
Investigating personality types, work values and performance of B. Ed first-year students across Science and Mathematics subjects.



Celine Harilall

Supervisor: Dr Belinda Van Der Westhuizen

Co-Supervisor: Dr George Ekol

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ABSTRACT

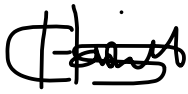
Despite continuous streams of research within education, one of the biggest challenges is academic learner performance and motivational values. If educational systems aim to better support learners, a look into who students are is required as not all learners are identical. Learners differ in personalities, values, motivations, and interests. Even though psychologists have investigated personalities and performance, there is still a lack of knowledge of the relationship between learner personalities, work values, and academic performance among university Science and Mathematics students. The aim of this study was to explore the relationship between personality traits, work values and education performance in university students.

The participants of this study included a total of 67 students at a South African university specialising in Mathematics, Chemistry, Physics and Life Sciences as well as 3 lecturers specializing in Mathematics, Chemistry and Physics. The university students were asked to complete two online questionnaires: A Big Five inventory (personality traits) and a work values inventory. The same students' end of semester academic results in their respective subjects were used as a measure of their educational performance. The relationship between personality traits, work values, and educational performance was investigated using correlational analysis. Interview data gathered from the subject lecturers were used for investigating the dominant teaching and learning approaches.

The results statistically demonstration that certain personalities (such as Consciousness, Agreeableness and Low Openness to experience) had significant correlations with academic marks and specific work values (such as Structure, Creativity, Performance, Self-development, and Altruism). The results also revealed teaching approaches adopted by lecturers in respective subjects. Implications of these findings towards improving educational performance in undergraduate degree courses in Science and Mathematics as well as extending the boundaries of research in the topic are discussed.

DECLARATION

I Celine Shante' Harilall, declare that this research report titled, Investigating personality types, work values and performance of B. Ed first year students across Science and Mathematics subjects' is my own work and has not been submitted before for any degree or examination at another University. The research report is submitted for the partial fulfilment of a Master's degree in Science Education at the University of Witwatersrand, Johannesburg, South Africa.

A handwritten signature in black ink, appearing to read 'C S Harilall', is positioned above a horizontal line.

C S Harilall

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CHAPTER 1: BACKGROUND OF THE STUDY

Introduction

In order to understand how students and pre-service teachers (PST) learn, it is crucial to understand what motivates them and how their personal attributes (e.g., personalities and values) may relate to their incentives and learning (Decker and Rimm-Kaufman, 2008). Personality traits have become some of the most important predictors of academic performances and work outcomes (Chamorro-Premuzic, and Furnham, 2003; Dilchert, Viswesvaran, and Judge, 2007; Van Aarde, Meiring and Wiernik, 2017). The Big Five personality traits are associated with preferred learning styles and can be an indicator of academic performance (Komarraju, Karau, and Schmeck, 2009).

This study allowed the investigation and exploration of the relationship between students' educational personalities and academic performance, and what this relationship is. With these findings, it might be possible to make recommendations regarding teaching approaches used in first-year pre-service science education delivery.

1.1 Context

There is a need for an increase in South African higher education graduates who possess the capability to adapt and function in a knowledge-dependent society and economy (Council on Higher Education (CHE 2010). In order to improve the growth and transformation of a country, raising the number of graduates can be a positive contribution (Gordhan, 2017). With this in mind, the improvement of graduation, throughput and retention rates in South Africa high education is a national priority with various research studies in both residential and distance tertiary institutions (Sikhwari, Maphosa, Masehela and Ndebele, 2015).

One of the best predictors for academic competence are students' final examination marks (Alyahyan and Düşteğör, 2020) at the end of first-year university (Pascarella and Terenzine 2005 in Decker and Rimm-Kaufman, 2008). A student's coursework mark is usually (or perhaps only) the first indicator of their level of success in that subject and if they will continue in the study of the subject (Borg and Stranahan, 2002), as it is important to understand how these marks are achieved in terms of practices as well as management goals.

The university that formed the context of this study had stated the importance of increasing academic success as an institution-wide priority as well as its 2020 - 2024 teaching and

management plan (2019) recognizing the importance of effective academic support and practice in addition to the diversity and flexibility of these learning opportunities.

1.2 The Background and Problem Statement of the Study

Within current global education systems, there is certainly room for evidence and answers of teacher preparation on future teacher quality (Decker and Rimm-Kaufman, 2008). Apart from attendance being a mandatory factor of throughput pass rates, an important factor is if students are compelled to make an effort and if they are sufficiently self-disciplined to study without being coerced.

The high dropout rates and slow progression of students are displayed as complex, persistent challenges and allegedly intractable crises within South African Universities. These high dropout rates or slow progression of students from previously disadvantaged population groups can result in further racial and socioeconomic disparities among future generations (Bokana and Tewari, 2014). However, even if there are available resources and satisfactory minimum requirements by national quality agencies, it does not guarantee good academic performance (Yusufu, 2012).

According to a South African accounting study by Steenkamp, Baard and Frick (2009) among first-year student's success, the main factors attributing to the prohibition of student success were lack of motivation, time management, lack of self-discipline, concentration, not asking for help, possessing a negative attitude, concentration, and subject interest, making unnecessary errors. Factors that prompted student success were hard work, practising the work, using mentors, asking for help, attending tutorials, self-motivation. These factors are consistent with Duff, et al.'s (2004 in Steenkamp, Baard and Frick, 2009) belief that a learning approach is a subset of personality that forms a determining factor in student success.

Students' test scores have been utilized in research studies to measure educational outputs, however, there are different study choices for measuring the inputs. For example, as inputs, Heuchert, Parker, Stumpf, and Myburgh (2000) had included personality similarities and differences amongst South African universities racial groups to compare these results with the United States college students.

This current study's research focuses on the contributions of the previous personality and work ethics frameworks as inputs for correlations to academic outputs of student achievements. A learner's intellectual ability does not form the primary factor for academic performance

because it also depends on the learner's preferred learning style (Kolb, 1984 in Siddiquei and Khalid, 2018). There is a need to investigate how university PSTs learn in order to successfully improve knowledge development and learning (Decker and Rimm-Kaufman, 2008).

There is a changed nature within students in higher education as they become more of participants, consumers and contributors to the learning process that is ever-evolving (Jaques, 1990). For example, various students in Steenkamp, Baard and Frick's (2009) study indicated that certain subject classes are 'boring' or that some compulsory courses are provided in large classes that can result in negative attitudes towards the subject or a lack of motivation (Lucas and Meyer, 2004 in Steenkamp, Baard and Frick, 2009). Thus, the foundations for a positive perception of teaching and learning are emphasized by a good rapport between lecturers or teachers and their students. In order to make this change, there is a need for inspecting the learning process of the student.

The research questions that guided my study are represented below:

Table 1.1: Research questions and methodology to answer research questions

RESEARCH QUESTIONS	METHODOLOGY
MAIN RESEARCH QUESTIONS	
What is the relationship between personality traits, work values, and educational performance among students taking B.Ed degree courses in Sciences and Mathematics?	The sub-research questions assist in the methodology.
SUB-RESEARCH QUESTIONS	
i) What is the distribution of the various personality types of first-year students who enrol in the B. Ed degree courses in Sciences and Mathematics?	Online personality questionnaire <i>discussed in chapter 3.</i>
ii) What is the distribution of work values in first-year students who enrol in the B. Ed degree courses in Science and Mathematics?	Online work values questionnaire <i>discussed in chapter 3.</i>
iii) What is the correlation between students' personality traits and their academic performance in first-year Sciences (Natural Sciences) and Mathematics courses?	Marksheet 3 <i>discussed in chapter 3.</i>
iv) What is the correlation between students' work values and their academic performance in first-year Sciences (Natural Sciences) and Mathematics courses?	Marksheet <i>discussed in chapter 3.</i>
v) What are the dominant teaching and learning approaches students taking B.Ed degree courses in Sciences and Mathematics exposed to? Are the teaching approaches identical, similar or the same across all subjects?	Semi-structured interview <i>discussed in chapter 3.</i>

1.3 Rationale of the Study

According to the participating University's current teaching and management plan (2019), one of the main foci which are aligned to the department of higher education's national initiatives is to support and strengthen academics in their role as university teachers. This means that this research has the potential to move beyond the aim of assisting university students and future PSTs, but also extends towards potential academics who may be university teachers.

Ahadi and Narimani's (2010) study revealed that students pursuing their educational goals have many challenges to deal with, such as the effect of students' educational behaviour being crucial to their emotions. Research investigations such as Ahadi and Narimani (2010) have insisted on the need to investigate motives related to educational behaviours and excitations based on characteristics of a dominant personality.

The transitioning stage of students from high school to higher education can be difficult and often described as a 'culture shock' (Pascarella and Terenzini, 1991 in Callaghan and Papageorgiou, 2020), because of the new personal, academic, and social demands which can result in poor academic performance or dropouts (Woollacott, Snell and Laher 2013). Part of these challenges can be adjustment difficulties due to a lack of social integration (Wilcox, Winn, Fyvie and Gauld 2005 in Callaghan and Papageorgiou, 2020). Certain first-year students may have little work-life expectations that are related to training for a career (Grönvall and Lehtinen, 2016 in Callaghan and Papageorgiou, 2020), hence if there are personal adjustments made, it can be functional and contribute to continuous tertiary studies (McCrae and Costa, 1986 in Callaghan and Papageorgiou, 2020). There is a need to investigate first-year students' work values and personalities for accommodating these characteristics and working styles in further research.

The study of PSTs is particularly important as PSTs shall not only get to know about themselves but also have a stance for helping their future students get to know who they are as well and better support them. People vary in degrees to which they meet multilevel demands academically or even personally in extracurricular activities and personality characteristics are important predictors in this ability.

There are various individual characteristics that contribute to personality beliefs and values: level of education, level of future working plans (e.g. career plans of where to work, in this specific research it would be PST plans of teaching in the foundation phase, senior primary or

further education training), previous working experiences, whether or not teaching is only a first step to other career options, personal experiences, and social histories. This means that a person's beliefs, values, and goals can contribute to their personality traits.

In order to guide the personality part of this study, The five-factor model (FFM) or referred to as the "big five" personality model is chosen. The FFM or "big five" personality model has been widely utilized for explaining personality structures and is a vastly accepted theoretical framework. This model has been demonstrated to be universally applicable across cultures (McCrae, 2002 in Callaghan and Papageorgiou, 2020). The FFM model and work value traits that guide this study are led by an independent academic and work research assessment company known as 123test® (123test.com).

Performances of certain activities are influenced based on who a person is and their differences (Callaghan and Papageorgiou, 2020). In turn, personality is dependent on individual behaviour, attitudes, interpersonal, experiential, emotional styles, and motivation. Recently, researchers began to acknowledge that self-discipline and grit move beyond an intelligence quotient (IQ) for explaining academic success, but it is also an individual's work drive hence the reason for the research also investigating the work ethic values embedded within PSTs in the Science division.

There are a vast number of studies that have investigated relationships between personality traits and related concepts, however, there is little research available that emphasizes the relationship between personality traits, learning styles, and academic achievement (Casi, Roberts and Shiner, 2005 cited in Siddiquei and Khalid, 2018; Köseoglu, 2016) and an even scarcer within Southern Africa- specifically amongst STEM subjects. In addition, there is the effect mediation and learning styles have on personality traits and on academic performance (Köseoglu, 2016). This study, therefore, provides information and research that sheds light on the importance of individual differences, personality traits, and learning styles for the purpose of improving academic performance.

Steenkamp, Baard and Frick (2009) claim that there are numerous studies providing general information about students entering higher education institutions. However, many of these studies focus on accounting students' approaches to learning. According to Steenkamp, et al. (2009) in a first-year accounting study at three different South African universities, their studies focused on casual relationships between students prior to school performance and predictors

for future success in addition to finding that previous studies did not take into consideration students' personal perceptions for succeeding in universities.

Van Aarde, Meiring and Wiernik (2017) claim that there is no comprehensive meta-analytic study to examine the validity of personality traits within the South African context which is a great limitation for researchers and practitioners within South Africa as there are diverse cultural, economic, and practical features within South Africa.

Even though there may have been research studies investigating student's personality traits (Callaghan, and Papageorgiou, 2020; Kok, and Meyer, 2018; Vogt, and Laher, 2009) there appears to be limited studies investigating student's work values and none on account of these jointly investigating learning styles, especially within South African contexts.

1.4 Significance of Research Report

This study aims at investigating first-year students -specifically PSTs majoring in Life Sciences, Physics, Chemistry and Mathematics – on their perceptions of their personality traits and work values that influence their academic success in a South African university.

If dominant factors are identified that influence student learning, it may contribute to formulating policies of more effective teaching and learning amongst PSTs. It may even extend to (Science, Technology, Engineering, Mathematical) STEM-related subjects within these PSTs classrooms and in university settings in order to improve performance at introductory levels and increase throughput rates of the curriculum. This research report will conclude with brief recommendations regarding Science and Mathematics education at the tertiary level in South Africa.

Even though this research report is not generalized beyond the scope of this study, the information gathered may provide valuable information to first-year lecturers and program coordinators. This research report may open pathways for further research intervention programs to occur. Therefore, this study intended to serve as preliminary research of encouraging individualised differences in personality traits, and learning styles to achieve academic success. In addition, this study aimed to be a foundation for not only investigating and addressing learners' differentiations but to assist in maximizing their learning by possibly informing teaching practices.

Furthermore, this research report was beneficial to the participants of the study when the students were required to complete the personality and work values inventory because individual feedback was provided. These student participants gained insights for learning how to get to know themselves better and learned how to help support them futuristically.

Chapter Summary and Outline of the Research Report

Chapter one provides a brief overview of the study. Chapter two shall provide theoretical frameworks and a literature review from previous studies that appends globally from other countries as well as investigations conducted in South Africa.

Chapter two shall provide theoretical frameworks and a literature review from previous studies drawn locally from South Africa and studies obtained from sources outside of South Africa. Chapter three shall discuss the methodology and methods adopted to conduct this study. This chapter shall also explain the research paradigm and the selected analytic approach. Chapter four will provide the quantitative results from the participants of the study, the data analysis finding and discussions. Chapter five shall provide a summary of how the collected data answers this study's qualitative research questions. The chapter shall continue to provide recommendations and curriculum structures for how lecturers and teachers can better support students.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Introduction

This study's conceptual framework and brief reviews of selected literature will be considered in this section. The literature selected shall provide key concepts, controversies, and commentary on existing gaps within the current literature.

2. 1 Conceptual Framework

The conceptual framework in Figure 2.1 represents the key concepts, the thought process, and the outline behind this study's research. The study utilized two aspects, namely personality traits and work values. The five-factor model (FFM) personality traits include the most common personality traits found within individuals: openness (O), Neuroticism (N), Extraversion (E), Conscientiousness (C), Agreeableness (A). From the variety of work values that exist, the following have been selected: Creativity, Variety, Structure, Self-development, Performance, and Altruism. Dominant personality traits and work value traits influence the learning style of a person because of the connection to their interests, drive, and motivation (Parks and Guay, 2009). Thus, an alignment to a person's FFM personality traits and work values to their learning style is associated with high academic performance, motivation, and effective learning (Parks and Guay, 2009).

