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# Determining a Relationship Between Attitude Towards E Learning and Academic Stress Levels in Higher Education Students

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# Determining a Relationship Between Attitude Towards E-Learning and Academic Stress Levels in Higher Education Students



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Research Report submitted in partial completion of the requirements for the degree of Master of Arts in the field of Psychology

# Declaration

A research project submitted in partial fulfilment of the requirements for the degree of MA by coursework and Research Report in the field of Psychology in the Faculty of Humanities, University of the Witwatersrand, Johannesburg, 15/03/2023.

I declare that this research report is my own, unaided work. It has not been submitted before for any other degree or examination at this or any other university.



Byron Franco Persello

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## Abstract

E-learning has become more prevalent in higher education institutes, partly due to the COVID-19 pandemic that necessitated social distancing as well as the rise in technology application to education. With stress being an important factor in the academic experience, this research report explores the relationship between the experience of stress and attitudes towards e-learning factors in students. The sample was 79 undergraduate students from the University of Witwatersrand who had undergone e-learning during the 2021 academic year. To gather the data, the Student-life Stress Inventory and Scale of Student Attitude towards E-learning was used. The results showed there was no correlation between experienced stress and attitudes towards the e-learning factors, results $r$ = -.178, n = 75, $p$ = .317. Descriptive analysis of the two measure's items indicates that participants recognised the benefits of e-learning but challenges using the e-learning medium were still relevant to their experience. The overall stress was beyond normal management for 86.11% of the participants, even though social support appeared available.

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Table of Contents

Declaration ..... 2
Abstract ..... 3
Acknowledgement ..... 4
Determining a Relationship Between Attitude Towards E-Learning and Academic Stress Levels in Higher Education Students ..... 8
Literature Review ..... 8
Advantages and Disadvantages of E-learning ..... 9
Perception of Stress in Higher Education (HE) Students ..... 10
Attitude towards E-learning ..... 11
Rationale ..... 13
Theoretical framework ..... 15
Social Constructivist Theory ..... 16
Connectivism ..... 18
Folkman and Lazarus's Transactional Theory of Stress and Coping ..... 20
The Theory of Planned Behaviour ..... 22
Methods ..... 23
Aim ..... 23
Research Questions ..... 23
Research Design ..... 24
Research Questions and Hypothesis ..... 24
Research Participants ..... 25
Participants' Demographic Details ..... 25
Measures ..... 26
Scale of Students' Attitudes towards E-learning. ..... 27
Student Life-Stress Inventory. ..... 30
Procedure ..... 33
Ethical Considerations ..... 33
Results ..... 35
Pearson Product-Moment Correlation ..... 36
SSI and SSAE categories ..... 37
Multiple regression analysis ..... 38
Measures of Central Tendency, Distribution, and Variance ..... 39

Scale of Student's Attitudes Towards E-Learning Item Descriptives ..... 40
Student-Life Stress Inventory Item Descriptives ..... 42
Discussion ..... 46
Conclusion ..... 54
References ..... 55
Appendix A – SSAE Items ..... 63
Appendix B – SSAE Items Positively and Negativily Grouped ..... 66
Appendix C - SSI ..... 67
Appendix D – Demographic Items ..... 71
Appendix E – Histograms of SSAE Select Items ..... 72
Appendix F – Histograms of SSI Select Items ..... 81
Appendix G – Ethical Clearance Certificate ..... 85

**List of Tables and Figures**

Table 1 Demographics of Study's Participants ..... 26
Figure 1 Histogram of Responses to Item "What degree were you studying"? ..... 26
Figure 2 Histogram of Item "What was your major" ..... 27
Table 2 Reliability Results of the SSAE from Al-Musawi ..... 29
Table 3 Reliability Results of the SSI From Gadzella and Masten ..... 32
Table 4 Comparison of SSI Reliability Between the Gadzella and Masten Study and the Present Study ..... 35
Table 5 Comparison of SSAE Reliability Between the Al-Musawi Study and the Present Study ..... 35
Table 6 Descriptives for the SSI and SSAE ..... 36
Figure 3 Distribution of the SSI Score Totals From Participants ..... 36
Figure 4 Distribution of SSAE Score Totals From Participants ..... 37
Table 7 Descriptive Statistics of the SSI and SSAE Categories and Domains ..... 38
Table 8 Correlation Matrix of SSI and SSAE Categories and Domains ..... 39
Figure 5 Total Scores of SSI by SSAE ..... 40
Table 9 Descriptive Statistics of E-Learning Items and Student Experience Domain ..... 40

Figure 6 Distribution of Total Scores for the Student Experience Domain..... 42

Table 10 Descriptives of SSI Select Items and Categories..... 43

Figure 7 Distribution of Response Totals to the Changes Category ..... 44

Figure 8 Distribution of Response Totals to the Physiological Category ..... 44

Figure 9 Distribution of Response Totals to the Emotional Category ..... 45

Figure 10 Distribution of Response Totals to the Cognitive Appraisal Category..... 45

# Determining a Relationship Between Attitude Towards E-Learning and Academic Stress Levels in Higher Education Students

With the increasing prevalence and integration of information technology, specifically the internet, education globally has begun to incorporate this technology into its service of delivery (Castro & Tumibay, 2019). This relatively new paradigm of e-learning offers education in a flexible, distant medium that should decrease the disparity of education amongst the different socio-economic classes in society (Mafenya, 2013). While there is evidence for this, less evidence is available concerning the efficacy of e-learning in general and about the stress students experience with this learning medium in South Africa. With the dearth of information concerning this, and South Africa's disparity of technology access, further research appears warranted. This research paper aimed to determine what, if any, relationship is significantly present between the two variables of factors that affect higher education students' attitudes towards e-learning and the student's levels of perceived stress. Additional insight towards the sample of higher education students' experience of e-learning and stress during the 2021 COVID-19 lockdowns may be elicited from the measures. To answer these questions, establishing what the literature has revealed about the relationship and where the gaps in knowledge are, was explored. Based on that information, two sets of measures were presented to participants within the selected sample population, who were University of the Witwatersrand students who had completed their first or second year in 2021 online. The results were compiled and analysed with descriptive and inferential statistics to determine if a statistically significant relationship exists between the two variables, and what specific items within the measures revealed about the sample's stress and e-learning experiences.

## Literature Review

With technology advancing over time, its permeation and use across global institutions is expected for it to remain contemporary and relevant. The use of technology in the education institute is no exception. E-learning is the use of the internet and digital media as a medium for teaching and learning to occur through (Theelen & van Breukelen, 2022). This includes the tools and software available through the Internet (Butola, 2021; Kong et al., 2014; Nichols, 2003; Ravenscroft, 2021). The term e-learning is synonymous with online learning in recent literature examined and found by Theelen and van Breukelen (2020). The research on e-learning and its effects on students and educators saw a resurgence since 2020 as the COVID-19 epidemic resulted in global lockdowns of societies (Butola, 2021; Rashid & Yadav, 2020; Theelen & van Breukelen, 2022; UNESCO et al., 2021). Lockdowns are the restricted movement and collection of people to prevent the spread of the COVID-19 virus. This meant

that places of learning needed to do a rapid transformation of their education delivery method to still reach students staying at home. This was done through learner portals and learning management systems, both locally in South Africa and globally (Laher et al., 2021; Theelen & van Breukelen, 2022).

Learning management systems are software programs that are accessible to students, facilitators, and administrative staff of an education institute as a means of facilitating the education process (Agaçi, 2017). The degree of access and method of engagement with the learning management system depends on whether an individual is a learner, facilitator, or administrator (Agaçi, 2017). The learning management system assists with the education process, by providing a central and online accessible, platform from which learning material can be disseminated and accessed by learners and facilitators (Agaçi, 2017). The learning materials are not just resources and slides from the facilitator, but also quizzes and forums in which a communal discussion can be focused (Agaçi, 2017). The learning management system also provides an avenue from which assignments and tests can be uploaded and downloaded from, along with marking and record keeping (Agaçi, 2017). It functions as the hub around which administrative and pedagogical functions are stored and engaged with, and communication between facilitators and learners occurs (Agaçi, 2017). E-learning ideally should not simply be transferring traditional, face-to-face education to the online platform as the delivery and reception of learning through the e-learning medium has different requirements from students and educators (Castro & Tumibay, 2019; Ravenscroft, 2001; Sunal et al., 2003). The change in delivery and reception of learning materials requires consideration to the course design with regards to student-educator interactions, student-educator technology access and efficacy, and the pedological approach (Batulo, 2021, Castro & Tumibay, 2021; Ravenscroft, 2001).

### *Advantages and Disadvantages of E-learning*

The benefits and detractions of e-learning are inherent in it being an online medium. As an online medium, it allows for education to be more accessible to people regardless of distance and at a more feasible cost as transportation is less (Butola, 2021; Gillingham & Molinari, 2012). Students are able to accommodate the curriculum learning outcomes to their own private schedules (Castro & Tumibay, 2019). There are also positive findings linked to the online instruction medium which positively affect student's attitude towards it such as the informal nature, more access to resources, the quality of discussion, and increased motivation in some cases (Mafenya, 2013; Sunal et al., 2003). The disadvantages of e-learning also stem from the online, distant aspect such as feelings of isolation and lack of access to technology (Bharuthram & Kies, 2013; Mafenya, 2013). The feelings of isolation are not

only physical but can be psychological if technology proficiency in students is not adequate. In a South African study done by Mafenya (2013), feelings of inadequacy and exclusion emerged from the use of the e-learning medium in students will little to no experience or exposure to computer technology. The disparity of access to technology is relevant in South Africa where many students who come from historically disadvantaged backgrounds do not have access or stable use of internet or computer technology in their hometowns (Bharuthram & Kies, 2013; Laher et al., 2021). Pertinent to this is that for e-learning to be effective it needs to be well structured and designed so that the students can benefit from the advantages and is intuitive to use. This requires time and research into optimal designs, which is still currently being done (Castro & Tumibay, 2019).

