Now answer the three questions labeled A, B, and C below.

A. Have you responded to all of the statements? _____ Yes _____ No

B. Have you entered your responses across the rows? _____ Yes _____ No

C. Have you responded accurately and honestly? _____ Yes _____ No

Sum the COLUMNS to obtain raw scores for N, E, O, A, and C.
Plot raw scores on facing page to obtain *T* scores.

1 ④③②①⓪	2 ⓪①②③④	3 ⓪①②③④	4 ⓪①②③④	5 ⓪①②③④
6 ⓪①②③④	7 ⓪①②③④	8 ⓪①②③④	9 ④③②①⓪	10 ⓪①②③④
11 ⓪①②③④	12 ④③②①⓪	13 ⓪①②③④	14 ④③②①⓪	15 ④③②①⓪
16 ④③②①⓪	17 ⓪①②③④	18 ④③②①⓪	19 ④③②①⓪	20 ⓪①②③④
21 ⓪①②③④	22 ⓪①②③④	23 ④③②①⓪	24 ④③②①⓪	25 ⓪①②③④
26 ⓪①②③④	27 ④③②①⓪	28 ④③②①⓪	29 ⓪①②③④	30 ④③②①⓪
31 ④③②①⓪	32 ⓪①②③④	33 ④③②①⓪	34 ⓪①②③④	35 ⓪①②③④
36 ⓪①②③④	37 ⓪①②③④	38 ⓪①②③④	39 ④③②①⓪	40 ⓪①②③④
41 ⓪①②③④	42 ④③②①⓪	43 ⓪①②③④	44 ④③②①⓪	45 ④③②①⓪
46 ④③②①⓪	47 ⓪①②③④	48 ④③②①⓪	49 ⓪①②③④	50 ⓪①②③④
51 ⓪①②③④	52 ⓪①②③④	53 ⓪①②③④	54 ④③②①⓪	55 ④③②①⓪
56 ⓪①②③④	57 ④③②①⓪	58 ⓪①②③④	59 ④③②①⓪	60 ⓪①②③④

N = _____   E = _____   O = _____   A = _____   C = _____

A. Have you responded to all of the statements?   _____ Yes _____ No
B. Do not score if this response is marked "No."   _____ Yes _____ No
C. Do not score if this response is marked "No."   _____ Yes _____ No

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NEO Five-Factor Inventory-3 Profile
Form S (Adult)

Male

	T	N	E	O	A	C
Very High	≥75-	≥37	≥43	≥43	≥44	≥47
	74-	36	42			
	73-		41	42	43	46
	72-	35		41		
	71-	34	40		42	45
	70-	33		40		44
	69-		39	39	41	
	68-	32	38		40	43
	67-	31		38		
	66-		37		39	42
High	65-	30		37		41
	64-	29	36	36	38	
	63-	28	35			40
	62-			35	37	
	61-	27	34	34	36	39
	60-	26	33			38
	59-			33	35	
	58-	25	32			37
	57-	24		32	34	
	56-		31	31		36
Average	55-	23	30		33	35
	54-	22		30	32	
	53-	21	29	29		34
	52-				31	
	51-	20	28	28		33
	50-	19	27	27	30	32
	49-					
	48-	18	26	26	29	31
	47-	17				
	46-	16	25	25	28	30
	45-		24	24	27	29
Low	44-	15				
	43-	14	23	23	26	28
	42-			22		
	41-	13	22		25	27
	40-	12	21	21		26
	39-	11			24	
	38-		20	20	23	25
	37-	10	19	19		
	36-	9			22	24
	35-		18	18		23
Very Low	34-	8		17	21	
	33-	7	17			22
	32-	6	16	16	20	
	31-				19	21
	30-	5	15	15		20
	29-	4		14	18	
	28-		14			19
	27-	3	13	13	17	
	26-	2		12		18
	≤25-	≤1	≤12	≤11	≤16	≤17

Female

	T	N	E	O	A	C
Very High	≥75-	≥42	≥45	≥45	48	
	74-	41	44	44		
	73-	40	43		47	48
	72-			43	46	47
	71-	39	42			
	70-	38		42	45	46
	69-	37	41	41		45
	68-		40		44	
	67-	36		40		44
	66-	35	39	39	43	43
High	65-	34	38		42	
	64-	33		38		42
	63-		37		41	41
	62-	32		37		
	61-	31	36	36	40	40
	60-	30	35			39
	59-	29		35	39	
	58-		34	34	38	38
	57-	28				
	56-	27	33	33	37	37
Average	55-	26	32			36
	54-	25		32	36	
	53-		31	31		35
	52-	24	30		35	34
	51-	23		30	34	
	50-	22	29	29		33
	49-				33	32
	48-	21	28	28		
	47-	20	27		32	31
	46-	19		27		30
	45-	18	26	26	31	
Low	44-		25		30	29
	43-	17		25		28
	42-	16	24		29	
	41-	15		24		27
	40-	14	23	23	28	26
	39-		22			
	38-	13		22	27	25
	37-	12	21	21		
	36-	11			26	24
	35-	10	20	20	25	23
Very Low	34-		19			
	33-	9		19	24	22
	32-	8	18	18		21
	31-	7	17		23	
	30-			17		20
	29-	6	16	16	22	19
	28-	5			21	
	27-	4	15	15		18
	26-	3	14		20	17
	≤25-	≤2	≤13	≤14	≤19	≤16