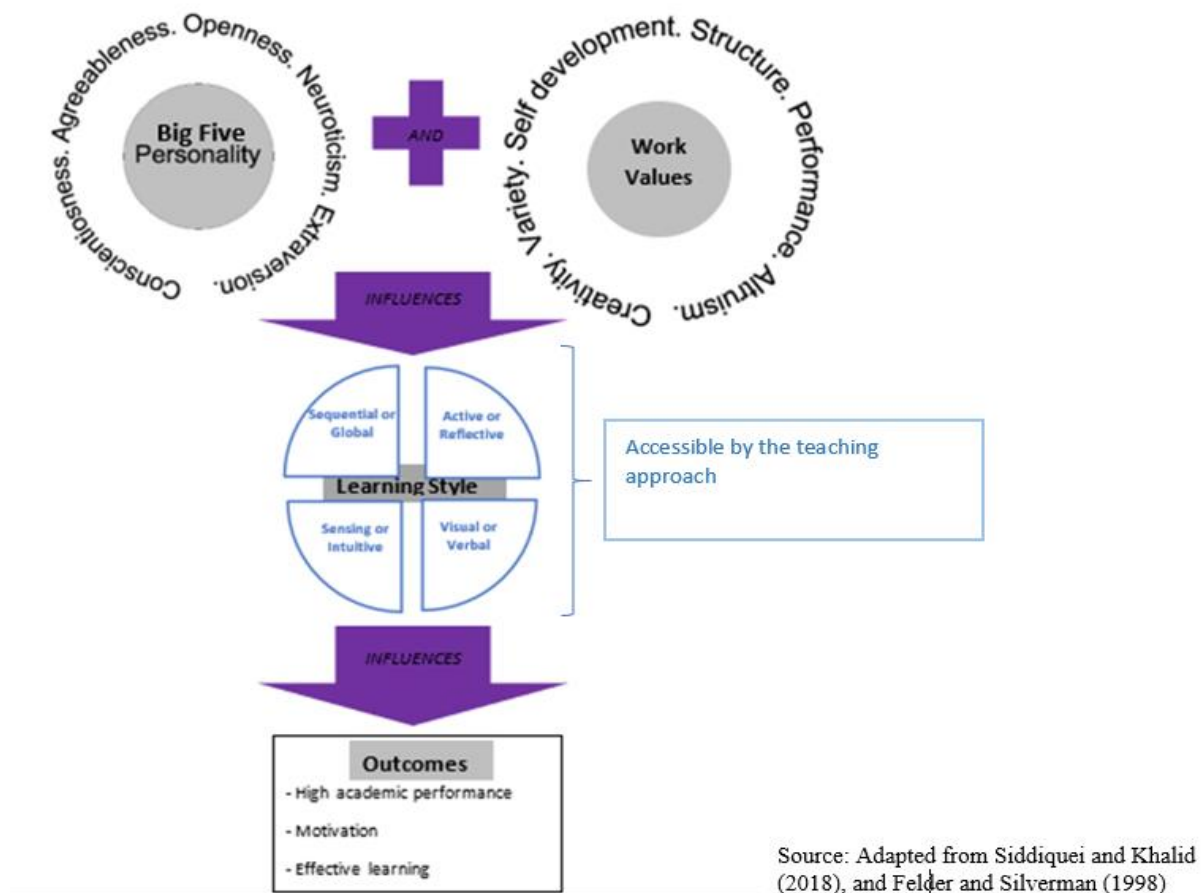


Figure 2.1 The connection of personality and work values to learning style dimensions, teaching approaches and outcomes

Figure 2.1 represents this study's conceptual framework of the role and position personality traits and work values have on learning styles, teaching approaches and their outcomes (Siddiquei and Khalid, 2018).

2.2 Key concepts, Theories, and Studies

Personality terms:

The term personality refers to personal differences in how we think, behave and feel. It combines unique characteristics and qualities that make a person who they are across situations and contexts. A personality is a fundamental aspect of our interaction and understanding of the world (Vedel and Poropat, 2017).

One of the greatest changes in personality research was the shift to the Five Factor Model (FFM) of personality (John and Srivastava, 1999 in Decker and Rimm-Kaufman, 2008). In this model personality traits are placed into five categories: “Neuroticism (anxious, self-conscious), Extraversion (talkative, social), Openness to experience (independent, curious), Agreeableness (altruistic, sympathetic), and Conscientiousness (determined, reliable)” (Decker and Rimm-Kaufman, 2008, p.47).

Five Personality Factor Model

In this research, students’ personality traits are described through the framework of the Five Personality Factor Model (FFM) (Costa and McCrae, 1992). Goldberg (1993) as well as Siddiquei and Khalid (2018). The FFM is defined from various perspectives, and according to Siddiquei and Khalid (2018), the FFM represents fairly fixed features of an individual. Generally, personality features are inherent features and are usually considered static if conscious efforts are not established (Verma and Sheikh, 1996 in Siddiquei and Khalid, 2018). The FFM personality traits are categorized into Openness to experience, conscientiousness, extraversion, Agreeableness, and Neuroticism (Goldberg, 1993 in Siddiquei and Khalid, 2018) (See figure 2.1). Another way that the FFM traits are characterized by Saucier and Goldberg (1998) is by five factors: Factor I (extraversion), Factor II (Agreeableness), Factor III (conscientiousness), Factor IV (emotional stability vs Neuroticism), and Factor V (intellect vs imagination).

The character trait - Openness to experience - is delineated as being imaginative, intellectually curious, and holding unconventional beliefs. If there are individuals that have a high score on this trait, it is likely that they are more creative, independent-minded, adventurous and possess the ability to think outside the box (John and Srivastava, 1999; Siddiquei and Khalid, 2018). Openness to experience also consists of traits such as inventive thinking, innovativeness, flexibility, idealism (Bozionelos 2004 in Callaghan and Papageorgiou, 2020). If there are individuals with a low trait score on this it may be more likely to be conventional and struggle with abstract thinking (John and Srivastava, 1999 in Siddiquei and Khalid, 2018). Openness to experience is strongly related to a learning goal orientation. A learning goal orientation in itself is associated with academic performance (Payne, Youngcourt, and Beaubien, 2007 in Vedel and Poropat, 2017).

The conscientiousness personality trait is identified as being thoughtful, having a tendency to control impulses by being responsible or orderly, behaving in ways that are socially acceptable

or that facilitate a goal-directed behaviour (John and Srivastava, 1999; Siddiquei and Khalid, 2018; Vedel and Poropat, 2017). Conscientiousness is largely connected to effort and control and retention (Poropat, 2016 in Vedel and Poropat, 2017).

Within an educational context, the conscientious trait leans more towards a student learning process which includes factors such as persistence (Komarraju and Karau, 2005 in Vedel and Poropat, 2017), achievement motivation (Richardson and Abraham, 2009), class attendance (Chamorro-Premuzic and Furnham, 2003; Conard, 2006 in Vedel and Poropat, 2017), and use of self-regulatory learning strategies (Bidjerano and Dai, 2007; McKenzie, Gow, and Schweitzer, 2004 in Vedel and Poropat, 2017) than their non-conscientious counterparts. Overall, certain behaviors of the conscientiousness trait generally enhance one's academic performance who tends towards this category and as a result, this trait group are more likely to successfully complete their chosen educational programs (Vedel and Poropat, 2017).

The Extraversion personality trait is depicted as sociable, talkative, friendly, cheerful, emotionally expressive (John and Srivastava, 1999). If an individual scores high on this trait, then they have a tendency to generally be outgoing and receive energy in a social setting. Extroversion is associated with enjoyment of an activity/stimulation and interpersonal interactions (Vakola, Tsaousis and Nikolaou 2003 in Callaghan and Papageorgiou, 2020). Extraversion relates to coping mechanisms of positive thought and rational action choices (McCrae and Costa 1986 in Callaghan and Papageorgiou, 2020).

An Agreeable personality dimension contains characteristics which are good-natured, helpful, considerate, trustworthy, and does not hesitate to sacrifice their interests (John and Srivastava, 1999; Siddiquei and Khalid, 2018). The Agreeableness personality is associated with being compassionate in interpersonal interactions (Vakola, Tsaousis and Nikolaou 2003 in Callaghan and Papageorgiou, 2020). Agreeableness correlates with being sympathetic, affectionate, kind, caring, and friendly (Saksvik and Hetland 2009 in Callaghan and Papageorgiou, 2020).

A person who has a high score on the Neuroticism personality aspect has a tendency to experience anger, emotional instability, sadness, be easily upset, and a variety of negative emotions (John and Srivastava, 1999). Neuroticism is related to coping mechanisms of hostile reactions, loss or challenges, fantasy thought responses in threatening situations, and passivity (McCrae and Costa, 1986 in Callaghan, and Papageorgiou, 2020).

Overall the above personality traits influence a person's motivation and facilitates their learning behaviours. This means that personality traits such as the FFM act as an intermediary to a person's learning style (Ibrahimoglu, et al., 2013; Marcela, 2015).

Learning

A broad definition of learning is, "... any process that in living organisms leads to permanent capacity change and which is not solely due to biological maturation or aging" (Illeris, 2007, p.3). The fundamental processes and actions of learning include content, incentive, individual acquisition, interaction, and the environment. The content aspect is about what is learned - described as knowledge or skills and may include opinions, attitudes, meanings, insights, strategies, behavioural ways, etcetera. It is the learners' task to construct meaning and has the ability to address the challenges of practical life for developing personal functionally. Illis (1994) states that this aligns to the constructivist approach. The constructivist approach was initially developed by Piaget (1953) and continuously is expanded on. This learning theory focuses on an individual's cognitive processes. The social cognitive theory and sociocultural theory were introduced by Vygotsky (1978) which focuses on social interactions, communities, and cultural identities (Penuel and Wertsch, 1995). The behaviourist theory emphasises the physical environment's influence on eliciting behaviours based on incentives, stimuli, and responses (Moore, 2011). These learning theories will not be the focus of this study but have been discussed because they indirectly form the foundations of various learning styles.

To elaborate on the role of incentives -that constitutes part of the behaviourist theory- provides and directs the required mental energy for the learning process to take place. This strand consists of feelings, emotions, motivation, and volition. The incentive secures the learner's continuous mental balance and develops personal sensitivity.

The incentive and content dimensions are instituted by impulses from interaction processes to be integrated within internal processes of acquiring and elaborating. These two areas are always involved in the learning process unless there are cases of severe brain damage (Damasio, 1994 in Illeris, 2007) The learning content follows the incentive -e.g. if learning is led by desire, compulsion, necessity, or interest. New information has the ability to change incentives meaning it is not constant. This means that learning is driven by interests, desires, necessities or compulsions. The content and incentive dimensions are dependent on the interactive process between the student and the cultural, social, and material environment. Thus, Illeris (2007) claims that if the interaction in a learning session is not acceptable or adequate to the students,

learning may be hindered as something different shall be learned or a negative impression on the instructor or subject is created. This implies the cognitive and emotional connection that various psychologists have been aware of (Vygotsky, 1978; Fruth, 1987 in Illeris, 2007).

In an educational institute, the focus is mainly on learning the content, however, the incentive function plays a crucial role. For example, how a learning situation is experienced, what feelings and motivations are involved resulting in the nature and mental strength of energy being mobilized. Values and durability are also closely related to the incentive dimension in the learning process (Illeris, 2007). Illeris (2007) terms these as three dimensions or triangle of learning: within learning there is the content, the incentive and the environment or interaction. Learning consists of internal (psychological) and external (social, cultural or material environment) processes. The content domain refers to what is learned- the knowledge, skills, insights, opinions, values, attitudes, strategies, and methods. The incentive dimension provides and directs the required mental energy for learning. These consist of elements such as motivation, feelings, emotions, volition. Its main function is to maintain a learner's mental balance or develop personality sensitivity. These two dimensions (incentive and content) are always initiated by impulses from the environmental or interaction processes that are now integrated in the internal process. This interaction dimension initiates the learning process through experience, imitation, transmission, perception. Thus, without the incentive, the learning process cannot commence nor will the learning pattern or style.

Learning styles

Learning styles accompany the notion that each student has his/her own individual way of learning which is termed as "learning style" (Siddiquei and Khalid, 2018) which shall form another theoretical framework in this current study influenced by personality traits and value incentives.

A learning style depicts how information is processed through different types of intelligence such as language, spatial representation, logical-mathematical analyses, musical thinking, understanding other individuals and ourselves in addition to the use of the body to solve problems or make things (Köseoğlu, 2016). Contrarily, there are differences of the strength of these intelligences, how they are invoked and combined amongst individuals to complete tasks (Synder, 2000 in Köseoğlu, 2016). Individuals' personal learning styles are developed based on these particular combinations of strengths and intelligence for the aim of academic achievement (Köseoğlu, 2016).

Learning styles have been part of the focus of various research studies and as a result, various definitions, interpretations, models, and theoretical positions have been constructed for individuals' learning differences (Cassidy, 2004 in Köseoğlu, 2016). As a result, various researchers have who have conducted research on the FFM personalities have utilized similar models of learning styles. For example, the research study by Siddiquei and Khalid, 2018) - that influenced this study's conceptual framework layout- which investigated the relationship between personality traits, learning styles, and academic achievement of e-learners in Pakistan at Beacon House National university had utilized and adapted the Felder and Silverman (1988) learning style, model. Felder and Silverman (1988) introduced four dimensions of learning styles that individuals prefer to perceive (sensing-intuitive), process (active-reflective), receive (visual-verbal), and understand (sequential-global) information.

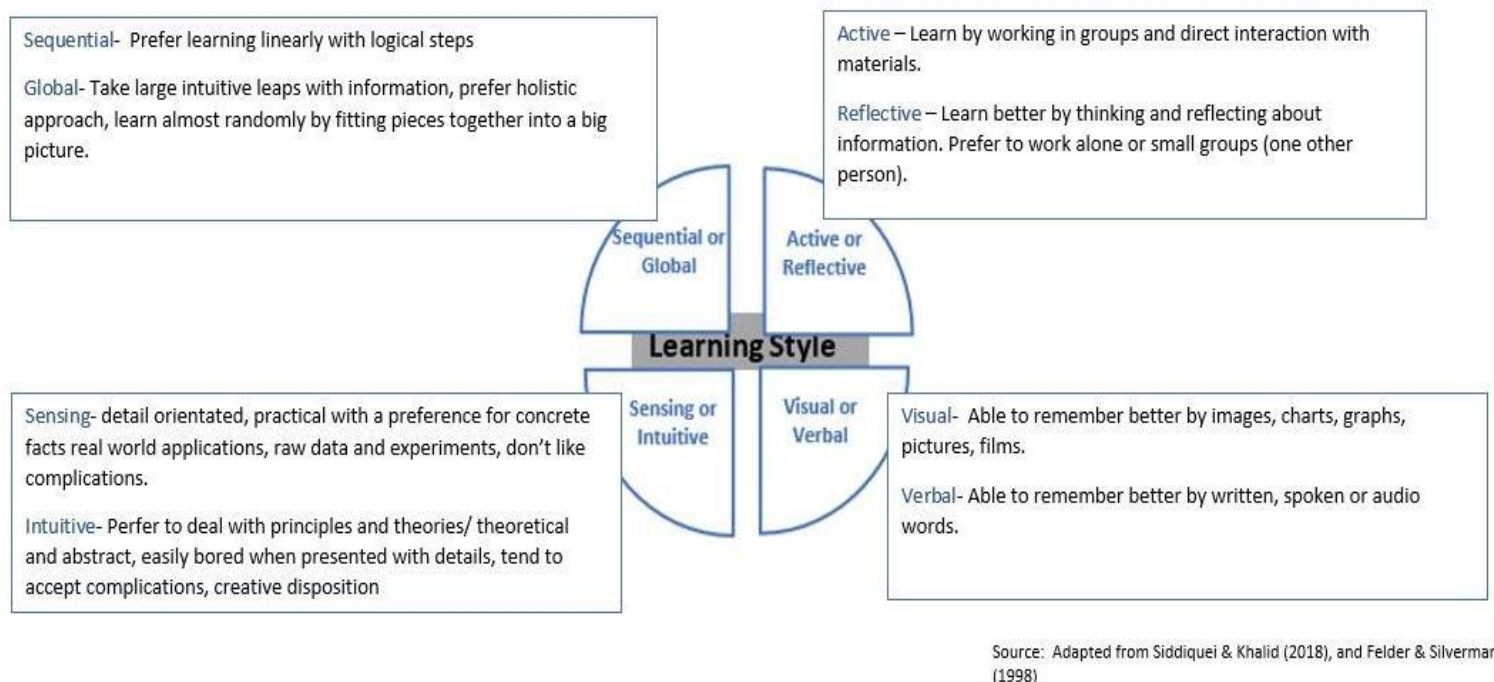


Figure 2.2: The four dimensions of learning styles (Adapted from Siddiquei and Khalid , 2018; and Felder and Silverman ,1998)

Figure 2.2 above represents a diagrammatic explanation of the four learning styles (Siddiqui and Khalid, 2018; Felder and Silverman, 1998). These four learning styles and approaches are: sequential or global, active or reflective, sensing or intuitive and visual or verbal. Based on figure 2.2, a sequential approach and learning style has logical steps while global refers to a holistic approach. The active approach refers to working in groups with materials while the

reflective refers to working individually or in small groups. The visual approach is through the utilization of charts, diagrams, videos (Siddiquei and Khalid, 2018).