### *Perception of Stress in Higher Education (HE) Students*

Stress is the response to an environment or situation that is demanding or represents a threat to the integrity of an individual, physically or mentally (Jain & Singhai, 2017; Kohler Giancola et al., 2009; Maykrantz & Houghton, 2020). For the HE student, these sources of stress can be relationships, lack of resources, academics, expectations, diversity, transitioning to university or college, or financial (Hurst et al., 2012; Joo et al., 2008). However, stress can be either positive or negative depending on how it is perceived and how it is regulated (Gadzella et al., 2012; Kohler Giancola et al., 2009). Stress in milder amounts is beneficial to students as it provides a thrust for personal growth such as the ability to cope with stress when it invariably occurs (Gadzella et al., 2012). It also has been linked to greater academic achievement compared to those with higher relative stress (Gadzella & Masten, 2005). The negative effects of stress can be related to lowered self-esteem, depression, suicide, maladaptive coping strategies like excessive drinking or smoking, and anxiety (Hooda & Saini, 2017; Joo et al., 2008; Maykrantz & Houghton, 2020; Saleh et al., 2017). In South Africa, stress in HE students is being researched and found to negatively affect academic success and student well-being (Dlungwane et al., 2017; Langtree et al., 2018). A study by Langtree et al. (2018) assessed the sources of stress in South African nursing students. While the expected stressors of the work-academic balance were found, additional financial stressors pertinent to South Africa emerged too. Students were expected to send money home to support their families, despite only receiving a stipend of R3000.00 a month to support themselves while they study (Langtree et al., 2018). This provides an example of how academic stress may not be examined in isolation to the academic sphere when studying the effects of academic-related stress. Concerning stress related to e-learning, Olasina (2019) in a mixed-method study with South African HE students, reported that student's stress related to learning in an e-learning system would negatively affect the participant's willingness to adopt e-learning.

A particularly relevant demographic in South Africa is first-generation learners. These are students who are in the process of obtaining a higher education degree and come from a family where neither the parents nor the siblings have a higher education degree (Uleanya & Rugbeer, 2020). First-generation learners in South Africa face additional challenges in addition to those expected of learners who are not first-generation (Uleanya & Rugbeer, 2020). These additional challenges stem from the reason why they are first-generation learners such as a tendency to not have English as their first language (the language of instruction at most universities), and they are under-prepared for the challenges associated with the experience of higher education (Uleanya & Rugbeer, 2020). This can lead to lower academic success and an increased likelihood of leaving the studies before they complete them or dropping out entirely (Uleanya & Rugbeer, 2020). First-generation first-year students tend to also come from lower economic-status households and environments (Motsabi et al., 2020). Motsabi et al. (2020) in their qualitative study of first-generation first-year students, suggest that social support from family and the community provides a buffer for which higher education challenges can be mitigated. Family in the Motsabi et al. (2020) study refers to individuals living in the same household as the student, where they give examples of parents and siblings. This buffering would then be compromised within the first-generation support system, as the complexities and details of the challenges are not easily relatable by the family members without a higher education degree (Motsabi et al., 2020). This requires social support for higher education challenges to be sought out from beyond the family structure into friends and the community that have had these experiences (Motsabi et al., 2020). This includes peers in the higher education environment. According to Motsabi et al. (2020), support from higher education peers, particularly those who are also first-generation learners helps manage the challenges experienced and motivates them to persevere through the degree.

The relevance of stress to HE student academic experience is established by the literature, but not sufficiently in the e-learning realm, a learning medium which has vastly increased in use and relevance in recent years. Particularly salient is the need to address this gap in the literature for the South African context, where stressors such as lack of resources and finances are particularly relevant for students.

### *Attitude towards E-learning*

The advantages and disadvantages towards e-learning contain aspects that affect a student's attitude. Attitude for this paper is conceptualised as being the overall positive or negative evaluation a student has towards the medium (Fishman et al., 2021). Measuring attitude towards e-learning requires

consideration to these factors that have a meaningful impact, operationalizing them into specific yet broad constructs. Studies within the literature have taken approaches to either constructing their own measure or adapting other measures to fit the construct of attitude towards online learning (Bhagat et al, 2016; Cakır & Solak, 2015; Gillingham & Molinari, 2012; Linjawi & Alfadda, 2018; Mehra & Omidian, 2012; Saadé et al., 2007; Sunal et al, 2003). Al-Musawi (2014) appears to have created a relevant measure with the development of the Scale of Students' Attitudes towards E-learning (SSAE). The abbreviation SSAE was not used in the original paper but denotated by this author. The SSAE covers a broad spectrum of factors that are important to the attitude students have of e-learning. They have been condensed into three domains: advantages and disadvantages of e-learning, the student's experience in e-learning on campus, and technical and pedagogical support at campus. These three domains are expanded on in the Methods section below.

While the SSAE may account for the student's overall attitude towards e-learning, the emotional aspect is relatively untapped within the items. Of the 44 items within the measure only two refer to the student's emotions or mental health, items 24 and 32. Item 24 states "I feel nervous and tense when I fail to use e-learning effectively" and item 32 states "I feel comfortable with performing the e-learning activities and tasks related to the e-course" (Al-Musawi, 2014). The student's emotional experience of e-learning is significant to consider as literature has identified its presence affecting the learning process (Goetz et al, 2007; Pekrun & Linnenbink-Garcia, 2012). When the emotional experience of students is accounted for, it shows a notable relation to student's attitude towards e-learning (Cakır & Solak, 2015; Mayer, 2020; Saadé et al., 2007). The field of study may affect the attitude towards e-learning. This factor has either not been accounted for within literature or has been shown to be significant (Al-Muwasi, 2014; Hung et al., 2010; Malik & Akkaya, 2021; Mortagy & Boghikian-Whitby, 2010). The concept of first-generation students (FGS) are students whose parents have either not attended or completed tertiary education (Heymann & Carolissen, 2011). The trend suggested in research is that FGS typically face additional challenges in comparison to their student counterparts such as support, stress, and finances (Campbell & Narayan, 2017; Heymann & Carolissen, 2011; Motsabi et al., 2020). This may be particularly relevant in this study, as it logically pairs with the status of not having access to technology, and South Africa's history of resource disparity.

The literature on e-learning shows an increasing breadth and depth towards the advantages, disadvantages, pedagogical, and student experiences, while academic stress is a well-established field of

research. The literature review indicates that while this is true, the relationship between experienced stress and attitudes towards e-learning factors is less certain.

## Rationale

The e-learning landscape has been thoroughly investigated during the early 2000's but showed a resurgence of interest since 2019/2020. The resurgence is of importance as technology changes and developments occur quickly over time (Castro & Tumibay, 2019). The context of technology and the subsequent studies done 15 years ago may not be as sensitive or conceptually accurate in our current period of 2022. E-Learning adoption has increased, and studies pointing to the benefits of e-learning and hybridization of it with traditional learning, warrant a more recent examination of it in South Africa.

The South African context is relevant when considering e-learning as technology access and education is not universal. E-learning is meant to enhance inclusivity and access to education for students who are at a financial disadvantage or located distantly from an education institute (Mafenya, 2013). In a descriptive qualitative study by Mafenya (2013), students at the University of South Africa were interviewed on their readiness for e-learning. One of the themes that emerged was the importance, and lack of, internet and electricity for the students depending on e-learning to access education (Mafenya, 2013). A lack of technical skills and experience in using computer technology also emerged as a theme (Mafenya, 2013). The student responses become especially relevant as the University of South Africa (UNISA) is the largest Open Distance Learning (ODL) institute in Africa, servicing HE exclusively through a distance medium (Unisa, 2020). The exchange medium of learning was once through the postal system, but now UNISA is recognizing the need for and student autonomy over technology, as a needed facet of their institute (Unisa, 2020). These findings are buffered by another qualitative and quantitative mixed study by Masonta et al (2015) that had secondary school participants aged 16 to 19. These students recognized the need for internet and technology proficiency despite the majority not having access to it (Masonta et al, 2015). This lack of access and experience with computer technology then extends to how these students may interact with e-learning platforms. In a study by Bharuthram and Kies (2013) on the challenges of e-learning in a South African university, the themes of inadequacy and exclusion emerged. These themes were found in students, who despite computer literacy training, still felt slow and excluded from the learning process in the e-learning medium (Bharuthram & Kies, 2013). The authors suggest that this is because the students do not have enough exposure to the technology in their home settings to gain proficiency through practice (Bharuthram & Kies, 2013). The importance of the student's attitude towards e-learning is undervalued

in literature where much of the research focuses on how e-learning, as a tool, can benefit or hinder learners (Akimanimpaye & Fakude, 2015). An education institute that is pursuing e-learning wholly or in part will need to know the attitude of its learners towards this new education delivery method for it to be accepted and used effectively.

With the widespread and rapid adoption of e-learning due to technological advancement and the COVID-19 context, a South African relevant and contemporary view of students' attitudes towards e-learning and their experience of stress is required. At the time of this report, the COVID-19 pandemic has had global and local effects on how to respond to disease-based natural disasters. The gravity of these effects can be inferred by the World Health Assembly's response to the pandemic, with the formation of the Intergovernmental Negotiating Body (INB). The function of the INB is to create an "accord" in which future pandemics are approached with better prevention, preparedness, and response (World Health Organization (WHO), 2022). While this is not a surety of future pandemics necessitating e-learning, it highlights the reality that they may occur and understanding e-learning conducted in prolonged stress environments is relevant.