Combined

	T	N	E	O	A	C
Very High	≥75-	≥40	≥44	≥44	≥47	48
	74-	39	43			
	73-			43	46	47
	72-	38	42	42	45	
	71-	37	41			46
	70-	36		41	44	45
	69-		40			
	68-	35		40	43	44
	67-	34	39	39	42	43
	66-	33	38			
High	65-	32		38	41	42
	64-		37	37		
	63-	31	36		40	41
	62-	30		36	39	40
	61-	29	35			
	60-			35	38	39
	59-	28	34	34		38
	58-	27	33		37	
	57-	26		33	36	37
	56-		32	32		36
Average	55-	25	31		35	
	54-	24		31		35
	53-	23	30	30	34	
	52-	22			33	34
	51-			29	29	33
	50-	21	28	28		32
	49-	20			28	
	48-	19	27	27	31	31
	47-				30	
	46-	18	26	26		30
	45-	17	25	25	29	
Low	44-	16				29
	43-		24	24	28	28
	42-	15	23		27	
	41-	14		23		27
	40-	13	22	22	26	26
	39-	12				
	38-		21	21	25	25
	37-	11	20	20	24	24
	36-	10				
	35-	9	19	19	23	23
Very Low	34-		18			
	33-	8		18	22	22
	32-	7	17	17	21	21
	31-	6				
	30-		16	16	20	20
	29-	5	15	15		19
	28-	4			19	
	27-	3	14	14	18	18
	26-	2		13		
	≤25-	≤1	≤13	≤12	≤17	≤17

Appendix 5: **List of selected words from the NEO-FFI-3 and their meanings**

Word	NEO-FFI-3 Item No.	Glossary Definition
Courteous	4	Polite and kind
Bully	9	Horrify and force people to do or Say things I want them to
Flatter	9	Compliment others untruly but only To get what you want from them
Pacing	10	Quicken
Intrigued	13	Captured and amazed by something
Egotistical	14	Concerned only with myself
Controversial (speakers)	18	People with ideas that some people strongly disagree with.
Conscientiously	20	Completely and carefully
Jittery	21	Becoming outrageous and intensely nervous
Poetry	23	Writing verses that rhyme
Worthless	26	Has no value
Cheerful	37	Happy and excited
High-spirited	37	Feeling delighted
Calculating	39	Secretly planning or scheming to get what I want
Chill	43	Feeling a shiver or shake throughout my body
Seldom	46	Not very often
Fast-paced	47	Time passing quickly with so many events and upcoming
Speculating	48	Thinking about possible answers
Considerate	49	Respect other's feelings and desires
Intellectual curiosity	53	Being attracted by things in life that challenge the mind and stimulate you to ask many questions about them
Abstract ideas	58	Purely theoretical ideas
Strive	60	Work hard, struggle and fight to achieve a goal

Appendix 6: Revised Study Process Questionnaire (R-SPQ-2F)

Name_____**ID#**_____

Age_____**Gender**_____**Date**_____

Native language_____

Country of Origin/Ethnicity_____

Grade Point Average (GPA). _____

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 box 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.

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

1. I find that at times studying gives me a feeling of deep personal satisfaction.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

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.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

3. My aim is to pass the course while doing as little work as possible.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

4. I only study seriously what's given out in class or in the course outlines.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

5. I feel that virtually any topic can be highly interesting once I get into it.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

6. I find most new topics interesting and often spend extra time trying to obtain more information about them.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

7. I do not find my course very interesting so I keep my work to the minimum.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

8. I find that studying academic topics can at times be as exciting as a good novel or movie.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

9. I learn some things by rote, going over and over them until I know them by heart even if I do not understand them.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

10. I test myself on important topics until I understand them completely.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

11. I find I can get by in most assessments by memorising key sections rather than trying to understand them.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

12. I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

13. I work hard at my studies because I find the material interesting.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

14. I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

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.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

16. I believe that lecturers shouldn't expect students to spend significant amounts of time studying material everyone knows won't be examined.

never or only rarely true of me	*sometimes true of me*	*true of me about half the time*	*frequently true of me*	*always or almost always true of me*
☐	☐	☐	☐	☐

17. I come to most classes with questions in mind that I want answering.

never or only	*sometimes*	*true of me about*	*frequently true*	*always or almost*
rarely true of me	*true of me*	*half the time*	*of me*	*always true of me*
☐	☐	☐	☐	☐

18. I make a point of looking at most of the suggested readings that go with the lectures.

never or only	*sometimes*	*true of me about*	*frequently true*	*always or almost*
rarely true of me	*true of me*	*half the time*	*of me*	*always true of me*
☐	☐	☐	☐	☐

19. I see no point in learning material which is not likely to be in the examination.

never or only	*sometimes*	*true of me about*	*frequently true*	*always or almost*
rarely true of me	*true of me*	*half the time*	*of me*	*always true of me*
☐	☐	☐	☐	☐

20. I find the best way to pass examinations is to try to remember answers to likely questions.

never or only	*sometimes*	*true of me about*	*frequently true*	*always or almost*
rarely true of me	*true of me*	*half the time*	*of me*	*always true of me*
☐	☐	☐	☐	☐

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

The responses to items are scored as follows:
A= 1, B = 2, C = 3, D= 4, E= 5

To obtain main scale scores add item scores as follows:

Deep Approach (DA) = 1 + 2 + 5 + 6 + 9 + 10 + 13 + 14 + 17 + 18
Surface Approach (SA) = 3 + 4 + 7 + 8 + 11 + 12 + 15 + 16 + 19 + 20

Subscale scores can be calculated as follows:
Deep Motive (DM) = 1 + 5 + 9 + 13 + 17
Deep Strategy (DS) = 2 + 6 + 10 + 14 + 18
Surface Motive (SM) = 3 + 7 + 11 + 15 + 19
Surface Strategy (SS) = 4 + 8 + 12 + 16 + 20