A proposition by Köseoğlu (2016) is that some students undertake agentic processing to perform on tests while others assume reflective and deep processing for understanding and if students are likely to deeply reflect on information then it is likely that they shall retain it longer.

In a Turkish study that investigated the extent that FFM and learning styles predict academic achievement at Bahçeşehir University, İstanbul by Köseoğlu (2016): 202 undergraduate students from various departments participated. The results revealed that reflective learning styles partially mediated the relationship between openness and academic success. Conscientiousness personality trait related positively to all four learning styles as well as had the strongest link to the Grade point averages (GPA). The findings from the study revealed that students who worry a lot (Neuroticism) were less likely to find meaning in what they were learning and in turn less interested in the learning process than their counterparts.

Unlike Siddiquei and Khalid's (2018), Köseoğlu (2016) instead utilized the Schmeck, Ribich, and Ramanaiah (1997) learning style model. These four learning styles were: fact retention (processing of information for main concepts to be memorized), methodological (being careful and meticulous), elaborative (adding new information to current knowledge), and synthesis analysis (denotes processing knowledge, categorizing and organizing the information into hierarchies). From this proposition of learning styles, different intellectual styles have had their preferences in acquiring knowledge in literature (Zhang, 2003; Sternberg and Zhang, 2001 in Köseoğlu, 2016). An argument has been proposed by Bartling (1988); Jakubek and Swenson (1993) that students should employ more complex approaches that necessitate and invoke deeper processing as they progress from the first year to last. Personality and learning style approaches thus have defining roles in academics (Köseoglu, 2016).

Academic Performance based on Personality traits

Apart from the FFM personality traits playing a causal role for improving academic performance, the FFM personality traits can also predict academic performance (O'Connor and Paunonen, 2007; Trapmann et al., 2007 in Siddiquei and Khalid, 2018). During reviews in the twentieth century, it was critiqued that research on personality and academic performance results were inconsistent and challenging to interpret due to inconsistent approaches and personality measurements (De Raad and Schouwenburg, 1996; Vedel and Poropat, 2017). This

was where De Raad and Schouwenburg (1996 in Vedel and Poropat, 2017) argued for a consistent personality framework to be adopted by making use of the FFM. The widespread FFM in educational research has led to the recognition of reliable and important estimates of the role of personality in education.

Conscientiousness and grade point averages were found to be connected to each other. Kappe and van de Flier (2010 in Siddiquei and Khalid, 2018). The conscientiousness claim is attributed to Wang, Jia, Chen, Lu, Liu, Yang, and Zhang (2017) who reported that conscientiousness positively related to students' physics scores. Conscientiousness is associated with self-discipline, organization, responsibility, having a forward looking and thorough approach (Grieve and Van Deventer 2005 in Callaghan and Papageorgiou, 2020). Individuals who score higher in conscientiousness could be expected to perform better in varying performance domains and be relatively more active than Neuroticism in adopting to challenges (Callaghan and Papageorgiou, 2020).

Openness to experience is related to academic performance. Even though this study is mostly centred in a tertiary institution, Openness to experience and conscientiousness are almost as equally effective for statistically predicting academic performance (Poropat, 2009 in Vedel and Poropat, 2017). However, interestingly Openness to experience and conscientiousness more closely connects with academic performance than intelligence in secondary and tertiary education (Poropat, 2014 in Vedel and Poropat, 2017). Since openness follows a goal-orientated learning, and goal orientation is also in itself related to academic performance, thus the reason for openness leaning towards academic performance. Openness to experience follows an adaption advantage as it can possibly support students' adjustments from tertiary education systems.

These motivational aspects with the Openness to experience trait does not only affect a student's short term academic outcome but also predicts their overall educational attainment as individuals with a high Openness to experience are likely to experience high educational levels throughout their lives (Crosta, et al., 1986 in Vedel and Poropat, 2017).

The Agreeableness personality trait corresponds with accommodation and cooperative attitudes. Thus, the agreeable student has a desire for 'getting along with others (e.g., the tutors, lecturers, teachers, parents) and results in academic motivation and behaviours aimed at improving academic performance (Vermetten, Lodewijks, and Vermunt, 2001 in Vedel and

Poropat, 2017). Thus Agreeableness is associated with self-improvement, persistent academic motivation, grades orientation, interest in self-improvement (Komarraju and Karau, 2005 in Vedel and Poropat, 2017).

The self-rated Agreeableness aspect within the FFM also has a positive correlation with academic performance (Poropat, 2009; Richardson et al., 2012 in Vedel and Poropat, 2017). Since agreeable is associated with extrinsic types of academic motivation -the more agreeable students tend to identify with and combine socially accepted values met in academia- it leads these students to value academic achievement and performance because it leads to socially accepted values within educational settings (Clark and Schroth, 2010; Komarraju et al., 2009 in in Vedel and Poropat, 2017). This results in a tendency to employ more self-regulatory learning strategies, styles such as time management, regulation on effort, fact retention, and elaborative processing. (Bidjerano and Dai, 2007; Komarraju et al., 2011 in Vedel and Poropat, 2017). These motivation factors assist in explaining why agreeable has a positive and strong link with academic performance

Although Extraversion only has a minimal correlation with academic performance, it has strong relationships with self-rated extraversion within primary and secondary education. Vedel and Poropat (2017) note that care should be taken to avoid over-interpreting the term ‘modest or minimal association with extraversion and academic performance. However, an Extrovert's sociability, assertiveness, and active engagement with their social environments could be beneficial for learning as it consists of frequent interactions with teachers or peers because Extroverts are better at seeking help from peers and instructors if they encounter learning challenges. This results in an increased understanding and becoming visible to the instructor. This can have a positive relation to academic performance.

Conversely, the same sociable Extroversion characteristics in a social environment can also constitute a challenge for this type of student. Even though a student scored high on Extroversion and may be generally more academically motivated and goal-oriented in higher learning (Clark and Schroth, 2010; Payne, Youngcourt, and Beaubien, 2007 cited in Vedel and Poropat, 2017), they are also driven to participate in societies and events, explore social environments, spend time with friends or other social activities. It is hypothesized this sociability-induced distraction may explain why academic performance is lower at higher academic levels as there is more responsibility on students for their own learning (Vedel and Poropat, 2017).

There has been previous research that associated Neuroticism with academic performance (Furnham and Medhurst 1995; Furnham and Mitchell 1991 in Collaghan and Papageorgiou, 2020). Collaghan and Papageorgiou (2020) hypothesized that higher levels of Neuroticism could negatively affect accounting students' performance or disproportionality present difficulties if there are adjustment processes involved. It may also explain why higher academic levels are less likely to affect students' academic performance than those at lower levels.

According to a University study by Köseoğlu (2016) in Istanbul, Türkiye where 202 university students completed the FFM personality traits questionnaire and the Inventory of Learning Processes Scale and self-reported their grade point averages: the results revealed that Agreeableness and Conscientiousness of the four FFM personalities related positively to all four learning styles (synthesis-analysis, methodical study, fact retention, and elaborative processing. However, Neuroticism had a negative relationship with all four of the learning styles. Moreover, extraversion and openness had a positive effect on elaborative processing. This implies that when personality traits are appropriately jointly used, satisfactory course performance can be predicted (Paunonen and Ashton, 2001 in Köseoglu, 2016).

According to a South African study by Callaghan and Papageorgiou (2020) that investigated students' personality, gender, and student performance at a South African University that involved 1380 first and second-year accounting students, the findings from this study revealed that fewer students with the traits of openness and Agreeableness would continue with second-year accounting studies. The Consciousness trait could not be a primary differentiator of performance in the first year but in the second year, it dominates more as a predictor in academic performance (Callaghan and Papageorgiou, 2020).

Further results from Callaghan and Papageorgiou's (2020) study revealed that in men, openness and conscientiousness were positively and Agreeableness negatively related with first-year performance, however, this was not the same for women, as Neuroticism was the only dimension that associated with performance negatively - similar to what has been discussed earlier in this chapter. This study further concluded that men who were higher in Agreeableness were more vulnerable to have poor performance in the second year. In addition, the study also concluded that might be the key to student performance in the second year. This study also claimed to be first to provide evidence for personality effects relating to account study continuance, gender and performance and invites further research in order to better understand these causal differences and reasons.

Work values definition

Values are described as desirable conceptions (Parks and Guay, 2009). Work values are a representation of our association with what we want to achieve through our careers and work (Šverko, 1999). According to Parks and Guay (2009), values consist of an evaluative aspect that the notion of personality lacks because personality can relate to what a person would naturally tend to do whereas a value would be what a person believes they should do. Values can also be slightly more dynamic than personality traits because a value structure could change when exposed to new environments yet a personality trait could be stable over an entire lifetime (Parks and Guay, 2009).

Part of this study's instrument (known as 123 tests.com briefly mentioned earlier in chapter 1 and later discussed in chapter 3) conceptualizes fourteen fundamental work values (123test.com) as follows:

Autonomy - being able to work with content to perform one's own chosen way.

Creativity - people scoring high on this work value are more eager to use their imagination and gain satisfaction from devising new original things.

Variety - this entails usually working on various things simultaneously or sometimes adventurous or exciting work. If there is a low score by people on this work value, they are more likely to appreciate regularity and consistency in their work as they deem these things more important. There is also a clear connection between work values Creativity and work values variety, thus a high score on one can correlate to a high score on the other. People who engage in a varied work type are required to have sufficient flexibility.

Self-development - consists of ambition to further develop personally and professionally. There are plenty of ways that interest and desire to develop oneself can arise, for example, to develop new skills, acquire general knowledge, or grow in your field of expertise. Another way to develop is by looking for a challenge within the personal sphere, for example, a desire to discover new sides of oneself and get the best out of yourself. Self-development takes time, energy and effort thus implying a requirement of time. Even people who score low on this value, still attach some importance to development.

Structure - This includes work of fixed routines and activities. People who have a high score value knowing where they stand, what they have to do, set clear rules and prefer set

frameworks, clear rules and prevent unexpected lack of clarity. People who score high on this also think that somebody else is dictating what they have to do.

Security- This refers to one's job or future security, people who have little attachment to this value have less difficulty with lack of clarity regarding the future of their job or temporary contract.

Influence- this involves what work one does and what others do to influence them in turn.

Prestige- This work value is associated with other terms such as: ambition, drive, performance or motivation.

Performance - In this specific context value is assigned to the work where a person's individual performance and ambition is rewarded. This can include a positive performance review, reward or satisfaction for one to demonstrate their capabilities.

Financial Reward - This work value refers to the monetary amount or earnings.

Work-life Balance- It refers to whether work can be combined with one's personal life or striking a definite balance between work life and personal life.

Working conditions- A pleasant work environment would consist of efficient equipment, appropriate atmosphere and spaces.

Work relationships - This refers to the social atmosphere and social contact.

Altruism - Helping others and being of service to them are people who hold this work value are in action and favor of.

In the context of this specific study, 6 out of the 14 work values have been selected to form part of the conceptual framework: Variety, Self-development, structure, performance, Altruism, and Creativity. These specific work values were selected because these 6 have relations to the FFM personality traits as well as learning styles that are also part of this study's conceptual framework (Figure 1.1) and part of a study by Roccas, Sagiv, Schwartz, and Knafo (2002) conducted at an Isreal University amongst psychology students to find the spearman correlation between values and the five-factor personalities. The results revealed that the Openness to experience personality had a positive correlation (0, 33) with stimulation values, universalism (0,47), self direction (0,48) and were negatively correlated with conformity (-

0,34), security (-0,29), tradition (-0,29), and added conscientiousness values (-0,26). Agreeableness correlated most negatively with power (-0,45), and achievement (-0,41). Conscientiousness correlated positively with achievement (0, 22), conformity values (0,16), security (0,22), and negatively with stimulation values (-0,24). Neuroticism revealed little association between values (Roccas, Sagiv, Schwartz, and Knafo, 2002).

The above-listed values align with Wentzel and Wigfield's (1998) hypothesis of the ways in which students integrate and coordinate their social motivations and academic concerns that impacts their academic success. This study investigated concerns about why certain students may eagerly take on new intellectual challenges while others disengage and devalue from these academic activities which extend efficacy, competence and beliefs but to values associated with success and achievement goal orientations. Subject task values refer to the incentives and purpose of doing various activities, it consists of components such as interests, attainments or utility values (Wigfield and Eccles, 1992; Wentzel and Wigfield, 1998).

2.3 Key Debates and Controversies:

Sauicer and Goldberg (1998) report that even though there are various kinds of descriptive content for people, differences in height, attractiveness, girth, attitudes and values are not all adequately captured by the FFM which demonstrates a need to link work values to the FFM.

The debate around the FFM Openness to experience :

A critique on the FFM of Openness to experience is that it has been reported as the most complicated and highly debated because of its indeterminate nature (Vedel and Poropat, 2017). A reason for its indeterminate nature is because Openness to experience possesses a creative component that reflects artistic and contemplative interests among individuals in addition to an intellectual aspect which displays a curious approach to learning. The intellect- curiosity stimulates the connection between openness and academic performance (von Stumm, Hell, and Chamorro-Premuzic, 2011 in Vedel and Poropat, 2017).

Chapter Summary

Without learner incentives, the learning process cannot be initiated. This results in the importance of investigating and comparing personality traits, and work values that are related to a student's motivation and support in relation to their academic performance. This chapter discussed previous literature, gaps in existing literature, and the structure of this study's conceptual framework. The subsequent chapter will address the method and methodology of the study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

Introduction

A research study contains several interconnected activities varying from the data collection to its interpretation, analysis, and report writing (Crosswell, 2012). This chapter shall provide an explanation and account of this research study and methodology. With this in perspective, firstly, I shall provide pragmatic considerations and ideas. Secondly, I shall describe the methods that will be undertaken for data collection. Thirdly, I shall elucidate the way in which the participants were selected. Lastly, I shall provide ethical considerations heeded for my study.

3.1 Research Design / Overall research Approach/ Paradigm:

It is obligatory of being aware of a method, methodology, and paradigmatic approach when preparing to conduct a research study. A methodology is not limited to the way in which data is collected but also includes the many means of the type of data collected. For this particular study, a mixed-method approach was utilized because it focuses on numerical aspects of dominant personality traits, work values, and performance grades in relation to quantitative aspects of these traits within the structure of the selected university courses. The correlation between work values, personality trait scores and academic marks forms the quantitative aspect of this research study. The qualitative aspect of this research study consists of an interview conducted with relevant lecturers to find the dominant teaching approaches. Thus quantitative and qualitative aspects were used to address this study's research questions since Johnson and Onwuegbuzie (2004) propose that the goal of a mixed-methods research approach is not to replace either quantitative or qualitative approaches but to draw from each of their strengths.

Eysenck (1983) reports the lack of a paradigm categorisation in psychology specifically in the personality vicinity and the correlations between personalities, work values and academic marks. A positivist paradigm focuses on occurrences that are studied by scientific observations yet interpretivism aims to include insights, meanings, and presumes that beings cannot be explored in a similar way to a physical phenomenon (Alharahsheh and Pius 2020). Even though this current study adopted a mixed-methods approach of qualitative and quantitative data, it leaned towards an interpretive paradigm because it focused on variables and factors that related to a specific context centering around human nature. Interpretivism argues that human beings

and their interpretations of the world are unable to be explored in the same way as investigating physical environments as positivists (Alharahsheh and Pius, 2020).

3.2 Research Design / Overall research Approach:

[Referring to Table 1.1 in Chapter 1](#). Data will be collected through

- Two online psychological questionnaire tests (123 test): A personality test and the work values test.
- A semi-structured online interview.
- Course grade marksheets.

[Referring to Table 1.1 in Chapter 1](#), in order to answer the first and second sub-research question, “What is the distribution of the various personality types of first-year students who enrol in Sciences and Mathematics courses?” and “What is the distribution of work values in first-year students who enrol in Sciences and Mathematics courses?”, online psychology questionnaire tests were selected and distributed - the FFM personality test for the first sub research question and the work values test for the second sub research question. The online FFM test consisted of 120 questions and the work values test consisted of 140 questions. The personality scores were calculated using the Jung (1921) and DISC assessment (Marston, 1920). The online psychological tests were provided to students in the form of a link. Students completed, received their test results, and were required to send the results by way of email. This form of data collection and analysis forms part of the quantitative method for analysing the results.