Not much literature concerning the relationship between HE e-learning and stress in South Africa is available. Olasina (2019) in their mixed-design study determined stress as a factor through thematic analysis in the willingness to adopt e-learning. The qualitative portion of their study indicated that in addition to other factors, the expectation of e-learning being a stressful experience affected their willingness to adopt e-learning. Kabir et al. (2021) found similar results in their study of 1145 Bangladesh HE students. These authors found that student readiness and willingness to adopt e-learning moderated the level of e-learning stress reported. The less willing participants were to adopt e-learning the more likely they were to score higher on stress from e-learning. Patnaik (2022), also in South Africa, reported stress as one of the factors negatively affecting the well-being of academics who needed to make a shift to online teaching. Silinda and Brubacher (2016) in a qualitative study of postgraduate online learning found that the challenge of communicating with supervisors was a significant source of stress. Stress as a factor that can affect mental and physical well-being is underappreciated in this emerging e-learning space, where it may go even more unseen due to distance and potential disconnection between educational institutes and students. The typical stressors of higher education such as difficulty of the work, poor study methods, conflict between social and academic demands, and financial concerns would all logically transfer over to e-learning (Joo et al., 2008; Kohler Giancola et al., 2009; Langtree et al., 2018).

How stress manifests from unique sources within the e-learning space is less understood. Many studies of stressors related to e-learning have been done on nursing student cohorts. A scoping review from 2010 to 2020 by (Majrashi et al. (2021) found that some of the stressors faced by nursing students doing e-learning, were high work- and assignment-load, as well as the challenges inherent in e-learning. These challenges were the increased cost of using the internet to study; access to the internet and electricity; lack of privacy at home to study; having to use smartphones to access the e-learning content; engaging with the internet as a learning medium; and lack of technology to engage with the e-learning medium(Masha'al et al., 2020; Subedi et al., 2020). However, some stressors such as allocating time to study have been found to be reduced with e-learning. Lazarevic and Bentz (2021) in their post-test control group study of 139 HE students, found that stress concerning the time to study was lower in the e-learning group than in the traditional learning group. Lazarevic and Bentz (2021) also found that the stress of accessing study materials was lower in the e-learning group compared to the traditional learning group.

The concept of e-learning in prolonged stress environments may not be limited to pandemics but potentially other circumstances where stress is experienced due to surrounding unchangeable conditions. Environmental conditions correlated with higher chronic stress occurrence are air pollution, and lower socioeconomic status (SES) (Evans, 2006; McEwen & Tucker, 2011). These environmental conditions are particularly relevant to the South African context.

The advancement of technology into the education sphere necessitates understanding how pedagogy is affected by the medium of instruction. Technological advancement of the learning medium is illustrated by the use of computers, internet, and software to assist educators and learners with the learning process. These advancements are critical in the current study of e-learning. To assist with this understanding, the cognitive theory of stress and coping, TPB, connectivism, and social constructivism theories intersect as interpretive frameworks. This interpretation will help understand how the relationship between attitude towards e-learning factors and experienced stress by undergraduate students impacts the learning experience.

## Theoretical framework

The constructivist learning theory is a broad field of study, that brings together varying theories of learning. The constructivist theory of learning holds that learning is an active process within the mind of the individual using external and internal inputs. The internal input is the student's knowledge, and the external input is the knowledge of the facilitator, the environment, and/or peers (Pritchard, 2009).

The student's internal processing then constructs meaning and value from these inputs (Pritchard, 2009; Siemens, 2004). My application for this definition is learning that occurs within a classroom setting. The classroom may present as face-to-face learning in a shared space with a facilitator or students learning via distance through the information technology medium. Information technology will be broadly applied as electronic technology to facilitate learning such as the internet, computers, and electronic media.

The method by which knowledge is assimilated depends on the sub-theory of the constructivist theory. Simons and Bolhuis (2004) differentiate theories according to what environments they are applied to and the purposes of learning. These environments could be the educational, work, or social context, with purposes of learning being for the sake of learning and improvement, for a goal, or understanding a topic (Simons & Bolhuis, 2004). This research context is a university e-learning space in South Africa with the purpose of students studying to obtain a qualification. The context is important as it informs the selection of social constructivist theory within Constructivism, and by extension, Connectivism as the theoretical framework for this research.

To understand the stress results from the participants, the cognitive theory of stress and coping by Folkman and Lazarus will be used. Additionally, the attitude towards e-learning factors and the participant's experience of these factors will be interpreted through the Theory of Planned Behaviour (TPB).

### *Social Constructivist Theory*

The construction of knowledge in the education setting can be understood by the social constructivist theory. The social constructivist theory is a field of different approaches to explain how learning requires input from social interaction (Pritchard, 2009). The idea of social interaction for learning was formalized and defined by Lev Vygotsky, who conceptualized that knowledge is created and given meaning through the interpersonal exchange between individuals (Wells, 1994). Theories of learning and its features specific to Vygotsky are referred to as Vygotsky's cultural-historic theory (Daneshfar & Moharami, 2018). The specific features are the zone of proximal development (ZPD) and using semiotic tools which work together to facilitate the learning process (Pritchard, 2009; Wells, 1994). The zone of proximal development is an abstraction to explain how learning occurs through the interaction with other individuals, typically those at a higher state of knowledge (Wells, 1994). The zone of proximal development is the idea that the learning can occur on two levels. The first level is the degree of learning that can occur independently within the learner, constrained by their own limitations

of knowledge and mental tools (Daneshfar & Moharami, 2018; Nardo, 2021). While this first level of learning is constrained within the individual it is not a feature of the individual, as the tools they use to engage with themselves are products of their social and cultural environment (Wells, 1994). The second level of learning is the increase in the potential of the learner's understanding and internalisation of information, which requires external inputs to facilitate this expansion of understanding (Daneshfar & Moharami, 2018). The mental tools within the first level and the external assistance of the second level are examples of semiotic tools used to engage with the information. Semiotic tools according to Vygotsky's approach, are psychological constructs that share an existence within the space of the mind and the physical world, language being the most prominent one according to Wells (1994). Language, and signs to a degree, are the means by which interactions within the zone of proximal development occur (Wells, 1994). Signs are objects or gestures that represent information, a hand waving does not constitute language but contains meaning dependent on the context (Wells, 1994). Social interaction within the ZPD is between the learner and facilitator and uses language to communicate ideas to oneself and others (Wells, 1994). This knowledge-making through social interaction is important as the first step for internalization of the event (Glassman, 2001). The facilitator could be a peer of the learner or a knowledgeable instructor (Pritchard, 2009). The assistance occurring in level two of the zone of proximal development occurs through the concept of scaffolding. Scaffolding is an expansion of Vygotsky's seminal theory of the ZPD by Wood et al. (1976) who posit that scaffolding is a learning technique used by a knowledgeable facilitator to assist a less knowledgeable learner (Wood et al., 1976). This is when the facilitator assists the learner with unknown features of a topic, providing partial solutions, and gradually removing support as the learner achieves new success, moving through the ZPD (Wood et al., 1976). This social constructivist theory posits that the integration, meaning, and value of knowledge is not isolated to just one-on-one interaction between learner and facilitator but is also created through a group effort (Pritchard, 2009; Wells, 1994).

An additional relevant theoretical feature of constructivist learning is that of schemas. Vygotsky's zone of proximal development focuses on the social and communicative aspects required for learning to be transmitted (Nardo, 2021). Schemas, in turn, theorise as to how the knowledge is integrated and retained within an individual from the learning process (Pritchard, 2009). A schema is structured as a framework in which isolated concepts connect to each other to form greater, more meaningful concepts (Pritchard, 2009). These concepts can be abstract ideas or representations of physical world object, but are all pieces of knowledge within another framework (Pritchard, 2009). An example would be the schema of an animal. The concept of "animal" could be something that moves, is

born, dies, and cannot speak. Each of these features is a point of knowledge that together form the idea of an "animal". The schema can have other schemas within them, such as that both fish and bird are "animals" but are differentiated but different structures. A bird having wings, and a fish gills, are features of that schema's structure. Piaget's model of schema theory makes use of the concepts of accommodations and assimilation to explain how this differentiation and engagement of schemas occurs. (Pritchard, 2009). Assimilation is the process of learning where new information is readily integrated into existing schemas, increasing the detail and specificity of that schema (Pritchard, 2009). Accommodation is the process in learning where additional input from the environment contradicts or is wholly different from the existing schemas within the individual (Pritchard, 2009). These new concepts are not able to integrate easily into the existing schemas, so the most relevant schema must adjust its structure to allow for placement of the new concept (Pritchard, 2009).

The social constructivist theory with regards to the ZPD can then be seen to have three important components: the interaction between learner and facilitator, the learner's internal appraisal of the knowledge, and the means of assisting the learner (scaffolding) (Glassman, 2001; Howe, 1996; Nardo, 2021; Pritchard, 2009). These three components are relevant when considering how students approach the e-learning medium where communication is no longer face-to-face. The zone of proximal development and student-facilitator dialogue is no longer physically constrained. Instead, communication and assistance occur synchronously or asynchronously in a distance format.

Synchronous learning is when learner and facilitator are present at the same time, with at least one way interaction occurring (Hrastinski, 2008). Asynchronous learning is when learning material is available at any point for access by the learner (Hrastinski, 2008). This will impact the method of assisting the learner as it now must occur live through voice communication or text on an e-learning platform (synchronous) or through message boards or e-mails (asynchronous). To account for the nuances of technology on learning, Connectivism as a theory of learning, will also be employed.

### *Connectivism*

Connectivism, as theorized by George Siemens, is a learning theory that builds on social constructivism tenets, while drawing upon other theories, to appropriately address learning in a digital age (Siemens, 2004). Siemens (2004) integrates the principles of chaos theory, network theory and self-organisation theory into the interpersonal foundation of Social Learning Theory (SLT). Connectivism states that knowledge is both within the learner and separate as its own network of information nodes (Siemens, 2004). This "within the learner" is parallel to the SLT concept of the internal appraisal by the

student. Knowledge within Connectivism is undefined but reading through Siemens's work, knowledge as a concept will be defined for this research as networks of information nodes. This concept of a network of nodes is a critical component to Connectivism. These nodes each function as points of information that when connected to other nodes, form a network (Siemens, 2005). This network of connections is not random, but information that has been organized, forming knowledge. Additionally, the connections between nodes are bidirectional in their influence of each other. By changing the value of one node the entire network is affected through a ripple effect of other nodes adjusting through the connections (Downes, 2022). A clear example of this network within the SLT is a schema. Schemas are structures for storing and retrieving memory, with new information being contextualised by varying schemas within a person before being assimilated, if familiar enough (Hanfstingl et al., 2022; Pritchard, 2009). The schema itself adjusts its nodes, or points of information, when new information is introduced. Thereby changing the overall schema structure or network. According to Siemens (2004), the internet functions in the same way, as a network of nodes. Learning occurs when a network (the equivalent of knowledge) is modified by new connections forming (Siemens, 2004). This is analogous to the interpersonal requirement of SLT; that knowledge is within a facilitator and is learnt by the learner through dialogue. Dialogue is the means for a learner and facilitator to connect their networks. As the facilitator assists the learner, the network or schema of the learner changes and learning occurs. The other method of schema adjustment is accommodation. Accommodation is when the schema itself adjust to the external input as the input cannot be wholly integrated (Hanfstingl et al., 2022). In the e-learning setting this requires the learner to create new schema or overhaul existing ones to understand new information or work in a setting they are unfamiliar with.

Connectivism departs from the social aspect of social constructivism theory by stating that knowledge can exist beyond the internal construction of people, in the form of the internet (Siemens, 2004). The knowledge network is continuously modified by people, as they interact with this knowledge network (Siemens, 2004). Siemens (2004) based this concept off the emerging body of information being generated globally, known as the internet. Learners access this network beyond themselves and through the process of discovery, learn when integrating knowledge in a manner that is relevant to them (Siemens, 2004). It also translates to using information technology in a manner that facilitates learning (Siemens, 2004). In the e-learning sphere, this would be how to use information from synchronous and asynchronous learning in conjunction with what is available on the internet. Journal articles are retrieved from online databases and e-textbooks are used to study. Complex topics are also simplified through auxiliary websites such as Wikipedia, YouTube, and other private websites if

textbooks and journal articles are difficult to approach a new subject. If students are unable to assimilate or accommodate new information through the facilitator or given materials, they expand this facilitator network independently through the auxiliary websites (Siemens, 2004). The relevance of Connectivism to e-learning is direct. To understand how students using the internet and information technology as a medium of instruction are affected, a theory of learning that accounts for the internet should be applied. However, the instructional design of e-learning is still being delivered through the face-to-face principles of traditional instruction (Barnett, et al, 2013). This substantiates the Constructivist approach as an appropriate contextual lens from the face-to-face era, in the e-learning space.

Constructivism and Connectivism are both present in the current era of learning. Constructivism through its theoretical presence with concepts such as the ZPD and scaffolding, is being used by teachers currently in their student-focused approaches (Theelen & van Breukelen, 2022). Connectivism's theory of how knowledge is created is similar to both the constructivism's theory and the current presence of the online internet medium. The internet's presence in our everyday lives, as well as its influence in the creation of Connectivism lends to its applicability for this current era of study (Siemens, 2004). The nature of e-learning requires not only interactions with the internet but the facilitator too. This dual integration of social constructivism theory tenets and Connectivism theory may both be needed for e-learning as a model to be understood.

### *Folkman and Lazarus's Transactional Theory of Stress and Coping*

The cognitive theory of stress and coping is a transactional theory and model developed by Folkman and Lazarus (Biggs et al., 2017). The transactional model determines stress to be the experience of an interaction between an individual and their environment (Folkman et al., 1986). The environment provides stimuli that could be potential stressors to the individual (Folkman et al., 1986). A stressor is anything that could be a source of psychological or physical strain to the individual, taxing there resources to engage with a challenge beyond normal levels  The individual constantly processes these stimuli in two stages of primary and secondary appraisal (Biggs et al., 2017). The primary appraisal of the stimulus determines whether it is a stressor or not. If it is determined to be a stressor, the secondary appraising determines what coping response would result in a lower degree of stress experienced from the stressor (Folkman et al., 1986). Once the coping behaviour has been done the individual then reappraises to determine if the degree of stress experienced has been lowered, and if not, further coping is attempted (Biggs et al., 2017). Primary and secondary appraisals are continuously

monitoring the environment's stimuli for potential stressors and the individual's ability to mitigate the stress experience (Biggs et al., 2017). This is the crux of the transactional model, the dynamic exchange between environment and individual leading to changes in the stress experience (Folkman et al., 1986). As such, the appraisal process for determining potential stressors and ways to mitigate them, considering factors about the individual and the environment.

Individual factors are goals, beliefs, and values, while environmental factors are the demands and resources available (Briggs et al., 2017). Circling back to primary appraisal, a stimulus in the environment such as a plate breaking accidently could be a potential stressor for a child. The stimulus of a broken plate is then appraised by the child's valuing of a broken plate. This valuing depends on past experiences, and the upbringing of the child will determine whether a broken plate will lead to harm or not. If harm of any kind is expected the secondary appraising occurs to determine how best to cope with the stress. Secondary appraisal draws upon environmental and individual factors too, which are situational variables, coping resources, and coping styles (Briggs et al., 2017). Situational variables are things that can be altered in the environment to reduce the source of stress, such as hiding the broken plate (Briggs et al., 2017). Coping resources are the two internal strategies of emotion and problem-based coping used to lessen the experience of stress (Briggs et al., 2017). The emotional coping could be the child self-soothing or denying the reality of the broken plate (Folkman et al., 1986). Problem-based coping would be looking for solutions to affect the source of stress such as trying to fix the plate or replace it (Folkman et al., 1986). Coping styles refer to previous coping strategies that assisted with similar stressors, such as bringing forward the broken plate and apologizing may have better outcomes than leaving for it to be discovered later (Briggs et al., 2017). There is much overlap and revision of the coping and appraisal processes.

This demonstrates that the individual-environment transaction allows for coping to come from both the environment and within the individual. The environment can be modified to change the stressor which then reinforces the need for continual reappraisal of stimuli (Folkman et al, 1986). Lastly, the role of emotions in appraisal and coping are explored further.

The primary appraisal determines whether a stimulus is either benign, neutral, or stressful (Folkman, 2008). If the stimulus were determined as either benign or neutral, then no secondary appraisal would occur. If an event was stressful, it elicits negative emotions such as fear, anxiety, or sadness, and secondary appraisal would occur (Folkman, 2008). If the secondary appraisal was successful, the stress experience is lessened, and positive emotions occur such as relief or happiness.

However, if coping mechanisms fail to reduce the stress, then meaning-focused coping develops which generates positive emotions and appraisals (Folkman, 2008). These positive emotions and appraisals do not directly change the outcome of the experienced stress, but rather assist and buffer the emotion or problem-based coping strategies that previously did not resolve the stress experience (Folkman, 2008). They also buffer the meaning-focused coping in a positive feedback loop (Folkman, 2008). This theory provides reasoning as to why e-learning provides different or altered stressors, as the e-learning environment would be a different one from traditional learning and so the stimuli for what is a stressor would change. Stressors of time management and travel to class would be mediated when the environment of where class is, changes.

The described transactional model views stress as a dynamic and actionable phenomenon, whereby stress is malleable to environmental and personal factors. The TPB will be used in conjunction to interpret the results.

### *The Theory of Planned Behaviour*

The TPB is a model for understanding why behaviour occurs. It posits that the intention to perform a voluntary behaviour is needed for the behaviour to occur, and this intention is moderated by three factors (Ajzen, 1991). These three factors are the attitude towards the behaviour, the perceived subjective norm about the behaviour, and the perceived behavioural control an individual has concerning the behaviour (Ajzen, 1991). The value of these three factors in determining intention to carry out a behaviour varies amongst individuals and behaviours. Additionally, not all three factors are needed for the intention to manifest and encourage the behaviour (Ajzen, 1991).

The attitude towards the behaviour is the negative or positive evaluation that the individual has towards the behaviour. More specifically, it is the belief about the consequence of performing the behaviour, called the behavioural belief that determines the positive or negative evaluation (Ajzen, 2011). The positive and negative evaluation is whether the outcome favours or disfavours the individual, respectively (Ajzen, 2011). This behavioural belief interacts with an individual's assessment of how likely it is that the outcome will occur, which results in their overall attitude towards the behaviour (Ajzen, 2011).

The perceived subjective norm is the perceived social pressure the individual has to either carry out the behaviour or not carry it out (Ajzen, 1991). The social pressure stems from the perception that other people within the individual's social circle want the behaviour to either occur or not occur. This

desire of the social circle motivates an individual's intention to engage with or avoid the behaviour (Ajzen, 1991).

Perceived behavioural control is how capable the individual perceives themselves to be at performing the behaviour (Ajzen, 1991). This capability rests upon the individual's belief about factors available that could hinder or help performing the behaviour. These beliefs are called control beliefs, and greater perceived behavioural control is expected when more assisting factors are present and fewer hindering factors, are believed to be present (Ajzen, 1991).

All three of these factors affecting intention to carry out a behaviour are based upon beliefs the individual has about themselves and their environment (Ajzen, 1991). These beliefs are formed from past experiences, observing others, and internal reflections. The intention to perform a behaviour is positively predicted by the positive evaluation of the outcome, if the behaviour is an ideal of the social network, and if there are enough factors to assist the individual in performing or pursuing the behaviour.

The importance of the environmental context and the self-evaluation in Folkman and Lazarus's theory as well as in TPB, provide a common alignment for interpreting the experience of stress and e-learning. The stance of this study therefore is that the degree to which e-learning is favoured correlates with the degree of stress experienced about e-learning, as is supported by Kabir et al. (2021).

## Methods

### Aim

The aim of this study was to determine whether there is a relationship between the attitude of undergraduate students towards e-learning and their perceived academic stress in the South African context during 2021.