To answer the third and fourth research sub-question, “What is the correlation between students’ personality traits and their academic performance in first-year Sciences (Natural Sciences) and Mathematics courses?” and “What is the correlation between students’ work values and their academic performance in first-year Sciences (Natural Sciences) and Mathematics courses?”, an overall academic mark sheet of the participants was obtained within the required course fields. This shall be correlated to contribute towards answering the main research question, “What is the relationship between personality traits, work values and educational performance among Science and Mathematics courses?”. Secondary data refers to data that is collected by another who would not be the primary user or researcher for the study. An advantage of secondary data is the swift accessibility of readily available information (Clow and James, 2013). The mark sheet or the overall average of the courses as well as the online questionnaire results classify as a form of secondary data because the mark sheets have been

previously utilized for academic purposes and the questionnaire website has automatically generated a programmed analysis of the results.

It is important to clarify, that in the context of this study within the university curriculum structuring, the reason for terming Sciences with Natural Sciences is because, in the first and second year structuring the 'Natural Sciences' course combines Life Sciences, Physics and Chemistry split up per semester. It is only from third year up that the course names and structuring change. Therefore, first and second-year courses are called Natural Sciences (including Life Sciences, Physics, and Chemistry) and from third-year courses are called Physical Sciences (including Chemistry and excluding Life Sciences) and Life Sciences separately named as so.

For answering the fifth sub-question to the main question, "What dominant teaching approaches are students being exposed to in B. Ed Sciences and Mathematics courses? Are the teaching approaches identical, similar or the same across all subjects?" a semi-structured interview was conducted with the relevant course coordinator lecturer. Scott and Morison (2006) are in favour of interviews being utilized as a tool for obtaining subjective accounts of views and beliefs and forms part of the qualitative aspect of this study. The purpose of the interviews was to gain insight into the practices that lecturers are undertaking in order to gain a general overview of the common teaching and learning approaches that are being conducted. A schedule of the interview questions is provided in Appendix B.

The interviews were audio-recorded, listened to, transcribed, and then analysed thematically using themes. The semi-structured interviews took no longer than 30 minutes to complete. The lecturers were provided with the option of choosing a telephone, Microsoft Teams, Google Meet, or Zoom call.

3.3 Participants, Sampling, and Ethical Considerations:

The participants in this study were first-year Bachelor of Education students specializing in Senior/ Further Education training courses from Mathematics and Sciences streams, as well as three appropriate lecturers who coordinated each of these courses. The first lecturer interviewed has an MEd, PhD and BScEd qualification. The second lecturer interviewed is a PhD candidate with 7 years of teaching experience. The third lecturer is a university professor with more than 20 twenty years of teaching experience. The A total of 67 PST's participated in the study, 39 students from Natural Sciences (Chemistry, Physics, Life Sciences), 28 students from

Mathematics. The students were both male and female who participated in the study, however this specific study focused on correlations between personalities, work values and academic marks.

The reason for choosing first-year students is because the first year contributes to a predictor factorability if students continue with their studies. The reason for choosing these subjects is because it forms part of the Science, Technology, Mathematical and Engineering (STEM) stream which can form an origination (based on the time limit) before expanding this research study into other subjects for a correlation comparison. Students in the Sciences (Natural Sciences) and Mathematics classes completed the two online psychological questionnaires. The reason for selecting this specific university is for convenience as I am already familiar with the systems, processes, and due to the Coronavirus Disease of 2019 (COVID-19) attempting to contact other educational institutions may take longer given the limited time frame of my research. The students within the University of Witwatersrand also had access to search engines, network systems, and technological modes of communicating. This allowed the investigation to be conducted while complying with COVID-19 protocols. My sampling rationale was based on my academic studies as a Master's student to complete the report within a limited timeframe. Due to COVID-19 protocols being followed and related time constraints the sample size of this research was limited .

Adhering to the ethical considerations, the participants were assured that their privacy was not exposed, nor dignity violated. Bearing this in mind, the participation of the participants was completely voluntary, and no real names were mentioned in the study. Pseudonyms and identifications were replaced with the participants' real names. Permission to conduct this study was requested and granted from the University of Witwatersrand Registrar, University of the Witwatersrand Human Research Ethics Committee, and the online website being utilized. The reason for requiring the student participants to fill in the online physiological test is because of being granted permission by the 123test® association under the condition that the website is used directly instead of copies and calculation of their keys used. The lecturers and students were provided with information assuring their anonymity, confidentiality, and voluntary principles that this study was based on.

Since one of the data collection methods consisted of interviews focusing on what lecturers reported, it was mandatory that the researcher be sensitive and possess ethical awareness during the interview (Pole and Morrison in Scott and Morrison, 2006). Ethical awareness and practices

consist of asking relevant questions that are related to the study as well as ensuring confidentiality by not involving third-party listeners or that no other person is present in the room or on the call line during the semi-structured interview. The students and lecturers that participated in this study were not be paid nor be exploited in any way.

3.4 Data Analysis

A univariate analysis was utilized for finding the distribution of the dominant work values and FFM personalities. The online test questionnaires and mark sheets were then analysed by utilizing correlation coefficients as a quantitative research approach. A correlation coefficient refers to the measure of two variables ranging between -1 and 1 (Salkind, 2006). The letter r is represented with a quantified number that varies between -1 and +1. Zero refers to no correlation and 1 refers to a perfect or complete correlation. A negative r implied that the variables are inversely related and a positive r implies the variables are directly related (Akoglu, 2018). The two different types of correlation coefficients are the Pearson product-moment correlation coefficient and the Spearman rank correlation coefficient. The bivariate Pearson correlation is largely used to measure the association between two variables, whereas the Spearman rank correlation ranks the relationship between variables. For this particular study, the Pearson correlation was adopted (Salkind, 2006). In this study, each value that was obtained for the group of each Factor was correlated to students' marks for the different subjects respectively. For example, values obtained for students being categorized under Factor I were correlated to the final marks obtained for Mathematics. Similar studies have utilized the Pearson correlation method and have had strong correlation coefficients on Personality types and academic performance (Vedel and Poropat, 2017). Previous studies' results have demonstrated that the conscientiousness personality to predict academic grades within primary, secondary, and tertiary education levels, emulating intelligence ($r=.21$: Richardson, Abraham, and Bond (2012). Other research studies' correlations were found to be stronger when conscientiousness was rated by knowledgeable other raters such as peers, students, parents in primary education systems ($r = .50$) (Poropat, 2014a) and secondary tertiary education ($r = .38$) (Poropat, 2014b). Openness to experience was similar yet also higher associated with academic performance in secondary tertiary education ($r=.28$) (Poropat, 2014b). For the qualitative analysis approach, the data from the interviews will follow a thematic analysis.

3.5 Research Rigour

Reliability and validity are associated with research rigour. Validity refers to the extent a research tool measures what it is supposed to measure, and the reliability is the consistency of the results if the research study is repeated under the same circumstances (Opie, 2004). For validity, the interview questions as a research instrument were peer-reviewed. The test online questionnaires are standardized tests and consist of their own validity.

Chapter Summary

In this chapter, I have explained why, what and how my research methodologies (tools for collecting data and analysing it) were relevant for answering this study's research questions. The participants in this study were also discussed. The following chapters will examine and discuss findings from the students' outcomes, mark sheet, and lecturer responses.

CHAPTER 4: RESULTS, DISCUSSION, AND CONCLUSION OF QUANTITATIVE RESULTS

Introduction

The following chapter provides and discusses the quantitative results of the personality and work values questionnaires that were administered to students. The aim of this study was to explore the relationship between personality traits, work values, and education performance in university students. The quantitative aspect of this research utilized the Pearson correlation analysis.

The FFM personality inventory and work values inventory was completed by a total of 67 first-year PSTs in the subjects of Mathematics (28 participants) and Natural Sciences which consists of Life Sciences (39 participants), Chemistry (39 participants), and Physics Subject (39 participants). Natural Sciences consists of the subjects: Life Sciences, Chemistry and Physics. This means that the same students who are enrolled in Natural Sciences undertook the courses of Chemistry, Physics and Life Sciences.

Table 4.0 Representing a list of the subjects that correspond to the number of students who participated in the personality and work values tests with the academic codes.

Subject Code	Subject	Number tested
EDUC 1274A/1245	Natural Sciences (Life Sciences, Chemistry and Physics)	39
EDUC 1277A	Mathematics	28

4.1. What Is the Distribution of the Various Personality Types of First-year Students who Enrol in B. Ed Sciences and Mathematics Courses?

The FFM of personality traits that arose based on the results of the questionnaires completed by the students has been grouped and sorted into tables 4.1 and 4.2 below to represent the distribution. Table 4.1 represents the percentage of students who have scored above 70 % and below 30 % for each personality trait. Table 4.2 represents the counts of dominant and respective secondary personality traits per subject.

Table 4.1 Below represents the distribution of FFM personality traits for students in Natural Sciences and Mathematics who scored over 70% and below 30 %.

A reason for selecting the 70 % and 30 % based on the percentage of personality scores that were determined using the Jung (1921) test and DISC (Marston, 1920) assessment from the online personality questionnaire was because Soto and Jackson (2020) state that the FFM is a range of broad domains. Since the FFM consists of broad factors of a personality, it would be more inclusive for the 70 % and 30 % ratio as opposed to other ratio options such as 80 % and 20% or 60 % and 40% and so forth which could be limiting.

Table 4.1 Representing the distribution of FFM personality traits for students in Natural Sciences and Mathematics who scored over 70% and below 30 %.

Subject	Percentage of personality scores over 70 %	Percentage of personality scores under 30 %	Personality Trait
Natural Sciences	3	67	Openness to experience (O)
Natural Sciences	38	18	Conscientiousness (C)
Natural Sciences	3	56	Extraversion (E)
Natural Sciences	13	5	Agreeableness (A)
Natural Sciences	21	6	Neuroticism (N)
Mathematics	4	64	Openness to experience
Mathematics	57	13	Conscientiousness
Mathematics	4	56	Extraversion
Mathematics	18	28	Agreeableness
Mathematics	32	38	Neuroticism

Table 4.2 below represents the number of counts that a specific personality from the FFM was dominant, followed the number of counts of the secondary traits.

Table 4.2 Representing the counts of the dominant traits and subsequent secondary traits.

Subject	Dominant traits	Secondary traits
Natural Sciences	O = 1	N = 1, C = 1, E = 1, A = 1
Natural Sciences	C = 21	A = 8, E = 4, N = 9
Natural Sciences	E = 0	Not Applicable
Natural Sciences	A = 6	C = 3, E = 2, N = 1
Natural Sciences	N = 11	A = 7, C = 3, E = 1
Mathematics	O = 1	N = 1
Mathematics	C = 17	A = 4, E = 4, N = 9
Mathematics	E = 0	Not Applicable
Mathematics	A = 3	C = 1, E = 1, N = 1
Mathematics	N = 5	A = 2, C = 3

According to both distribution tables of 4.1 and 4.2, in both the Sciences and Mathematics subjects (Life Sciences, Physics and Chemistry), conscientiousness was the dominating personality followed by the secondary personality trait being Neuroticism. It is interesting to note that in both Sciences and Mathematics, the Extroversion personality trait was classified as having no dominance even though it did appear twice as secondary traits in Mathematics and Sciences.

4.2. What is the Distribution of Work Values in First-year Students Who Enrol in the B. Ed Degree Courses in Science and Mathematics?

The results of the work value traits that are based on the questionnaires completed by students have been grouped and sorted into tables 4.3 and table 4.4. Table 4.3 represents the percentage of students who have scored above 70 % and below 30 % for each work value, Table 4.4 represents the counts of the dominant and respective secondary work value trait per subject. The 70 % and 30 % scoring as high score (70%) and low (30 %) was selected for the distribution categorization is described earlier as well as to be consistent with the personality distribution scores.

Table 4.3 Below represents the distribution of work value traits for students in Natural Sciences and Mathematics who scored over 70% and below 30 %.

Subject	Percentage of students with work value scores over 70 %	Percentage of students with work value scores below 30 %	Work Value
Natural Sciences	26	0	Creativity
Natural Sciences	23	8	Variety
Natural Sciences	8	18	Self-development
Natural Sciences	87	0	Structure
Natural Sciences	64	0	Performance
Natural Sciences	15	3	Altruism
Mathematics	4	57	Creativity
Mathematics	32	7	Variety
Mathematics	11	18	Self-development
Mathematics	79	0	Structure
Mathematics	68	0	Performance
Mathematics	29	7	Altruism

Table 4.4 Representing the counts of the dominant work values and subsequent secondary value.

Subject	Work Values	Dominant Value	Secondary Value
Natural Sciences	Structure	30	3
Natural Sciences	Performance	4	22
Natural Sciences	Self-Development	0	1
Natural Sciences	Altruism	0	0
Natural Sciences	Variety	2	2
Natural Sciences	Creative	3	4
Mathematics	Structure	17	5
Mathematics	Performance	8	14

Mathematics	Self-Development	2	3
Mathematics	Altruism	1	4
Mathematics	Variety	0	2
Mathematics	Creative	0	0

Based on table 4.3 and 4.4 above it is evident that the most dominant work value in both Mathematics and the Sciences subjects is Structure followed by Performance which was secondary.

4.3. What is the Correlation Between Students' Personality Traits and Their Academic Performance in First-year Sciences (Natural Sciences) and Mathematics courses?

The term correlation is described as the relationship that exists between things, phenomena, or between statistical or mathematical variables which have a tendency to vary, be associated, or occur in a way that moves beyond chance alone (Akoglu, 2018). References such as strong, or weak are often mentioned to refer to the relationship between variables. The strength of correlation r is labelled differently by several researchers (Akoglu, 2018). For this study, I will report the strength of the correlation as positive or negative, and strong or weak. Since the correlations were between two variables (personality traits and academic performance), it was termed the bivariate Pearson correlation and can be represented in a scatterplot diagram (Akoglu, 2018). As mentioned in chapter 3, the negative value of correlation r implies an inverse relation, meaning that as one variable increases the second variable decreases and vice versa. Zero correlation means that there is no relationship between the two variables, and one is a perfect correlation between the two variables, that is the two variables increase or decrease the same (Akoglu, 2018). Table 4.5 will be used as a reference during the correlation coefficient analysis and discussion (Napitupulu, Rahim, Abdullah, Setiawan, Abdillah, Ahmar and Pranolo, 2018).

Table 4. 5 Represents the correlation coefficients at intervals with the key abbreviations.

Coefficient Interval	Correlation	Key
0,00-0,199	Very Weak	VW
0,20-0,399	Weak	W
0,40-0,599	Medium	M
0,60-0,799	Strong	S
0,80-1.000	Very Strong	VS

Extracted from Napitupulu, Rahim, Abdullah, Setiawan, Abdillah, Ahmar and Pranolo (2018).

Table 4.6 Represents the Pearson correlation coefficient to assess the relation between personality traits and academic achievement amongst learners.

Personality Type	Life Sciences Correlation	Code	Physics Correlation	Code	Chemistry Correlation	Code	Mathematics Correlation	Code
Openness to experience	0,16	VW	-0,98	VS	-0,19	VW	-0,14	VW
Conscientiousness	0,39	W	0,23	W	0,22	W	-0,05	VW
Extraversion	0,13	VW	0,14	VW	0,16	VW	-0,11	VW
Agreeableness	0,28	W	0,19	VW	0,14	VW	-0,02	VW
Neuroticism	0,28	W	-0,07	VW	-0,21	W	-0,14	VW

Key to abbreviations of correlation codes present in table 4.6 are explicated in table 4.5.

Based on the results from table 4.6 there are various correlation ranges between the personality traits and academic achievement on subjects. The personality trait of Openness to experience has a positive correlation with students academic performance in Life Sciences (0,16) yet negative correlations in Physics, Chemistry and Mathematics. This means that if students have an Openness to experience personality, the higher the score, the higher their academic

achievement in Life Sciences. However, lower students score in Openness to experience the higher their academic achievements in Physics (-0,98), Chemistry (-0,19) and Mathematics (-0,14). The strongest correlation (-0,98) was negative in Physics with the personality trait Openness to experience . Figure 4.1 below represents the strongest negative correlation between Physics and academic achievement marks.