### Research Questions

1. Is there a statistically significant relationship between the attitude towards factors of e-learning and academic stress in undergraduate students?
2. Using descriptive statistics, what insights of e-learning as a learning tool can be extracted from the undergraduate's participation with the e-learning measure?
3. Using descriptive statistics, what insights of perceived stress can be extracted from the undergraduate's participation with the stress measure?

## Research Design

The research design was a descriptive, cross-sectional, and retrospective type using questionnaires administered in 2022. The criterion variables are students' attitudes towards the three domains of e-learning as identified by Al-Musawi (2014); advantages and disadvantages of e-learning, the student's experience in e-learning on campus, and technical and pedagogical support at campus. The predictor variable is the level of stress experienced by students during their e-learning phase of 2021. The sampling method was non-probability purposive sampling as the psychology students and potentially other departments who experienced online learning in their first or second year during 2021, were targeted to match the aim of the study.

## Research Questions and Hypothesis

Considering the literature, this research paper explores what is the relationship between student perceived stress and the student's attitude towards e-learning factors. The attitude towards factors of e-learning, along with the three categories of e-learning factors serve as criterion variables, specifically measurable with the SSAE scale created by Al-Musawi (2014) and modified for our context of distance e-learning and South African context. The student's perceived stress was the predictor variable measured using the Student-Life Stress Inventory (SSI). If a correlative relationship between the two variables is present, it will provide an indication as to whether changes in perceived stress significantly correlate with changes in the attitudes towards e-learning factors. It is expected that the relationship will be a negative correlation, with the attitude towards e-learning scores increasing as perceived stress scores decrease. An additional question to be answered is whether the three levels of perceived stress (mild, medium, or high) affect the degree of correlation. This is in accordance with the literature of the SSI theory that mild amounts of stress are beneficial, with higher amounts becoming detrimental to student functioning (Gadzella & Masten, 2005). The assumption is that there may be a positive correlation between the attitudes towards e-learning factors and stress when stress is mild. This correlation is assumed to become negative as the stress levels increase. Whether there is a correlation or not, and whether the benefits and detriments significantly affect the correlation will be examined through statistical analysis. If no significant results are found, then we have potentially shown a decreased importance of stress as a factor on e-learning in the South African context. The research questions as to whether the experienced stress and attitudes towards e-learning can provide insight into the sample's 2021 experience of learning will be explored with statistical analysis. It is assumed that items from the SSI and SSAE will measure aspects of experienced stress and attitude towards e-learning to provide this insight.

$H_O1$ = There is no relationship between the domains of e-learning and student's stress levels.

$H_1 1$ = There is a negative correlation between the domains of e-learning and student's stress levels.

$H_O2$ = There is no relationship between the domains of e-learning and student's stress levels.

$H_1 2$ = There is a curvilinear relationship between the domains of e-learning and student's stress levels.

## Research Participants

The primary research participants were the 2022 second- and third-year students in the Department of Psychology of the University of the Witwatersrand. Students from the other Humanities departments were sought too. These students were targeted as they experienced their first and/ or second year of university through the e-learning medium in 2021. A minimum sample size of 120 participants was targeted. The number of students that engaged with the invitation to participate in the study was 143. Only one participant did not agree to all the stipulations of the participant information sheet. Of the 142 participants, 80 reached the end of all three questionnaires: the demographic inventory, the stress inventory, and the e-learning inventory. One participant had not responded to four of the five items within a section of the SSI and was removed, lowering the total number of participants to 79. For the inclusion criterion, the maximum amount of missing data was kept to below 5% of the total responses (Montelpare et al., 2020). The imputation method for missing data was the serial mean method. This was only applied to the category in which the missing item was part of, to prevent the influence of responses from other categories in the measure.

Each of the 79 participants had 94 items to respond to. There was a total of 24 missing data points across all 79 participant responses. If a participant had data missing, the minimum number of data points missing was one and the maximum was three.

## Participants' Demographic Details

Data was collected by administering to each participant a self-report measure in the form of a questionnaire. Demographics of age, self-identified race, self-identified gender, whether they are a first-generation tertiary student, degree of study, and major of study, were collected as the first part of the questionnaire. The second part of the questionnaire contained two previously published measures for

experience of stress and attitudes towards factors of e-learning. Please refer to Table 1 and Figure 1 and 2 for the demographic information of the 79 participants that were initially included in the analysis.

**Table 1**

*Demographics of Study's Participants*

| | Self-identified Gender | | | Age | | | Self-identified Ethnicity | | | First-generation learner | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | Percentage | Range | Count | Percentage | | Count | Percentage | Response | Count | Percentage |
| Male | 7 | 8.9% | 18 – 23 | 69 | 87.3% | Indian | 7 | 8.9% | Yes | 26 | 32.9% |
| Female | 70 | 88.6% | 24 – 29 | 6 | 7.6% | Black | 51 | 64.6% | No | 53 | 67.1% |
| Other | 1 | 1.3% | 30 – 35 | 1 | 1.3% | White | 13 | 16.5% | | | |
| Missing | 1 | 1.3% | 36 – 40 | 2 | 2.5% | Chinese | 2 | 2.5% | | | |
| Nonbinary | 0 | 0% | 47 > | 1 | 1.3% | Coloured | 6 | 7.6% | | | |
| Prefer not | 0 | 0% | | | | Other | 0 | 0% | | | |
| to say | | | | | | Prefer not to say | 0 | 0% | | | |

* n = 79

## Measures

Data was collected by administering to each participant a self-report measure in the form of a questionnaire. Demographics of age, self-identified race, self-identified gender, whether they are a first-generation tertiary student, degree of study, and major of study, were collected as the first part of the questionnaire. The second part of the questionnaire contained two previously published measures for experience of stress and attitudes towards factors of e-learning.

**Figure 1**

*Histogram of Responses to Item "What degree were you studying"?*

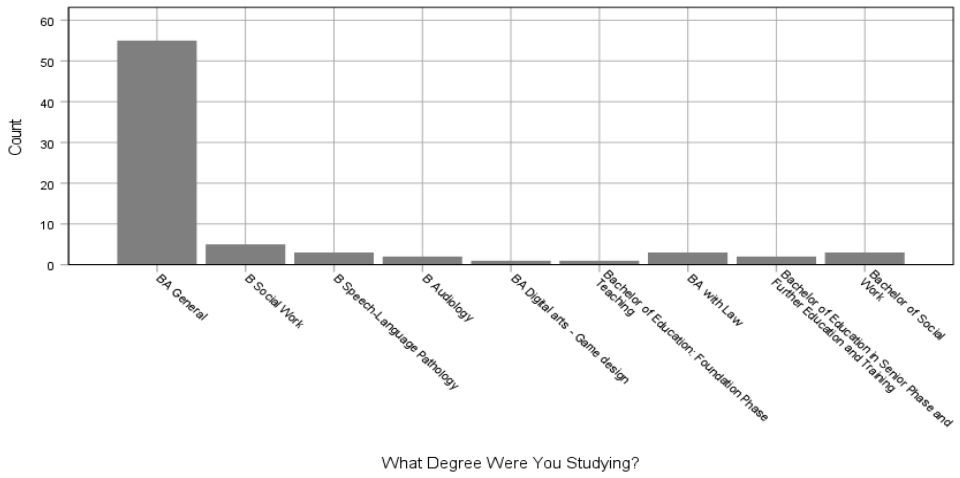
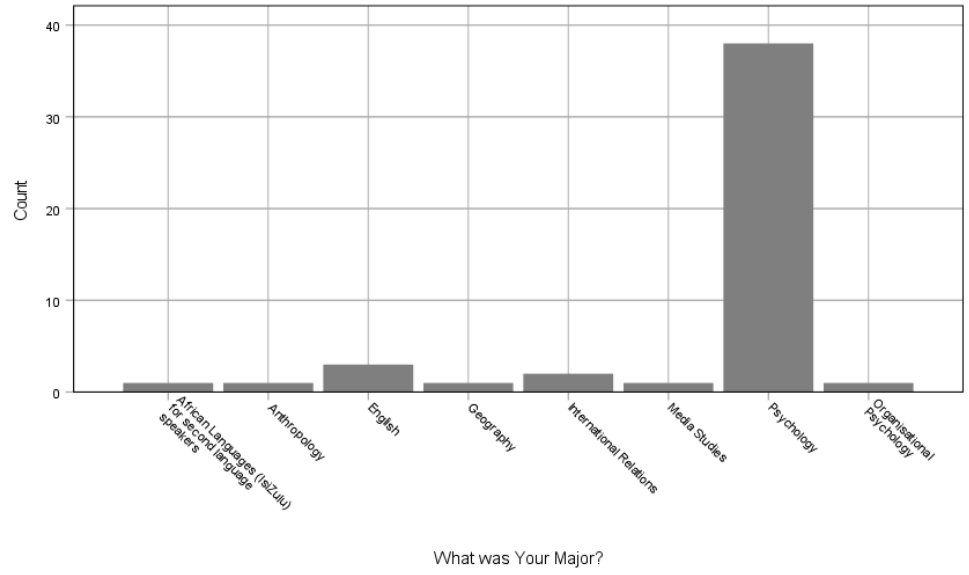


**Figure 2**

*Histogram of Item "What was your major"*




Scale of Students' Attitudes towards E-learning.

The SSAE uses a 5-point Likert"-type scale ranging from "Strongly Disagree"(1), "Disagree"(2), "Undecided"(3), "Agree"(4), to "Strongly agree"(5). The SSAE's items are positively phrased so that higher scores indicate a positive reflection of their experience with e-learning factors and lower scores indicate a more negative reflection. Scores that centre around the middle indicate ambivalence towards their experience with the e-learning factors. Half of the items are negatively scored. Higher scores on these items indicate a negative reflection on e-learning factors and lower scores indicate a positive reflection on e-learning factors. Please refer to appendix B for the reversed items.

The Scale of Student's Attitude towards E-learning has 43 items which are grouped into three categories or "domains", according to the original creator. The advantages and disadvantages of e-learning use domain consists of 10 items. These items refer to features of e-learning that provide potential positives and negatives to the e-learning experience. These features are unique to e-learning, such as flexibility for students and learner control, and are congruent with what literature suggests to be beneficial or detractive of e-learning (Al-Musawi, 2014; Castro & Tumibay, 2019; Hung et al., 2010; Wang et al., 2013). Higher scores for this domain indicate a more positive experience of e-learning because of the advantages it offers. Lower scores indicate that the disadvantages were more prevalent in the e-learning experience. Examples of items in this domain are: "Online learning makes teaching and

learning more flexible", and "E-learning saves time and effort for both teachers and students". This domain consists of four reversed items such as "I believe that e-learning has contributed little to the teacher-student interaction and communication".

The student's experience in using e-learning at home domain consists of 21 items. The original domain was called "Student experience in using e-learning on campus", this was changed to "…at home" to contextualise the e-learning specific to this studies e-learning setting. This domain's items refer to emotive results of e-learning and comparisons with face-to-face learning. Higher scores in this domain reflect more positive experiences and less negative emotions related to the e-learning experience. Lower scores reflect a more negative emotive experience of e-learning and less willingness to use it further. Examples of items in this domain are: "I have a strong desire to register in e-learning courses.", "I find using e-learning both easy and possible", and "I wish I could choose more online courses at home to study.". The original item was "I wish I could choose more online courses on campus to study", this was changed to "…at home to study". This change of "campus" to "home" was to specify the measure towards the at-home context of 2021. These items are important examples as motivation and student perception of e-learning can affect the student's academic outcomes through the e-learning medium (Malik & Akkaya, 2021; Saadé et al., 2007; Wang et al., 2013). This domain contains 11 reverse scored items such as: "I find it difficult to use e-learning to express my ideas in writing", "I feel depressed when I think of learning the subject matter online", and "I feel depressed when I think of learning the subject matter online".

The technological and pedagogical support from home domain consists of 12 items. The original domain was called "Technical and pedagogical support at campus, this was changed to "…at home" to contextualise the e-learning specific to this study's e-learning setting. This domain's items tap into features of the learning management system and how well they were received by the learner during the e-learning process. Some items also specify the quality of the facilitator within the e-learning paradigm. Higher scores for this domain indicate a greater presence of resources and accessibility tools related to e-learning, as well as positive facilitator perception. Lower scores reflect greater challenges using e-learning. These topics of facilitator engagement and information technology efficacy are identified as relevant factors in student's acceptance and efficacy of the e-learning medium (Castro & Tumibay, 2019; Saadé et al., 2007; Wang et al., 2013). Additionally, lack of access to technology and efficacy can have detrimental effects towards e-learning too (Ullah et al, 2017). Examples of items from this domain are: "Faculty members at my university are very motivated to use e-learning on a wide scale." and "My

university systematically updates the e-learning websites". This domain has seven reverse scored items such as: "I assume that the slowness of network decreases the level of effectiveness of e-learning on campus", and "The e-learning system at my university lacks the technical support necessary for the management of e-course.

Table 2 presents the reliability results of the SSAE and its three domains by Al-Musawi (2014). Results for this study can be found in Table 6 in the methods section.

The TPB aligns with the SSAE to a large extent in that the SSAE is concerned with gauging the positive or negative perception participants have of e-learning factors. In this case, the intention to perform the behaviour equates to the degree by which learners engage with the e-learning medium. This reflects the first factor of the TPB, that the positive or negative evaluation of a behaviour is relevant in determining the intention to do the behaviour. This is bolstered by the Olasina (2019) study which found that the intention to adopt e-learning was moderated by the attitude towards e-learning. The advantages and disadvantages domain of the SSAE measures how positively or negatively respondents view the use of e-learning. This is relevant when considering the behavioural intention to use e-learning,

**Table 2**

*Reliability Results of the SSAE from Al-Musawi*

| | Original Cronbach Alpha | |
|---|---|---|
| | Bahrain | Kuwait |
| Total SSAE | .84 | |
| Advantages and disadvantages of e-learning | .94 | .91 |
| Student experience in using e-learning | .86 | .88 |
| Technical and pedagogical support | .79 | .73 |

as the study by Olasina (2019) gave results showing that the perceived usefulness of e-learning is critical in determining the intention to use and accept e-learning. The second domain of the SSAE, the experience of e-learning is more emotive orientated gauging the participants attitude towards e-learning factors. This domain relates to the positive or negative evaluation of the behaviour too, as more positive feelings towards a behaviour are associated with a greater willingness to adopt and accept the behaviour (Olasina, 2019). The third domain of the SSAE, technological and pedagogical support, along with the first two domains discussed all tap into an important factor of the TPB, the perceived

behavioural control. The ability of the learner to engage with e-learning and be supported in this endeavour is critical to forming the intention to perform a behaviour. Perceived support to perform the behaviour of engaging with e-learning is both from internal and external sources (Ajzen, 2011).

### Student Life-Stress Inventory.

The Student-Life Stress Inventory (SSI), is a 51-item inventory that has two sections; the students' stressors and their reaction to stressors, which are divided into five and four categories, respectively. The SSI uses a 5-point Likert-type scale ranging from "Never"(1), "Seldom"(2), "Occasionally"(3), "Often"(4), to "Most of the time"(5). Please refer to Appendix C for a list of all the items.

The categories in the stressor section record the respondent's frequency of experiencing different sources of stress. Higher scores reflect a higher frequency of the stressor being experienced by the respondents. Lower scores reflect a lower frequency of the stressor being experienced.

The frustration category has seven items that correspond to sources of frustration. Some items from this category are: "I have experienced frustrations due to delays in reaching my goals.", "I have experienced lack of resources (money for auto, books, ect.)", and "I have experienced dating frustrations.".

The conflicts category has three items that correspond to situations where tension between desirable and undesirable choices occur. This category when presented to participants starts with the clause "With reference to 2021, I have experienced conflicts which were:". This was then followed by the items: "Produced by two or more desirable alternatives.", "Produced by two or more desirable alternatives. ", and "Produced when a goal had both positive and negative alternatives."

The pressures category has four items that correspond to situations where external demands have increased. This category when presented to participants start with the clause "With reference to 2021, I have experienced pressures:". This was then followed by items such as: "Due to deadlines (papers due, payments to be made, ect).", "Due to overload (attempting too many things at one time).", and "Due to interpersonal relationships (family and/or friends expectations, work, responsibilities).".

The changes category has three items that correspond to negatively perceived changes in the participants' context. This category when presented to participants starts with the clause "With reference to 2021, I have experienced:". This was then followed by the items: "Rapid unpleasant

changes.", "Too many changes occurring at the same time.", and "Changes which disrupted my life and/or goals.".

The self-imposed category has six items that correspond to sources of stress that originate within the participant. Examples of items within this category are: "I like to compete and win.", "I have a tendency to procrastinate (put off things that have to be done).", and "I feel I must find a perfect solution to the problems I undertake.".

The first three categories in the reaction to stress section record the respondent's frequency of experiencing symptoms and signs of stress. Higher scores reflect a higher frequency of the symptoms and signs manifesting, and lower scores reflect a lower frequency of them manifesting. Each category in this section started with the clause "With reference to 2021…" to localise the stress responses to during the 2021 period, instead of general stress responses.

The physiological category has 14 items that correspond to typical physiological responses during stressful situations. Examples of the items are: "Sweating (sweaty palms, ect.).", "Exhaustion (worn out, burned out)", and "Migraine headaches, hypertension, rapid heartbeat.".

The emotional category has four items that correspond to typical emotional events during stressful situations. These items are: "Fear, anxiety, worry.", "Anger.", "Grief, depression.", and "Guilt.".

The behavioural category has eight items that correspond to typical behaviours enacted during stressful situations. Examples of the items are: "Cried.", "Abused self.", "Smoked excessively.", and "Separated myself from others.".

The final category is the cognitive appraisal category with two items. Both these items require reverse scoring. This category records the frequency of cognitive engagement with the experienced stressful situation. Higher scores before reverse scoring reflect higher frequency of proactive engagement with the stressful situation. Lower scores reflect lower frequency of proactive engagement. The two items are: "Thought and analysed about how stressful the situations were." and "Thought and analysed whether the strategies I used were most effective.".

The measure also provides an avenue of dividing the sample of respondents into three levels of stress as either mild, medium, or high. This division is the single self-report item participants are initially presented with. The reliability of the SSI from Gadzella and Masten (2005) are in Table 3, below. Results of the reliability for this study are in Table 4 in the method section.

**Table 3**

*Reliability Results of the SSI From Gadzella and Masten*

| | Cronbach Alpha |
|---|---|
| | Original SSI |
| Total | .92 |
| Frustrations | .67 |
| Conflicts | .71 |
| Pressures | .75 |
| Changes | .86 |
| Self-imposed | .61 |
| Physiological | .83 |
| Emotional | .82 |
| Behavioural | .73 |
| Cognitive appraisal | .77 |

Folkman and Lazarus's theory of stress and coping serves as a relevant template to which the SSI results can be interpreted. Folkman and Lazarus's Theory can broadly be dichotomised as having two main focuses: the environmental factors and the reaction of the individual (Biggs et al., 2017). The environmental factors are where potential stressors are identified and the first half of the SSI is focused on gauging the frequency of experienced stressors. The individual's reaction to stressors is the same concept of the second half of the SSI, which measures the frequency of different reactions by the individual to stressors. Seen in this way, the SSI measures the frequency of factors that constitute the stress phenomena in Folkman and Lazarus's theory.

Folkman and Lazarus's theory does not specify sources of stressors rather that they are contextual and identified by the individual (Folkman et al., 1986). The SSI has five categories within its stressor domain, four of which are concerned with the experience of stress as identified from the environment. The fifth category identifies a source of stress originating within the individual. Folkman and Lazarus's theory determines stressors to be transactional in nature, between the environment and the individual but starting in the environment with a stimulus (Folkman et al., 1986). The SSI stressor categories thereby agree with the view but with the addition that stress may be stimulated internally first too.