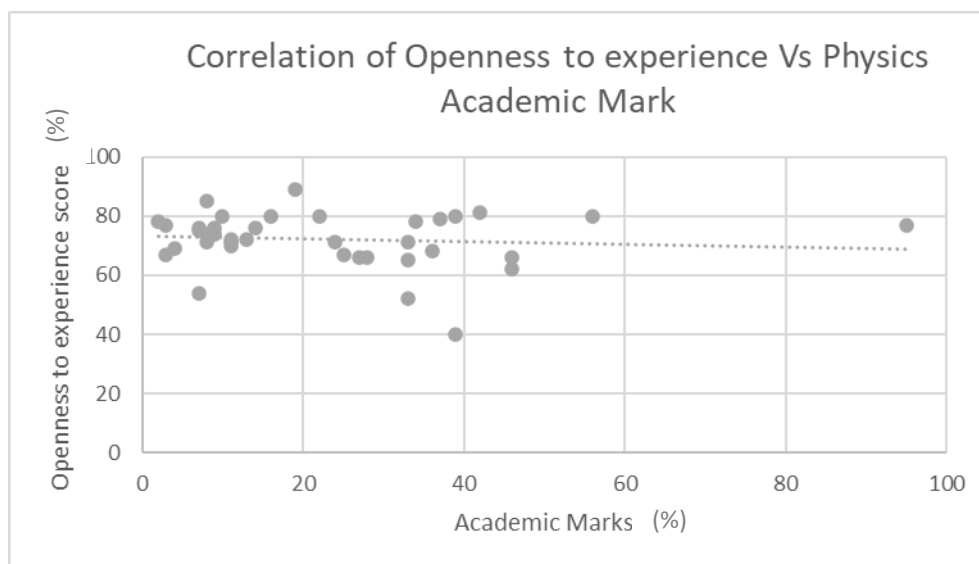


Figure 4.1 Representing the strongest negative correlation.

According to table 4.6, the Consciousness personality has a very weak correlation (-0,05) with the Mathematics subject and means that students who are less organized will have higher academics marks, however the Consciousness correlation to the Mathematics subject of academic performance is an extremely weak correlation. The Consciousness personality has a positive correlation with Life Sciences (0,39), Physics (0,23) and Chemistry (0,22) containing positive correlations. This suggests that students who score high in Consciousness for being orderly or organized will have high academic marks.

The Extraversion personality from table 4.6 demonstrates a negative correlation with Mathematics. This indicates that students who score high as being introverted (meaning a low Extroversion personality score) have high academic marks. The Extroversion personality score is positively correlated with Life Sciences (0,13), Physics (0,14) and Chemistry (0,16). This indicates that students who score high in a Extroverted personality have high academic marks.

Table 4.6 displays a negative correlation for the personality of Agreeableness (-0,02) and Mathematics. This means that less helpful or considerate have higher academic scores,

however this a very weak correlation of -0,02 which is almost has little to no correlation. The Agreeable personality has a positive correlation to Life Sciences (0, 28), Physics (0, 19) and Chemistry (0,14). This suggests that students who are helpful, friendly or considerate which means scoring high in the Agreeable personality, have high academic marks.

According to the results of Table 4.6 on the personality of Neuroticism: there is a negative correlation between neuroticism and the academic marks of Physics (-0,07), Chemistry (-0,21) and Mathematics (-0,14). This means that students who score high in Neuroticism have low academic scores in Physics, Chemistry and Mathematics. This implies that the students who are more emotionally stable will have high academic scores in Physics, Chemistry and Mathematics. However, the negative correlation between Physics (-0,07) and academic scores is extremely weak. The Neuroticism personality has a positive correlation to the academic scores of Life Sciences. This suggests that students who score high in the Neuroticism personality trait- meaning that they are more stressed and emotionally unstable- have high academic marks.

As Table 4.6 depicts, there is a relationship indicated by a correlation coefficient which is similar to this study's hypothesis and Siddiquei and Khalid (2018) of Neuroticism having a negative correlation within the subjects of Physics, Chemistry, and Mathematics. However, compared to other studies beyond Siddiquei and Khalid (2018), such as Nechita, Alexandru, Turcu-Știolică and Nechita (2015) whose aim of the study was to identify personality profiles that are related to academic performance within the faculty of medicine at the University of Medicine and Pharmacy from Craiova. The results from Nechita, et al.'s (2015) study refuted one of their hypothesis of the Neuroticism personality having a negative correlation with academic performance. This aligns with this current study's results in table 4.6 of Neuroticism not being negatively associated within the subject of Life Sciences.

It is interesting to note that all five personality traits: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism with academic marks demonstrate a positive correlation in Life Sciences, Chemistry, and Physics, however in the subject of Mathematics all five personality traits demonstrate a negative correlation.

The overall results represent slightly weaker positive and negative correlations of the Mathematics and Sciences subjects with Openness to experience with Physics having the strongest correlation to academic marks. This suggests that students with flexible personalities

who are imaginative, intellectually curious (John and Srivastava, 1999; Siddiquei and Khalid, 2018) would be more inclined to perform better in Physics.

4.4 What is the Correlation Between Students' Work Values and Their Academic Performance in First-year Sciences (Natural Sciences) and Mathematics Courses?

Table 4.7 below represents the Pearson correlation coefficient between work values and academic achievement of the Life Sciences, Physics, Chemistry and Mathematics subjects.

Table 4.7 Represents the Pearson correlation coefficient to assess the relation between work values and academic achievement amongst learners.

Work Values	Life Sciences Correlation	Code	Physics Correlation	Code	Chemistry Correlation	Code	Mathematics Correlation	
Creativity	0,098	VW	-0,05	VW	-0,11	VW	-0,0502	VW
Variety	0,05	VW	-0,21	W	-0,31	W	0,067	VW
Self-development	-0,05	VW	-0,24	W	-0,55	M	-0,028	VW
Structure	-0,02	VW	0,025	VW	0,085	VW	0,33	W
Performance	0,22	W	-0,037	VW	-0,0904	VW	-0,0022	VW
Altruism	0,11	VW	-0,038	VW	-0,19	VW	-0,027	VW

Key to abbreviations of correlation codes present in Table 4.7 are explicated in Table 4.3.

Based on Table 4.7, the academic scores for Life Sciences positively correlate with Creativity (0,098), Variety (0,05), Performance (0,22) and Altruism (0,11) and negatively with Self-development (-0,05) and Structure (-0,02). The academic scores for Physics had little to positive correlations with the Structure value (0,025), and had little to no negative correlations to the Performance (-0,037) and Altruism value (-0,038). There was a negative correlation in

Physics to the Self-development (-0,24) and Variety value (-0,21). The academic marks for Chemistry negativity correlated with almost all work values: Creativity (-0,11), Variety (-0,31), Self-development (-0,55), Performance (-0,09), and Altruism (-0,19), except for Structure (0,085) which had a positive correlation to the Chemistry academic marks. The academic scores of Mathematics correlated negatively with Creativity (-0,0502). There was little to no negative correlation in Mathematics scores between Self-development (-0,028), Performance (-0,00022), and Altruism (-0,027). The Structure value (0,33) had a positive correlation to the Mathematics scores. Note that most of the correlation values obtained range between weak and very weak, so do not provide enough information for once to make any inferences about personality traits and academic marks in all those courses.

The weakest positive correlation was against the variety work value and the Life Sciences subject of 0,05. This is represented in Figure 4.2. This suggests that students who hold the value of Variety which implies that they open to a variety of approaches means that having this value would not have a prominent impact on student's academic marks in Life Sciences.

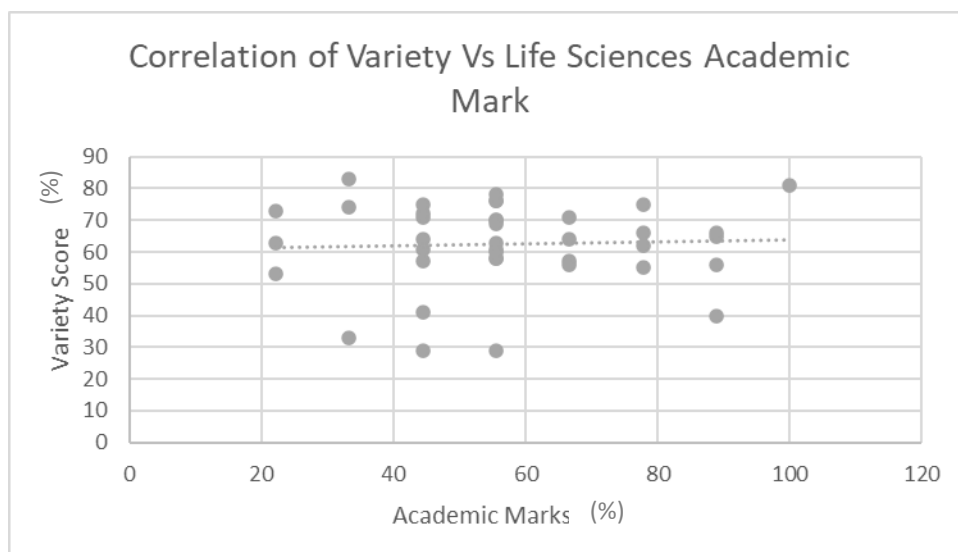


Figure 4.2 of Graph representing the variety value across Life Sciences Academic Marks

The strongest positive correlation was between the work value of structure in Mathematics 0,33 and represented in Figure 4.3. Even though this was the highest positive correlation, according to Table 4.7 of the correlation interval it is still classified as a weak correlation. This means that students who value a structured learning environment would be more inclined to perform better within the Mathematics subject.

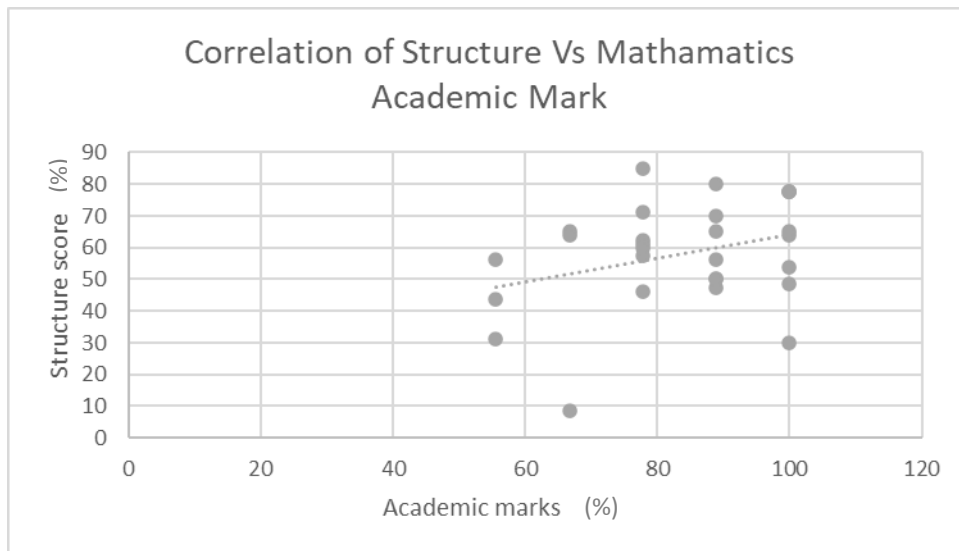


Figure 4.3 of a graph representing the value structure correlation across Mathematics academic marks.

The weakest negative correlation graph was with the performance work value within the mathematics of $-0,0022$ which is extremely weak or has little to no correlation. This is represented in Figure 4.4 below. This implies that students who value being individual performance, rewards, and prefer instructions and having another dictate what they do would not align to their performance resulting in a lower performance within the mathematics subject.

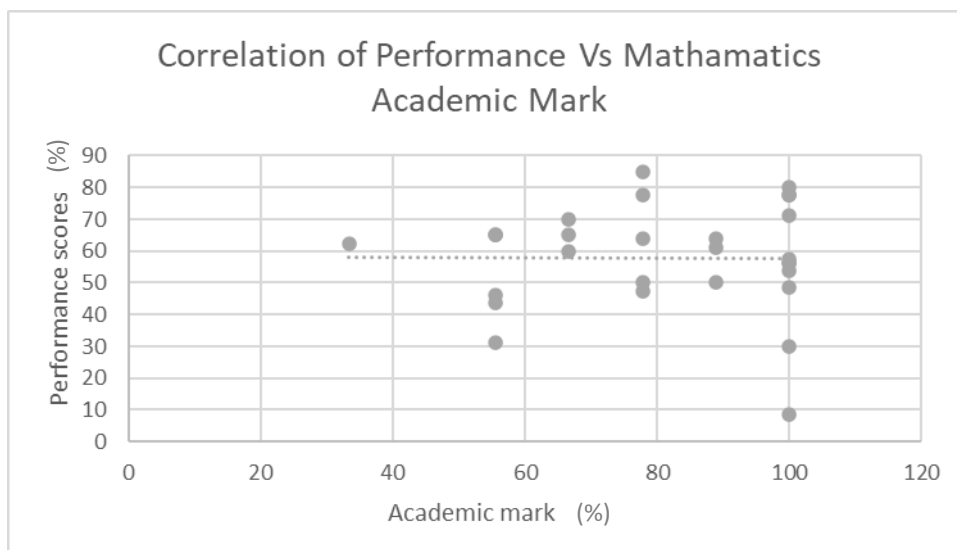


Figure 4.4 of the performance work value correlation across the mathematics academic mark.

Tables 4.12, Table 4.9 and Table 14.4 below, displays the overall correlation of this study's main research question (presented in Table 1.1 Chapter 1) between FFM personalities, work values and academic marks.

Table 4.8 Represents the correlations between personalities, work values, and academic performance in Life Sciences (n=39).

	Openess to experience	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Ceativity	Variety	Self development	Structure	Performance	Altruism	Academic Mark Life Sciences
Openess to experience	1											
Conscientiousness	0,288074766	1										
Extraversion	0,095213966	0,32141998	1									
Agreeableness	-0,065652091	0,114589206	0,326466312	1								
Neuroticism	0,09624541	-0,486468163	-0,535691763	-0,264953458	1							
Ceativity	0,611698966	0,117008576	0,250040879	0,164336315	-0,012502122	1						
Variety	0,533827433	0,123001207	0,04109985	-0,044895477	0,071181438	0,670118	1					
Self development	0,561513741	0,234683918	0,004415105	0,176794134	0,146400052	0,489664	0,378169	1				
Structure	0,260464881	0,304059742	0,41945672	-0,170549759	-0,251777548	0,284009	0,320801	-0,102413768	1			
Performance	0,238064083	0,072318242	-0,196196948	-0,320960774	0,181596304	0,377252	0,540131	0,12099808	0,120152	1		
Altruism	0,156834852	0,043349158	0,054807254	0,370490199	-0,011610419	0,22768	0,292007	0,358142268	0,006415	-0,07944482	1	
Academic Mark Life Sciences	0,050923502	0,391474075	0,125597865	0,283357117	-0,296886091	0,015652	0,045056	-0,053711368	-0,02111	0,21844681	0,110569	1

Based on the significant relationships found in Table 4.8, a summary is provided in Table 4.12.

Table 4.9 Represents the correlations between personalities, work values and academic performance in Physics (n=39).

	Openess to experience	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Creativity	Variety	Self-development	Structure	Performance	Altruism	Academic Mark Physics
Openess to experience	1											
Conscientiousness	0,288074766	1										
Extraversion	0,095213966	0,32141998	1									
Agreeableness	-0,065652091	0,114589206	0,326466312	1								
Neuroticism	0,09624541	-0,486468163	-0,535691763	-0,264953458	1							
Creativity	0,611698966	0,117008576	0,250040879	0,164336315	-0,012502122	1						
Variety	0,533827433	0,123001207	0,04109985	-0,044895477	0,071181438	0,670118	1					
Self-development	0,561513741	0,234683918	0,004415105	0,176794134	0,146400052	0,489664	0,378169	1				
Structure	0,260464881	0,304059742	0,41945672	-0,170549759	-0,251777548	0,284009	0,320801	-0,102413768	1			
Performance	0,238064083	0,072318242	-0,196196948	-0,320960774	0,181596304	0,377252	0,540131	0,12099808	0,120152	1		
Altruism	0,156834852	0,043349158	0,054807254	0,370490199	-0,011610419	0,22768	0,292007	0,358142268	0,006415	-0,07944482	1	
Academic Mark Physics	-0,097825979	0,233618824	0,141554375	0,187787053	-0,069619512	-0,04606	-0,211843	-0,243778896	0,024517	-0,03728746	-0,03806	1

Based on the significant relations found in Table 4.9, a summary and analysis is provided in Table 5.12.

Table 4.10 Represents the correlations between personalities, work values, and academic performance in Chemistry (n=39).

	Openess to experience	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Creativity	Variety	Self-development	Structure	Performance	Altruism	Academic Mark Chemistry
Openess to experience	1											
Conscientiousness	0,288074766	1										
Extraversion	0,095213966	0,32141998	1									
Agreeableness	-0,065652091	0,114589206	0,326466312	1								
Neuroticism	0,09624541		-0,535691763	-0,264953458	1							
Creativity	0,611698966	0,117008576	0,250040879	0,164336315	-0,012502122	1						
Variety	0,533827433	0,123001207	0,04109985	-0,044895477	0,071181438	0,670118	1					
Self-development	0,561513741	0,234683918	0,004415105	0,176794134	0,146400052	0,489664	0,378169	1				
Structure	0,260464881	0,304059742	0,41945672	-0,170549759	-0,251777548	0,284009	0,320801	-0,102413768	1			
Performance	0,238064083	0,072318242	-0,196196948	-0,320960774	0,181596304	0,377252	0,540131	0,12099808	0,120152	1		
Altruism	0,156834852	0,043349158	0,054807254	0,370490199	-0,011610419	0,22768	0,292007	0,358142268	0,006415	-0,07944482	1	
Academic Mark Chemistry	-0,236182878	0,217705725	0,164005416	0,13627343	-0,211601571	-0,10646	-0,308803	-0,546050372	0,085327	-0,09049168	-0,18542	1

Based on the significant relations found in Table 4.10, a summary and analysis is provided in Table 5.12.

Table 4.11 Represents the correlations between personalities, work values, and academic performance in Mathematics (n=29).

	Openess to experience	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Ceativity	Variety	Self development	Structure	Performance	Altruism	Academic Mark Mathematics
Openess to experience	1											
Conscientiousness	0,168305936	1										
Extraversion	0,167146837	0,287738619	1									
Agreeableness	-0,006551618	-0,074690261	-0,005460757	1								
Neuroticism	0,09169412	-0,467439667	-0,643237537	-0,157116176	1							
Ceativity	0,543603964	-0,211861379	0,200259534	0,000851342	0,129633723	1						
Variety	0,36199476	-0,19110527	0,050710629	-0,033058917	0,247700637	0,690494	1					
Self development	0,476394045	0,178933712	-0,062643339	0,293321547	0,074774814	0,324028	0,199704	1				
Structure	0,017374924	0,006713955	0,304081128	-0,28233983	0,108508491	0,349028	0,49347	-0,243969574	1			
Performance	0,078734003	-0,170524426	-0,255103403	-0,205440777	0,307122513	0,295158	0,56554	-0,07487116	0,287	1		
Altruism	0,15113997	-0,013804006	-0,014004997	0,206177081	0,045032804	0,358708	0,553064	0,482423634	0,182037	0,06550663	1	
Academic Mark Mathematics	-0,138159969	-0,047255982	-0,108163283	-0,020500852	-0,006014847	-0,05022	0,067293	-0,028436745	0,32556	-0,0022403	-0,02706	1

Based on the significant relations found in Table 4.10, a summary and analysis is provided in Table 4.12.

Table 4.12 below provides a description of the significant relationships based on Table 4.8, Table 4.9 and Table 4.10 of the Life Sciences, Physics, Chemistry and Mathematics subjects. Table 4.12 represents and discusses the strongest correlations between 0,2 -0,6 based on the coefficient intervals in Table 4.3. The ranges of the correlation coefficients are included (minimum-maximum).

Table 4.12 Describing the significant correlations between personality traits and work values.

Life Sciences	Physics	Chemistry	Mathematics
a)Openness to experience personality trait positively correlated with Creativity, Variety, Self-development, Structure, and Performance. (2,3 - 0,61)	a)Openness to experience personality trait correlated positively to the Creativity, Variety, Self-development, structure, Performance and Altruism work values. (0,16 - 0,61)	a)Openness to experience personality trait correlated positively to the Creativity, variety, Self-development, structure, performance and Altruism. (0,20-0,61)	a)Openness to experience personality trait positively correlated with the Creativity, Variety and Self-development work values. (0,36 - 0,54)
b)Conscientious personality trait correlated positively with the Self-development and Structure work value. (0,23 - 0, 30)	b)Conscientious personality trait correlated positively with Self-development and Structure work values. (0,23 - 0,30)	b)Conscientious personality trait correlated positively with Self-development, and Structure. (0,23- 0,30)	b) Conscientious personality trait negatively correlated with the Creativity work value. (-0,21)
c) Extraversion personality trait positively correlated with the Creativity, Structure value and negatively with the Performance work value. (0,23 - 0,41) (-2,0)	c) Extraversion personality trait correlated positively with the Creativity work value and negatively with the Performance work value. (0,25 - 0,42) (-0,20)	c)Extraversion personality trait correlated positively to the Creativity and structure work value. (0,25 - 0,41)	c)Extraversion personality trait correlated positively correlated with Creativity and Structure work values, but negatively correlated with Performance work value. (2,0 - 0,30) (-0,26)
d) Agreeableness personality trait positively correlated with Self-development and Altruism work value and negatively with Structure and	d) Agreeableness personality trait positively correlated with the Creativity, Self-development, and Altruism work value and negatively with the Structure	Agreeableness personality trait correlated positively with Altruism work value and negatively with Performance and Self-development work	d) Agreeableness personality trait positively correlated with Self-development and Altruism work value but negatively correlates with

Performance work value. (0,17 - 0,37) (-0,17- -0,32)	and Performance work value. (0,16- 0,37) (-0,17- -0,32)	value. (0,37) (-0,20 - -0,32)	Structure and Performance work values. (0,21-0,29) (-0,21 - -0,28)
e)Neuroticism personality negatively correlated with the Structure work value. (-0,25)	e)Neuroticism personality correlated negatively with the Structure work value. (-0,25)	e)Neuroticism personality correlated negatively with the Structure work value. (-0,25)	e)Neuroticism personality correlated positively Variety and Performance work value. (0,25 - 0,31)
f) The Life Sciences academic marks positively correlated with the Performance work value. (0,22)	f)The Physics academic mark correlated negatively with Variety and the Self-development work value. (-0,21 - -0,24)	f)The Chemistry academic mark correlated negatively with Self-development and Neuroticism. (-0,21 - -0,55)	f) The Mathematics academic mark positively correlated with the Structure work value. (0,33)

4.6 Discussion

Based on the distribution Table 4.1 and Table 4.2, the most dominant personality trait was Conscientiousness, followed by the secondary personality trait of Neuroticism. The other counts of dominant personality traits in both Sciences and Mathematics were low. For example, in Sciences, Agreeableness would be the dominant tertiary personality trait but had a 57 % distribution count lower than Neuroticism and in Mathematics, the Agreeableness dominance personality count was 60% lower than Neuroticism.

Table 4.1 reveals that 38% of students in Sciences scored higher in Conscientiousness and in Mathematics 57% of students scored high in the Conscientiousness personality trait. 13 % of students scored high in Agreeableness in the Sciences subjects, and 18 % of students scored high in Agreeableness in Mathematics. Thus, Table 4.1 and Table 4.2 reveals that in both Sciences and Mathematics, Conscientiousness, Neuroticism and Agreeableness were not only the most dominant personality trait but also the traits that students scored high in. However, in Table 4.1, there was a higher percentage of students who scored low in Openness to experience in both Sciences and Mathematics. This suggests that there is a higher percentage of students

who are closed to new experiences or experiences that they are unfamiliar with. The majority of students would prefer having routines and having a traditional perspective. This is not surprising given that majority of these students are coming fresh from High School and have not yet had wider experiences in the world of work or gone to schools for their first teaching experience (TE).

Based on the distribution Tables in 4.3 and 4.4, the most dominant work value in both Mathematics and Sciences courses was the Structure work value as students also scored the highest in this work value followed by the secondary dominant work value and second-highest value of students scoring high in being the work value of Performance. Students scoring high and valuing Structure and Performance aligns to part of this study's hypothesis and predictions of traditional education systems valuing academic achievement.

Based on Table 4.3, it is interesting that most students scored the lowest in the work value Creativity for both Science and Mathematics subjects since most students also scored the lowest in Table 4.1 of the personality trait Openness to experience (imaginative, inclined to be more creative, adventurous, trying new things, being more flexible and liberal). Based on the correlations between personality traits and work values in Table 4.8, Openness to experience correlated positively with the work value of Creativity. This confirms that students who score high in Openness to experience would also score high in the work value of Creativity. The Creativity work value being a substrate of the Openness to experience personality is similar to previous studies such as Tan, Lau, Kung and Kailsan (2019). Tan, et al. (2019) investigated the relationship between Openness to experience and Creativity among undergraduate students in Malaysia. The results from Tan, et al. (2019) also revealed the important engagement linkage between students who scored high in Openness to experience s also scored high in intrinsic values related to Creativity.

In terms of the correlations between personality traits and academic marks, I expected from literature (Vedel and Poropat, 2017) that students who scored high Consciousness (thoughtful, attention to detail, social acceptance behaviours) would score high in their academic marks and have a low score in Extroversion (students who prefer to work alone). However, according to the correlation coefficients in Tables 4.1, Table 4.8, Table 4.9, Table 4.10: Consciousness does have a positive correlation to students' academic marks in Life Sciences, Physics (slightly higher weak correlation), Chemistry (similar correlation to Physics) yet a negative correlation and little to no correlation (weakest) in Mathematics. This suggests that in the subjects of

Chemistry and Physics, students who scored high in the personality of Consciousness would tend to have higher academic performance marks.

Represented in Table 4.6 and in Figure 4.1, the strongest negative correlation coefficient of personality traits to academic marks was in Physics, based on the distribution in Table 4.0. Openness to experience had the highest percentage of the number of students scoring the lowest for this personality trait and according to Table 4.2 Openness to experience was not the most dominant or appeared as a secondary trait. These correlation coefficient results raise the question of whether certain personalities are favoured in traditional education systems? A reason for raising this question is because students who have a low Openness to experience score are less reluctant to try to experiences and prefer traditional approaches.

In terms of the distribution in Tables 4.5 and Table 4.4, 23% of students in Sciences and 32 % in Mathematics scored high in the Variety work value yet it was not the most dominant value in the Sciences and Mathematics subjects. There were negative weak correlations of the Variety work value to Physics and Chemistry represented in Table 4.7 and hardly any positive correlation in Life Sciences and Mathematics. According to Tables 4.8, 4.9, 4.10, and 4.11, there was a positive medium correlation between Openness to experience in Life Sciences, Physics, and Chemistry, and a positive weak to medium correlation in Mathematics.

Based on the above paragraphs and results in Life Sciences, Physics and Chemistry it appears that students who value Structure and Performance are less Open to new experiences and change, have high academic scores and perform better than students whose personality is more Open to new experiences. This implies that students with certain personalities and work values may be favoured over others.

Through the above analyses, summaries and discussions, overall it appears that personality traits have a stronger correlation with academic performance than with work values. This study focused on the influence of personality traits and work values on academic performance. From my expectations based on prior research on this topic, I am convinced that my findings do confirm that there are differences regarding academic performance depending on personality factors. Contrary to my expectations, my findings revealed that work values had a very weak correlation in comparison to the personality traits on academic performance.

Based on the different correlations between work values and personality traits within this study's chapter, the results lean towards Park's and Guay's (2009) study because Park and

Guay (2009) investigated how personalities are related to values yet also distinct. This current study does demonstrate in Table 4.5 and Table 4.6 how the differing correlation intervals represent the similarities and differences among work values and personality traits.

Based on Roccas, et al.'s (2002) study, their results demonstrated that the Openness to experience positively corrected with Self-direction (0,33) and Stimulation values (0,48). According to the current study, Self-development, and Creativity also correlated positively with the personality trait Openness to experience in Mathematics (0,48 and 0,54 respectively), and Sciences (Life Sciences, Chemistry, and Physics) (0,56 and 0,61 respectively) subjects. Like Roccas, et al. 's (2002) study where Agreeableness correlated negatively with Achievement (-0,41), this study's results also reflected the Performance value negatively correlating with achievement in the Sciences (-0,32). This implies that students who scored high in Openness to experience also scored high in Self-development and Creativity work values as well as students who scored high in Agreeableness do not value the Achievement and Performance work value in all Sciences and Mathematics subjects. This negative correlation was unexpected because the Agreeableness personality trait was previously reported as being associated with academic motivation and grades orientation (Komarraju and Karau, 2005 in Vedel and Poropat, 2017).

Based on expectations on this current study and from prior research, it is confirmed that there are significant differences among the influence of academic structures on students' personalities and work values.

Chapter Summary

The above chapter presented and discussed the quantitative results of the research study, the following chapter shall present and discuss the qualitative results of the research study in as well as conclude and culminate with reflections upon this study.

CHAPTER 5: PRESENTATION AND DISCUSSION OF QUALITATIVE RESULTS AND CONCLUSION

Introduction

In Chapter five, I present and simultaneously discuss the qualitative results of the interviews conducted with the subject lecturers. The chapter will conclude by providing reflections and limitations of the study. Some recommendations, based on the overall results and discussions have been made. Since the primary purpose of this study was to investigate the relationship between personality traits, work values and educational performance of university students, the purpose of the qualitative aspect of the investigation was to explore current teaching and learning approaches that are utilized. This qualitative approach addresses the study's sub-research question 5 provided in Chapter 1. The qualitative aspect of the research followed a thematic analysis.

The interviews were conducted with three lecturers whom each teach Life Sciences, Chemistry, and Mathematics for a specific semester or term.

5.1 What are the dominant teaching and learning approaches students taking B. Ed degree courses in Sciences and Mathematics exposed to? Are the teaching approaches identical, similar or the same across all subjects?

Figure 5.1 represents key aspects of responses that were provided by the participants. The most apparent keywords were based on the purpose of each interview question and were as follows: dominant teaching and learning (t and l) approaches, active and reflective t and l approaches, practical work, t and l approach considering Agreeableness and Altruism, sequential and global t and l, fact retention t and l, and assessments. Figure 5.1 represents seven-word clusters that are presented in bold italics and the theme(s) that have been extracted and represented in italics. This figure was constructed based on the responses provided from the interviews. The thematic map constructed in Figure 5.1 below was influenced by Terry, Hayfield, Clarke and Braun's (2017) account of researchers utilizing visual aids such as thematic maps in relation to the data. Figure 5.1 was adjusted to better fit the data set.