Concerning the individual's appraisal of potential stressors, Folkman and Lazarus's theory holds that this process is a cognitive one by the individual (Folkman et al., 1986). The SSI's reaction to stressors domain has four categories within it, two of which are physiological and emotional reactions. The other two are about the behavioural and cognitive responses. The physiological and emotional reactions within Folkman and Lazarus's theory would be part of the appraisal processes, determining the severity of a stressor. The behavioural and cognitive responses would be part of the appraisal too, as either the coping or reappraisal of a coping attempt. This can be further specified in that the behavioural reactions and cognitive reactions are the result of emotion-focused and problem-focused reactions of Folkman and Lazarus's theory, respectively.

## Procedure

The proposal was submitted to the Human Research Ethics Committee (HREC Non-Medical) to be reviewed. Once ethical clearance was confirmed, the Registrar's Office was contacted and a request to distribute the research questionnaire link to the relevant sample population was made. The questionnaire is made up of the demographic items, the SSAE, and the SSI.

The SSAE has select items modified from reference to e-learning that occurs on campus, to e-learning that occurs at home. This was to maintain the content and intention of the e-learning theme while specifying it to the at-home context in which the participants were expected to be under during the 2020-2021 pandemic. The modified SSAE and SSI were formatted for electronic delivery and response. This was created through REDCap, which is a service that allows for survey creation, distribution, and collection. The means of delivering the questionnaire was a link sent to students' emails, done via the University Registrar's Office. Clicking on the link in the invitation led directly to the landing page of the survey in REDcap, which was comprised of the participation information sheet that had age (18 or over) and consent questions. If the three qualifying questions of age and consent were agreed to, participants were led to the questionnaire. All responses were automatically logged and filed directly to the researcher's personal questionnaire account. REDCap is an established survey and data gathering platform with built in security for protection of data and confidentiality (Software, n.d). The gathered data for both the SSI and SSAE had reverse items, which were reverse scored in the SPSS software.

## Ethical Considerations

Ethics clearance for this project was obtained from the University of the Witwatersrand's Human Research Ethics Committee (Non-medical). Participants were informed of the nature of the study

and measures they were to respond to. Attention to feelings of uncomfortableness may have been experienced when recalling past information from the stricter lockdown periods. Possible benefits to the participants were described as possible insight with regards to their own anxiety states in the past and a clearer understanding of their attitude towards e-learning. Disclosed information is stored behind a virtual password on a hard drive in the researcher's possession. Cloud data will be deleted once the backup is confirmed. Any information or questions required by participants were available to them by contacting the researcher through the supplied contact details. No contact was made. To maximize anonymity students were not required to present any demographic information they were not comfortable with or that could potentially lead to identification or association such as gender. To account for factors such as knowledge of department or major of study, confidentiality by myself and my supervisor were given to ensure that the information identifying participants even by proxy, are not disclosed publicly. The participants were informed that participation was voluntary, they may discontinue at any point, and participation, refusal to participate, or incompletion of the questionnaires will not affect their academic outcome. No harm was expected to come to the participants because of participation in this study. Further details concerning the ethics adhered to and disclosure of information is available to the participant in the Participation Information Sheet (PIS). This was immediately presented to participants once they followed the link inviting their involvement with the research. At the bottom of the PIS are the consent questions confirming participant's age is appropriate and whether they consent to take part in the study.

## Results

The SSI and SSAE are scored by summing the totals of the items across each measure. These sums were used as the final scoring for each participant in the statistical analysis. The SSI was used to measure experienced stress as a variable. The SSAE was used to measure attitude towards e-learning factors as a variable. The reliability of the SSI and SSAE are in Table 4 and 5 below, respectively.

**Table 4**

*Comparison of SSI Reliability Between the Gadzella and Masten Study and the Present Study*

| | Cronbach Alpha | |
|---|---|---|
| | Origin SSI[a] | Present Study |
| Total | .92 | .893 |
| Frustrations | .67 | .69 |
| Conflicts | .71 | .698 |
| Pressures | .75 | .521 |
| Changes | .86 | .883 |
| Self-imposed | .61 | .661 |
| Physiological | .83 | .809 |
| Emotional | .82 | .703 |
| Behavioural | .73 | .652 |
| Cognitive appraisal | .77 | .874 |

a. (Gadzella & Masten, 2005)

**Table 5**

*Comparison of SSAE Reliability Between the Al-Musawi Study and the Present Study*

| | Original Cronbach Alpha[a] | | Present study Cronbach Alpha |
|---|---|---|---|
| | Bahrain | Kuwait | South Africa |
| Total SSAE | .84 | | .853 |
| Advantages and disadvantages of e-learning | .94 | .91 | .654 |
| Student experience in using e-learning | .86 | .88 | .937 |
| Technical and pedagogical support | .79 | .73 | .264 |

a. Al-Musawi (2014)

Answering the first research question, the following analysis indicates that there is a non-significant relationship between experienced stress and attitude towards factors of e-learning, ($r$ = -.078,

n = 74, *p* = .511), as measured by the SSI and SSAE, respectively. The relationship between stress and e-learning is still relevant when examining specific categories of stress and e-learning.

The measures of central tendency and variability for the SSI and SSAE can be found in the Table 6 below.

**Table 6**

*Descriptives for the SSI and SSAE*

| Inventory | Mean | Median | Mode | Standard deviation | Range | Variance |
|---|---|---|---|---|---|---|
| SSI | 152.83 | 154 | 141 | 20.61 | 96 | 424.47 |
| SSAE | 142.15 | 142 | 122, 132, 142, 158, 159 | 20.93 | 103 | 438.24 |

n = 75 after outlier deletion

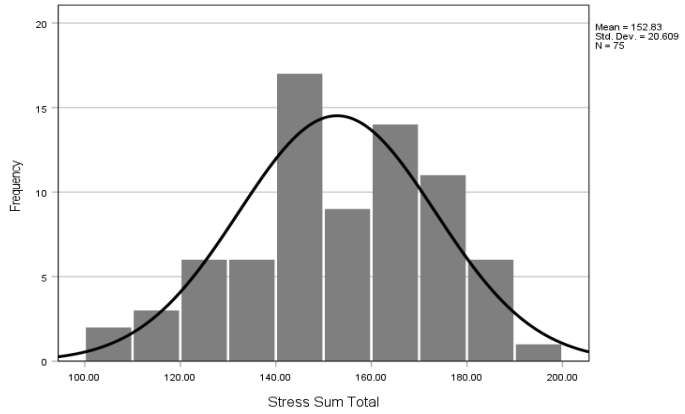
## Pearson Product-Moment Correlation

The Pearson Product-Moment Correlation was used to determine the relationship between identified stress and perception of e-learning. There was a non-significant relationship between stress and e-learning, (*r* = -.178, n = 75, *p* = .317).

For both variables the assumptions were all met for the correlation test. Outliers in the SSI had been identified through the SPSS box-plot function and removed. The SSI showed a negative skew which was still normally distributed. Please refer to Figure 3 below. The SSAE also showed a normal distribution with no skewness, please refer to Figure 4 below.

**Figure 3**

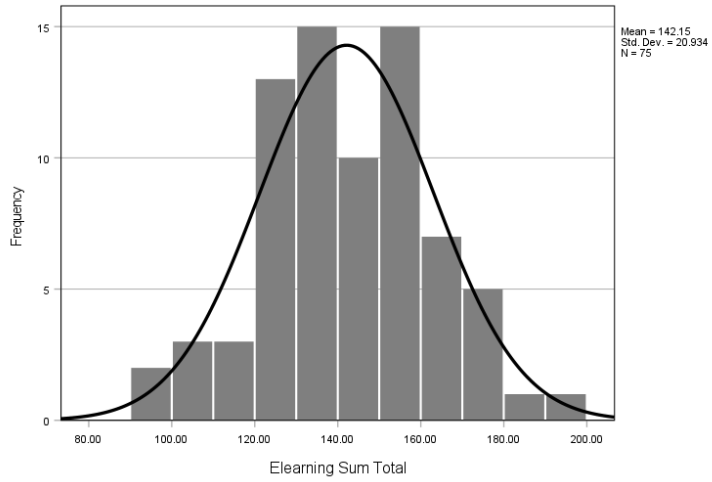
*Distribution of the SSI Score Totals From Participants*



As there was no correlation between the SSI and SSAE measures, a correlation matrix was done to determine if there was a relationship between SSI and SSAE categories, explained below.

**Figure 4**

*Distribution of SSAE Score Totals From Participants*




Examining the participants' responses to the categories within the SSI and SSAE measures, provides a more detailed idea of how the participants perceived their stress and e-learning experience.

## SSI and SSAE categories

Table 7 presents the central tendency and variability of the SSI and SSAE categories' sum totals. To determine if there was any correlation occurring on a more nuanced level, a correlation matrix between the categories within the SSI and SSAE was run using a two-tailed Pearson Product-Moment Correlation test.

There was a correlation between Technical and Pedagogical Support with e-Learning and Stress - Emotional, $r(65) = .285$, $p < .022$. The effect size for this result is small as it is less than .3 (Lane, n.d). There was also a correlation between Technical and Pedagogical Support with e-Learning and Stress – Cognitive Appraisal, $r(65) = -.252$, $p < .043$. The effect size for this result is also small as it is less than .3 (Lane, n.d).

The assumptions for the Pearson Correlation were met except for lack of outliers. Initially, eight outliers were identified with a boxplot for each of the categories. Once deleted and the boxplots reinspected, an additional seven outliers occurred. These were deleted, resulting in one more outlier. Once deleted, no more outliers were present, and correlations were run with n = 65.