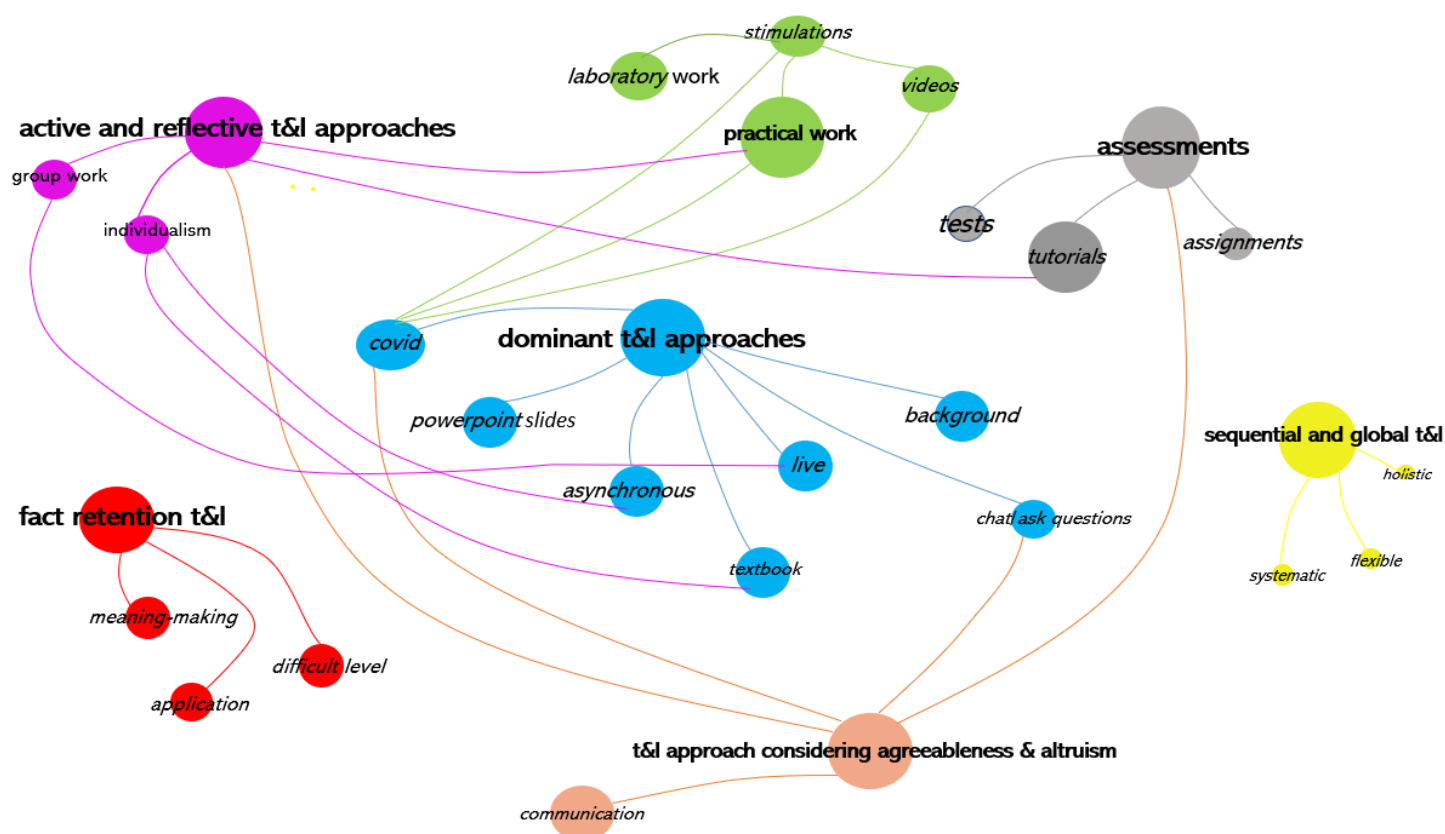


Figure 5.1 Representation of key aspects of responses

Figure 5.1 Keyword co-occurrence thematic map of responses is utilized to answer the following research question: What are the dominant teaching and learning approaches students taking B. Ed degree courses in Sciences and Mathematics exposed to? Are the teaching approaches identical, similar or the same across all subjects? Note: the threshold was thirty with seven key aspects selected for display as a meta-theme based on the rationality of the interview questions. Throughout this analysis, synonyms of specific terms, concepts, and words were utilized when identifying specific themes for dominant teaching approaches.

Table 5.1 Interview transcripts from subject lecturers responding to the question: “How do you usually teach lessons? e.g. lectures, posting reading material, self-study?”

Subject	Statements
Chemistry	“...first year in the University and they are from a background that maybe they were being taught through a chalkboard, whiteboard or PowerPoint.” “I won’t teach through self-study or voice-over recordings – I don’t do that” “...they should be able to see the PowerPoint and I run it after a point, further because conferencing has a chat, they can ask questions and I can respond. That gives an interaction meaning that I can ask questions and students can respond and

	<i>that keeps ongoing. So, I don't normally go for the teaching where we use posting, I don't post. On the conferencing they already have the notes, they can go through the PowerPoint at their own disposal."</i>
Life Sciences	<i>"I conduct lectures and in the lecture, I prepare for them twice in that I know that there are students who fail to connect for example when we struggled with the platform Teams or BBB ... I had to record it -do a recording of my lecture prior to that presentation- and then when I go to the timetable slot I would make a presentation using PowerPoint again."</i>
Mathematics	<i>"...if it wasn't COVID then I would have had lectures, I was teaching maths, so definitely lectures, textbooks- I always regarded as very important because I think it is important for students, especially those who are going to become teachers to learn to read maths for themselves."</i> <i>"pre COVID I would work with the textbook and use a visualiser and talk about the concepts"</i> <i>"four lectures a week... and there would be two tutorial periods"</i> <i>"And of course by the way I suppose an important part was at the end of the lecture, students were always free to come and ask me questions and they did. Often students came and asked me how to do this, how do I do that, I don't understand this, I don't understand that so there was often about a 15 minute period of discussion with individual students other students could come and listen of course but where they came and asked me questions because in the tutorial it was mostly tutors who took the tutorials."</i>

Based on the above responses from Table 5.1, the lecturers indirectly acknowledged the personality trait of extraversion to a limited extent in the sense that students could ask questions if there were class discussions because in the Chemistry subject an option was provided by students to speak in the chat and ask questions as well in the Mathematics subject where the lecturer that students could ask questions on a social media platform chat since the Mathematics was a synchronous route during online learning. The Extroverted personality has a tendency to be active, outgoing and assertive (Watson and Clark, 1997). Students who are classified as having a dominant extraversion personality trait prefer to communicate and sort out ideas by talking and prefer to learn by doing, talking with others, expressing themselves, whereas introverted students would prefer written communication and work out their ideas through reflections (Woosley, 2001 in Murphy, Eduljee, Croteau, and Parkman, 2017).

Cluster 1: Cluster 1 (blue colour) in Figure 5.1 characterises the most dominant teaching strategies. The representation focuses on using PowerPoint (e.g. theme), asynchronous, live,

background, chat/ask questions, textbooks, COVID-19. Examples of statements related to this theme are represented in Table 5.1 based on the differences and approaches of each subject.

Table 5.2 Interview transcripts from subject lecturers responding to the question: “Do you conduct group work or prefer learners to work alone or small groups to learn by reflection? if yes: a) How often? Is it small groups of group work? if no: a) Do you provide opportunities for learners to engage with each other?”

Subject	Statements	Total counts
Chemistry	<i>“I prefer both...whether we are in COVID or not there are some work that we do. For example, in chemistry, what do we do? It involves a lot of practical work and tutorials so in that regard what happens by nature, practical work has to involve group work so that they do the prac and submit the write-up. Of course, the write up is individual work but the actual practical is group work.”</i> <i>“The same when you are dealing with tutorials...The students work together and come with a particular answer”</i>	2:active
Life Sciences	<i>“ If I had the capacity to set up group activities -which I have recently developed- I would have given my students tasks to work in groups at some time as I used to do when we had contact sessions. ...In every lecture I would have at least an activity where they work in pairs or threes...So it may be a way, it will help them to help each other to come up with a better structure of the cell.”</i>	3:active
Mathematics	<i>“ Okay, so remember we talking about maths content, if it was a lecture, I haven’t explained I lectured. In the tutorial groups, I wasn’t there mostly and yes they could talk to each other, certainly of course they could and in fact, I like the idea of students helping each other. Occasionally we did that in class, very occasionally”</i> <i>“we would have - I think -it was four lectures a week where I would be in front of the class lecturing to a class about 120 and then there would be two tutorial periods where students would come who were senior students. Of course, they always got the notes which were considered guides to the textbook because I didn’t see much value in me rewriting the textbook for them or rewriting the textbook we prescribed...I decided not to go the synchronous route.”</i>	1:occasional 1 active/ 2:reflective

Examples of statements related to this theme are represented in Table 5.2 based on the differences and approaches of each subject. Based on the statements and number count from Table 5.2, even though lecturers were open to group work by active learning or individual and small group work as reflective, the subject that seemed open to conducting the most amount of

group work during contact learning sessions was Life Sciences followed by Chemistry (more active learning approach) and then Mathematics (more reflective).

Cluster 2: Cluster 2 (purple colour) in Figure 5.1 characterizes active and reflective teaching and learning approach (e.g. the meta-theme) that displays aspects that centre around group work, individualism, practicals, tutorial (e.g. theme) which emerged from Table 5.2.

Table 5.3 Interview transcripts from subject lecturers responding to the question: “How do you conduct practicals? a) Providing simulation? b) Watching recorded practicals? c) If it was not for COVID-19, where would you be conducting your practicals?”

Subject	Statements
Chemistry	<i>“Most of the practicals because of now are online, we are using simulations... if it was not Covid we could be in the labs and they would be in groups and do those things themselves. So for example, what happens to the brightness -you are talking about electric circuits-of the bulbs in a series circuit as we add more batteries and what happens to the current. They will have to do, they will put one cell, another cell and be recording the current when using the ammeters. So the actual teaching when we are outside COVID it will assist us to see the cells, in a simulation, the cell is connected to the wire and the bulb, no they have to do it themselves and observe all those things.”</i>
Life Sciences	<i>“I have had mainly two approaches to practicals. One of them is for them to manipulate, manipulate in the lab where they go into the laboratories, where they do experiments with the microscope looking at cells because these are going to be future teachers, they need to have the techniques of working with the microscope and being able to view cells from specimens and identify the appropriate specimens and that is one when we are in contact... , there are certain activities that are not possible, if for example one at to look at group cephalopods as an example. We don’t have cephalopods in our labs, we don’t have cephalopods in fresh water in these contexts where we are and I cannot give my students a manipulative practical so I ask them to go and watch videos.”</i>
Mathematics	<i>“There are no practicals and we didn’t have formal tutorials in the COVID time but they did have these tut groups as I mentioned above WhatsApp groups which I was on the side-lines of, occasionally I participated.”</i>

The statements in Table 5.3 represent the approaches conducted by lecturers for each subject. Based on the above statements from Table 5.3, Mathematics as a subject do not conduct practicals, the Chemistry and Life sciences utilize simulations and videos only if laboratories are inaccessible that limit access to these facilities.

Cluster 3: Cluster 3 (green colour) in Figure 5.1 represents the approach adapted for conducting practical work (meta-theme) which represents a centred focus on laboratories, simulations, and videos that emerged from Table 5.3.

Table 5.4 Interview transcripts from subject lecturers responding to the question: “Do you incorporate tasks or content for learners to express their caring, kind or friendly sides?”

Subject	Statements
Chemistry	<i>“Yes, not much at the moment because I was struggling to be more creative technologically, but what I do is that students are able to communicate with one another and the students can also learn maybe through the WhatsApp groups, they can still interact.”</i>
Life Sciences	<i>“That has been very difficult for me to work with because the content that we are working with at the moment is, you know first-year life sciences education which is natural sciences education is now only covered as content. In the past, it was covered as content and methods. When I was teaching NS1 methods, it was possible to bring in some of those terminologies that bring in an ethic of care to the students and develop them to become caring teachers so at least the wording that we used at the time would show a bit of care but right now while working with content it is very difficult to demonstrate that you care and then I have been exploring of late another assessment framework which was put forward by Daphink, an American, it is under the notion of significant learning and the argument is that learning is not only in terms of the objective components that we can mark with a tick whether an answer is correct or wrong but learning is effective, it goes into how people feel, how people relate. I have been struggling to try and incorporate that....“</i>
Mathematics	<i>“Okay, truth, I can’t say I do. I don’t, I mean it not, my focus is on the cognitive and the academic in the maths course so I don’t suppose in the maths course. I don’t, obviously if somebody came to me if students did write about issues, expressing. I don’t know, certainly wrote to me about emotional issues and I could correspond why they couldn’t write a test or whatever and I certainly listened to what they said and was sympathetic if necessary but I don’t think its that what you asking but the maths questions themselves do not involve emotions.”</i>

Cluster 4: Cluster 4 : (orange colour) in Figure 5.1 represents a teaching and learning approach considering the Agreeableness Personality and the Altruism value (e.g. meta-theme) with a focus that centred on communication, asking assessment framework, active and reflective approach. Examples of statements related to this theme were represented in Table 5.4 based on the differences and approaches of each subject. Based on the statements from Table 5.4 from all three subjects, it appears that there are various reasons for not incorporating a teaching

approach influenced by the Altruism value or Agreeableness personalities such as teacher and technology capacity limitations, limitations of the course structure and assessment frameworks or the approach to how the subject as a whole is viewed- to not incorporate an emotional engagement side.

Table 5.5 Interview transcripts from subject lecturers responding to the question: “Do you constantly provide a structured learning environment or prefer a holistic approach by fitting pieces together into a big picture? e.g., a) submitting projects on time? b) learning in logical steps c) or in their own time with a bigger deadline?”

Subject	Statements
Chemistry	<i>“The idea here is that I teach things systematically and in the assessments, I have to assess according to what I have taught and makes me to see, to trace learners’ understanding...”</i>
Life Sciences	<i>“Unfortunately we can't work with a more open framework because we have deadlines to beat but COVID has taught us something. That our students where they are learning from. If they were learning from the university classrooms there would not be much to worry about in terms of deadlines and so on but I realise that there are students who struggle with meeting deadlines so we have had deadlines so that work is done but I have extended those deadlines many times. I am more flexible than I would have been.”</i>
Mathematics	<i>“...well I saw my role as being very structured I presented a very structured course when I was talking 2021 and even before that. My courses were always very well structured they got course guidelines at the beginning which told them what they would do every week, which part of the textbook they would do, what the topic of the content was they were very structured, the tutorial examples were present before the course. However, in terms of them learning I was very happy for them to learn in a holistic fashion as you put it, I don't know if it is a holistic fashion, they were listening and reading”.</i> <i>“A lot of learning in maths has to take place outside the classroom because you can't just absorb all the maths while you sit there and listen to the teacher presenting concept the first time. So, I mean I certainly expected them to go back and look at the concepts again with the examples, do the examples for them to adopt a more holistic approach, and go back to things when they needed to etcetera. I don't know it's implicitly holistic but explicitly it would be structured if you know what I mean”.</i>

Cluster 5: Cluster 5 (orange colour) represents the sequential and global teaching and learning style that consists of a focus that represents the notion of systematic, flexible,

holistic. Examples of statements related to this theme are represented in Table 5.5 based on the differences and approaches of each subject. The responses from Table 5.5 reveal that the Chemistry lecturer prefers a structured approach. The Mathematics lecturer prefers a structured teaching approach to learning within the classroom. However, once outside the lecture and classroom, the Mathematics lecturer prefers that learners adopt a holistic learning approach. The Life Sciences lecturer highlights the limitations of being restricted to having an open framework. The Life Sciences field acknowledges that due to COVID-19, they were able to become more flexible and take into consideration learners' experiences.

Table 5.6 Interview transcripts from subject lecturers responding to the question: “Do you mostly focus on fact retention and real-world applications? e.g. a) practical with a preference for concrete data, less complications? b) e.g., processing information to memorize for tests rather than assimilating what has been learned?”

Subject	Statements
Chemistry	<i>“Yes, it is both. The teaching is not about just giving them the facts but about also looking at the application as I said in the first place, you know. You need to provide and stimulate the thinking.”</i>
Life Sciences	<i>“When you look at our learners and especially that they are learning from different contexts, an educator is supposed to think about how that notion relates to wherever they are so that they are able to make meaning out of it. So learning as a meaning-making process means to relate relevance of that topic to their lives to that it can make meaning. That is all I am trying to say. So, whilst the interest is in syllabus science, I think the pedagogy that we use need to transform more and I am keen on giving learners knowledge which relates to their own life experiences so that they can relate with it better.”</i>
Mathematics	<i>“I would say mostly in maths, well it’s a mixture, a lot of it is learning mathematical concepts which are abstract by their very nature, exponential function is an abstract concept, but of course lot of the examples and the teaching might involve the textbook in other words when it was the online course would involve real world examples as well but actually in a funny way I know people like to focus on the real world and the importance to maths on the real world and yes it is of course it is extremely important in the real world, we saw that during COVID with all those graphs but it actually often can make the concept more confusing at first so some of the examples are of real world I would say my focus though is on the concept and the examples there were a mix of examples where some were applied but I can tell you in general, the applied examples are far more difficult, those are what we call word problems... We did, I did try to give some of the sorts of examples in the text but more abstract stuff is what I focused on.”</i>

Cluster 6: Cluster 6 (red colour) in Figure 5.1 represents the teaching and learning approach of fact retention or sensing (e.g. meta-theme) with a focus on application, meaning-making, difficulty level (e.g. themes). Examples of statements related to this theme are represented in Table 5.6 based on the differences and approaches of each subject. Based on the response statements from Table 5.6, the Life sciences and Chemistry subject lecturers lean towards a sensing and intuitive teaching approach whereas from a mathematics perspective adopting a sensing and applied example approach is more challenging to understand.

Table 5.7 Interview transcripts from subject lecturers responding to the question: “What type of assessments do you usually use to give feedback and how often?”

Subject	Statements
Chemistry	<i>“At first year, I have the following assessments: I had 3 tutorials, 1 long assignment, I have 2 tests and 3 practicals. The tutorials are something they do on a weekly basis and then not everything is marked but some I choose to be marked. The assignment is compulsory, one as to do it because the assignment includes most of the topics we have for the exam. So it is an overall assessment, the tests are given based on the topics that are related so they do the test, for example when you are talking about atoms, isotopes, periodic table more or less the same then they can do other tests or so, matter and materials on all those things..”</i>
Life Sciences	<i>“It has been a challenge with COVID and this remote teaching to bring in activities, especially those which enable learning during the process of engagement with the knowledge during the lectures...would certainly love to engage my learners with informal assessment tasks. So today we just work mainly on the milestones: a weekly practical, a weekly tutorial activity and after some way halfway in the course they have a test and that test because of timing and other issues affecting students like electricity access, access to connectivity then the easiest one is giving them a multiple-choice kind of assessment and that multiple-choice assessment, you can then set it in such a way that the students can access it at any one time they are able to and that way you can be assured of assessment but it is not the best because it does not allow me to establish an assessment for learning.”</i>
Mathematics	<i>“...all multiple choice. And before that formative tests the ones which were for practice, so I suppose there were 4 tests which 2 counted for exam purposes 2 didn't count for exam purposes and there was 1 exam- all multiple choice in the COVID environment, and they got marked. Okay, but they didn't get feedback actually, I mean they get their marks but I didn't give them back their bank of questions, everyone got their own set of questions, they were randomly generated from a bank of questions by the computer. They could ask me and I would tell them which ones or where they had gone wrong, yeah they could ask me.”</i>

Cluster 7: Cluster 7 (grey colour) in Figure 5.1 represents the assessment types adopted by lecturers (e.g. meta-theme) with a focus on common practices such as assignments, selected tutorials, practicals, tests, and multiple-choice questions (e.g. theme) adopted by each subject. The statements represent lecturers' views, reasons and attitudes towards adopting these assessment methods. Examples of statements related to this theme are represented in Table 5.7 based on the differences and approaches of each subject. Table 5.8 provides a summary of the assessment approaches per subject.

Table 5.8 Summary of assessment approaches

Chemistry	Life Sciences	Mathematics
Selected tutorials 2 Tests 1 Long assignment 3 Practicals	1 Weekly practical 1 Weekly tutorial 1 Halfway course test multiple choice	2 weighted course tests of 4 multiple choice

5.3 Summary of the Main Findings from the Qualitative Data

The qualitative results provided a brief indication of teaching approaches practised by lecturers. Based on the above results it would appear that within the subject of Mathematics, Chemistry and Life Sciences students are expected to follow systematic, proactive, disciplined, organized and effective modes of learning based on the teaching approaches adopted. For example, based on Figure 5.1 and Tables 5.1 -5.8, Table 5.9 categorizes the summary of the keywords and themes per subject below.

Table 5.9 Categorizes and Summarizes overall influences and teaching and learning approaches per subject.

Life Sciences	Chemistry	Mathematics
PowerPoint slides synchronous approach practical work videos systematic/due to COVID-19 became slightly more flexible	PowerPoint slides optional to chat/ask questions synchronous approach systematic practical work simulations	textbook optional chat/ask questions asynchronous approach difficulty level influences practical applications systematic

assessments: tests, tutorials, practicals	assessments: tests, tutorials, practicals	assessments: tests
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Table 5.9 revealed common teaching approaches that were discussed during the qualitative interviews. Based on the results it appears that Life Sciences and Chemistry subjects utilized the making slide deck of notes during lectures. However, Mathematics utilized textbooks more. Both Chemistry and Life Sciences provided live lecturers whereas Mathematics provided an asynchronous approach. Based on the interview answers it appears as if all subjects assumed a systematic approach. The Lecturers expected students to also ask questions in chat designated areas as a form of interaction. Thus it appears as if the courses are systematic as well as structured.

5.4 Discussions of the Overall Findings, Limitations and Implications of the Study.

The main purpose of this study was to determine the relationship between personality traits, work values and educational performance among first-year B. Ed students majoring in Science and Mathematics courses. The said purpose was achieved through sub-purposes: (i) to find the distribution of various personality types for students who enrol in B.Ed degree courses in Science and Mathematics, (ii) to find the distribution of work values for students who enrol in B. Ed degree courses in Science and Mathematics, (iii) to find the correlation between students' personality traits and their academic performance, (iv) to find the correlation between students' work values and their academic performance in first-year Sciences and (v) to find the dominant teaching approaches adopted by lecturers teaching Sciences and Mathematics courses. The focus regarding the latter points was mainly to investigate the distribution of personality traits and work values as well as the academic correlations between these variables among students.

Tables 4.1, 4.2, 4.3 and 4.4 showed that certain personality traits and work values evidently dominate among the students who were tested. For the most dominant personality traits in both Sciences and Mathematics, it was the Consciousness personality trait followed by Neuroticism and the Agreeableness personality. For the dominant work value in both Science and Mathematics courses, Structure was the most dominant work value followed by the work value of Performance (based on Tables 4.3 and 4.4). Based on further correlations between the personality traits, work values and academic performance discussed in Chapter four, students who scored low on the Openness to experience personality traits would perform better or have a high academic performance in the Physics, Chemistry and Mathematics subjects. It was

interesting that the most significant negative correlation was found between Openness to experience in Physics. This meant that students who scored low in Openness would perform better in Chemistry followed by Mathematics with low correlations as well. Based on the strong positive correlations between personality traits and work values, students who scored low in Openness to experience also scored low in the work value of Creativity (Tables 4.8, 4.9, 4.10, 4.11 and 4.12). This could be interpreted as students who preferred being practical, less open to change, preferred less Creativity and had higher academic scores.

The second significant correlation with a personality and work value was Conscientiousness and academic performance because in all Science subjects (Life Sciences, Physics and Chemistry) there were positive correlations between the academic performance. Mathematics had a negative correlation which was very weak nonetheless. This meant that students who scored high in Conscientiousness had a tendency to perform better academically. This meant that students who were more reserved, conformed to socially accepted ways and goal-oriented would score higher grades than their counterparts academically.

Based on the results within Chapter four of students in certain personalities (Openness to experience, Agreeableness, Conscientiousness, Extroversion, and Neuroticism) scoring high in the Sciences and Mathematics it does not imply that specific students are more skilled than others but just that subjects are taught in specific ways that favour certain students' personalities and work values over others. For example in Life Sciences, students who are high in Conscientious, and conform to traditional structures are favoured over others. In Physics, students who prefer traditional approaches, are conservative, and conform to traditional structures are also favoured over others. In Mathematics, students who are practical, conserved and structured may be favoured over others by the strongest positive correlation of structure.

5.5 Limitations of the Research

The overall results in Chapter four and discussions revealed that student profiles differ in their uniqueness as well as in various factors that influence academic and personality performance (Callaghan and Papageorgion, 2020). Moreover, these factors also differ depending on the new entrance of students as each new year can have a set of new types of students.

A Further research limitation was that this study was conducted among first-year undergraduate students, and it would be interesting to include students in their second, third or final years of studies as well to view correlation changes.

Even though Science and Mathematics subjects were chosen, it would have been interesting to include subjects across different programs and departments to increase the scope, impact and compare correlations. However, given the limited time frame of this research other subjects were not included in the current study. Nevertheless, this does not influence the trajectory of further research including intervention strategies, expanding the subject ranges or grade levels.

An additional limitation could be the context of the research as there was a slightly smaller scope of participants in the research as the study needed to be conducted under COVID-19 protocols.

5.3 Implications and Recommendations

The implications of the research reveal that it is important to acknowledge students with a variety of personalities rather than indirectly favouring the dominant personality traits. The findings also reveal that students who are dominant in certain personality traits (low Openness to experience, Consciousness, Agreeableness) and work values (Structure) may be favoured over others, yet we know that it is important to include students with a variety of personalities and work values.

In terms of recommendations, it is important for teaching approaches to acknowledge the variety of personality traits and work values in order for students to continue and become aware of the differences amongst people for the benefit in professional environments of their own career paths.

An example of teaching approaches for acknowledging students based on their personality traits would be in instances where students who have a more dominant personality towards Openness to experience could benefit from teaching approaches that consist of Creativity, variety, independence and judgement (Zhang, 2002). Perhaps others with dominant personalities in Agreeableness could benefit from altruistic approaches such as valuing and respecting other's peoples and conventions (Zhang, 2002) or providing an opportunity for students to help or provide advice toward solutions. Opportunities for Altruism could also be provided for students who have a dominant personality in Consciousness since there were positive correlations between Consciousness and the Altruism work value in the context of this study's results and others discussed in prior chapters. There were also positive correlations between students who scored high in Consciousness having valued the work value of being Structured. Perhaps self-regulating teaching and learning suggestions to follow could be provided for these students. Students who are more dominant in Extraversion would benefit

from a teaching approach that is structured based on the results of positive correlations in this study. Lastly, students who are Neurotic which is antipodal to emotional stability would find the work value of Performance important based on this study. This implies that students dominant in the Neurotic personalities would benefit from teaching approaches where Performance and Ambition is rewarded. For example, students who tend to score high in Neuroticism possess a tendency to feel guilty, embarrassed, pessimistic, have low self-esteem (Zhang, 2002) or are motivated for academic achievement because of fear of failure (De Feyter, Caers, Vigna, and Berings, 2012) could benefit where their individual performance is rewarded.

In order to acknowledge the various personality traits among students and provide a sense of belonging and inclusion, it is recommended that personality and work value questions be provided to students. These questions could be provided before the beginning of actual lectures to allow time for them to adapt to the teaching and learning approaches in their respective groups.

5.4 Reflections and Conclusions

An overall conclusion from this study is that there is a vast range of students who are not identical with the same personalities, values and interests. One teaching approach cannot be suited for every student and there is some merit in providing students with a sense of individualized learning opportunities based on who they are as individuals. This means that it is important to investigate and profile the needs of all students before a lecturer decides on the best possible teaching approach for specific students based on their personalities, and work values while still considering subject disciplines.

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LIST OF APPENDICES

Appendix A: Student Online Psychological Test Questionnaire

Link to personality test: <https://www.123test.com/personality-test/>

Link to work values test: <https://www.123test.com/work-values-test/>

Appendix B: Interview Schedule

Main question	Follow up /prompting questions	Reason for asking these questions
1. How do you usually teach lessons?	Lectures? Posting reading material? Self-study	To find out whom lecturers accommodate/ what teaching and learning styles are dominant.
2. Do you conduct group work? or prefer learners to work alone or in small groups to learn by reflection?	if yes: a) How often? Is it small groups of group work? if no: a) Do you provide opportunities for learners to engage with each other?	To find out if the learning style is active or reflective
3. Do you provide new opportunities for learners to get creative with each other or the material?	E.g. by promoting inventive thinking	intuitive learning & Openness to experience
4. How do you conduct practicals?	guiding options: a) Providing a simulation? b) Watching recorded practicals? c) (for science subject) If it was not for COVID-19, where would you be conducting your practicals?	visual or verbal? & Sequential or global?

Appendix C - Information letter and consent forms - Student

Good day

My name is Celine Harilall and I am a Masters in Science Education student in the School of Education at the University of the Witwatersrand. As part of my studies, I am required to undertake a research study under the main supervision of Dr Belinda van der Westhuizen and the co-supervision of Dr George Ekol. The aim of my research is to find out the relationship between personality traits, work values and educational performance amongst first-year students who enrol for the B.Ed Sen/FET Sciences and Mathematics courses.

As part of this research study, I humbly invite you to participate in answering two online questionnaires. One on personality types and the other on work values. Once you have completed the questionnaire, you will receive the results in your email inbox. I ask that you please forward me the results at 1430943@students.wits.ac.za. With your permission, I will also view your class mark sheets provided by your current lecturers. Both the questionnaires will take approximately 25 minutes to complete with instant feedback results. By participating in this research, you may also get to know yourself deeper. This study will not only provide information about the different types of students in a university but also gain insights about positions and relations of the differences amongst individuals.

There will be no personal costs to you if you participate in this project. You will not receive any direct benefits from participation but there are no disadvantages or penalties if you do not choose to participate or if you withdraw from the study. This means that there are no right or wrong answers, nor any judgement given to any of your answers. You may withdraw at any time or not answer any questions if you do not want to. Your questionnaires will be completely confidential and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation in my final research report.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report. With your permission, the data collected from this research project may be used by other researchers in an anonymized format. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,

SIGNATURE

RESEARCHER: Celine Harilall
EMAIL: 1430943@students.wits.ac.za
CONTACT NUMBER: 073 499 5949

SUPERVISOR: Dr Belinda van der Westhuizen
EMAIL: belinda.vanderwesthuizen@wits.ac.za
CONTACT NUMBER: 082 856 7495

Name of researcher Celine Harilall

By choosing to click on the online questionnaire links you are indicating your willingness to be a participant and agree that your participation will remain anonymous, the information you provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained are 18 years and over

Links to complete BOTH the questionnaires:

Personality test 1: <https://www.123test.com/personality-test/>

Work values test 2: <https://www.123test.com/personality-test/>

Appendix D - Information letter and consent forms – Lecturer

Good day

My name is Celine Harilall and I am a Masters in Science Education student in the School of Education at the University of the Witwatersrand. As part of my studies, I am required to undertake a research study under the main supervision of Dr. Belinda van der Westhuizen and the co-supervision of Dr. George Ekol. The aim of my research is to find out the relationship between personality traits, work values, and educational performance amongst first-year students who enrol for the B.Ed Sen/FET Sciences and Mathematics courses.

Please may I humbly invite you to participate in a semi-structured interview, granting access to your student's performance marks and involving your students to participate in two online website questionnaire tests/ surveys? With your permission, I would also like to record the semi-structured interview between you and me. The audio recording will be stored on a password-protected laptop that only the researcher (I) and my supervisor will have access to.

Your participation is completely voluntary and there shall no be personal costs to you choosing to participate in this research study. You will not be advantaged or disadvantaged in any way. Your name and identity will be kept confidential at all times and in all academic writing about the study. Your individual privacy will be maintained in all published and written data resulting from the study. There are no foreseeable risks in participating. You may withdraw at any time or not answer any questions if you do not want to.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report. With your permission, the data collected from this research project may be used by other researchers in an anonymized format. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,

SIGNATURE

RESEARCHER: Celine Harilall
EMAIL: 1430943@students.wits.ac.za.
CONTACT NUMBER: 073 499 5949

SUPERVISOR: Dr Belinda van der Westhuizen
EMAIL: belinda.vanderwesthuizen@wits.ac.za
CONTACT NUMBER: 082 856 7495

LECTURER CONSENT FORM

Name of researcher Celine Harilall

Please fill in and return the reply slip below indicating your willingness to be a participant in my voluntary research project called: A mixed-method study investigating B.Ed students' personality types, work values, and performance across Science and mathematics subjects.

(Please select the relevant options below).

I agree that the interview may be audio recorded. YES/NO

I agree that my participation will remain anonymous. YES/NO

I agree that the researcher may use anonymous quotes in his / her research report. YES/NO

I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained. YES/NO

I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained. YES/NO

..... (Name of participant)

..... (Date)