**Table 7**

*Descriptive Statistics of the SSI and SSAE Categories and Domains*

| Categories of SSI | n | Range | Minimum | Maximum | Mean | Standard Deviation | Variance |
|---|---|---|---|---|---|---|---|
| Frustrations | 65 | 19 | 11 | 30 | 19.21 | 4.93 | 24.29 |
| Conflict | 65 | 10 | 3 | 13 | 8.42 | 2.32 | 5.37 |
| Pressures | 65 | 8 | 11 | 19 | 14.98 | 1.99 | 3.95 |
| Changes | 65 | 12 | 3 | 15 | 9.6 | 3.3 | 10.87 |
| Self-imposed | 65 | 13 | 16 | 29 | 23.30 | 3.37 | 11.35 |
| Physiological | 65 | 37 | 17 | 54 | 37.4 | 8.57 | 73.44 |
| Emotional | 65 | 14 | 6 | 20 | 14.2 | 3.42 | 11.73 |
| Behavioural | 65 | 24 | 9 | 33 | 19.84 | 4.98 | 24.78 |
| Cognitive Appraisal | 65 | 8 | 2 | 10 | 4.51 | 2.07 | 4.29 |
| Categories of SSAE | | | | | | | |
| Advantages and disadvantages of e-learning | 65 | 24 | 21 | 45 | 33.2 | 4.82 | 23.26 |
| Student experience of e-learning | 65 | 61 | 43 | 104 | 75.36 | 13.12 | 172.20 |
| Technical and pedagogical support | 65 | 16 | 28 | 44 | 36.71 | 3.77 | 14.18 |

Changes in the Emotional and Cognitive Appraisal variables were both associated with changes in the Technical and Pedagogical support variable. The correlation matrix is presented below in Table 8.

## Multiple regression analysis

To examine the relationship between the correlating variables, multiple regression analysis was used. The stress categories were treated as the predictor variables, and the e-learning category was treated as the criterion variable. The Emotional and Cognitive Appraisal categories had a statistically significant relationship with the Technical and Pedagogical Support variable, $F(2, 62) = 4.589$, $p < .014$, $R^2 = .359$.

The Emotional category was statistically significant to predict Technical and Pedagogical Support with e-Learning, $p < .035$. However, the Cognitive Appraisal category did not significantly predict Technical and Pedagogical Support with e-Learning, $p > .069$. All the variables met the assumptions for the analysis.

**Table 8**

*Correlation Matrix of SSI and SSAE Categories and Domains*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Advantages and disadvantages of e-learning | - | | | | | | | | | | | |
| 2. Student experience of e-learning | .663** | - | | | | | | | | | | |
| 3. Technical and pedagogical support | .044 | .190 | - | | | | | | | | | |
| 4. Frustrations | -.056 | -.175 | .089 | - | | | | | | | | |
| 5. Conflict | -.018 | -.070 | .173 | .397** | - | | | | | | | |
| 6. Pressures | -.007 | -.151 | -.003 | .479** | .324** | - | | | | | | |
| 7. Changes | -.219 | -.146 | .084 | .425** | .327** | .488** | - | | | | | |
| 8. Self-imposed | .148 | .122 | .029 | .150 | .264* | .387** | .159 | - | | | | |
| 9. Physiological | .073 | .020 | -.047 | .321** | .168 | .330** | .292* | .298* | - | | | |
| 10. Emotional | .053 | -.036 | .285* | .307* | .293* | .356** | .172 | .248* | .433** | - | | |
| 11. Behavioural | .177 | .004 | .014 | .201 | .051 | .147 | .054 | .063 | .617** | .455** | - | |
| 12. Cognitive Appraisal | -.024 | -.147 | -.252* | -.003 | -.354** | -.009 | -.196 | .021 | -.073 | -.123 | -.014 | - |

* $p < .05$. ** $p < .01$

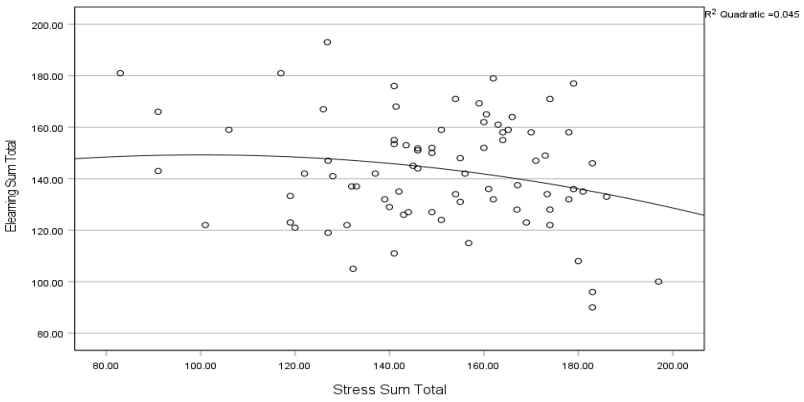
The use of the stress measure to represent the predictor variable and the e-learning measure to represent the criterion variable was necessary for the analysis to be run. Experienced stress was chosen as the predictor variable as stress can influence emotions, and the e-learning variable was concerned with attitude (Jain & Singhai, 2017). Practically, the variable roles of experienced stress and e-learning attitude can be exchanged. The literature on the relationship between stress and e-learning is not conclusive enough to determine which or whether either construct is the cause of change in the other.

## Measures of Central Tendency, Distribution, and Variance

The second hypothesis requires the predictor and criterion variable to fit a curvilinear distribution instead of a linear one. Referring to the scatterplot (Figure 5) indicates that there is no variation of a curvilinear distribution occurring. This fails to reject the null hypothesis that there is a curvilinear relationship between experienced stress and perception of e-learning factors.

**Figure 5**

*Total Scores of SSI by SSAE*




## Scale of Student's Attitudes Towards E-Learning Item Descriptives

The SSAE contains items that are relevant to the experience participants had with e-learning. Items that were relevant to the e-learning literature were selected from the SSAE and descriptive statistics were run on them. This was done to answer the research question of what insights can be determined from the SSAE. Table 9 contains the relevant items examined and their descriptive statistics. Histograms of these items can be found in Appendix E.

**Table 9**

*Descriptive Statistics of E-Learning Items and Student Experience Domain*

| Domain description | Sum | Mean | Median | Mode | Standard deviation | Range | Variance | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Student experience of e-learning | 5296 | 73.56 | 75 | 57 | 15.28 | 71 | 233.56 | -.457 | .279 |
| Item description | | | | | | | | | |
| Online learning makes teaching and learning more flexible. | 309 | 4.29 | 4 | 4 | .722 | 3 | .522 | -.954 | 1.182 |
| Adopting e-learning as a learning style shall help students strike a balance between study and family requirements. | 153 | 2.13 | 2 | 2 | 1.034 | 4 | 1.069 | .923 | .394 |
| I think that e-learning made the learning process more enjoyable | 231 | 3.21 | 3 | 4 | 1.21 | 4 | 1.463 | -.168 | -.976 |
| I believe that e-learning has contributed little to teacher-student interaction and communication. | 176 | 2.44 | 2 | 2 | 1.125 | 4 | 1.264 | .265 | -1.093 |
| I think that e-learning has limited effectiveness in improving teaching and learning. | 212 | 2.94 | 3 | 4 | 1.099 | 4 | 1.208 | -.084 | -.877 |

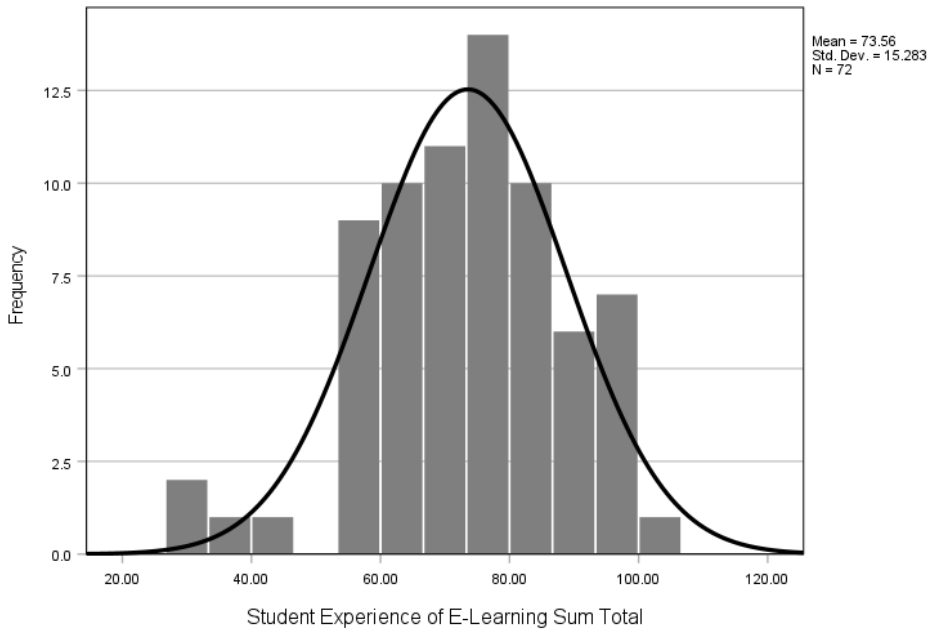
| Item description | Sum | Mean | Median | Mode | Standard deviation | Range | Variance | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| E-learning saves time for both teachers and students. | 268 | 3.72 | 4 | 4 | 1.153 | 4 | 1.330 | -.848 | -.081 |
| I think that e-learning had little impact on my achievement. | 260 | 3.61 | 4 | 4 | 1.193 | 4 | 1.424 | -.680 | -.392 |
| Online learning increases my ability to understand subject matter. | 244 | 3.39 | 4 | 4 | 1.17 | 4 | 1.368 | -.430 | -.901 |
| I find it difficult to use e-learning to express my ideas in writing. | 268 | 3.72 | 4 | 4 | .937 | 3 | .879 | -.569 | -.463 |
| I find it difficult to get significant information through e-learning. | 267 | 3.71 | 4 | 4 | 1.04 | 4 | 1.083 | -.771 | -.029 |
| I feel depressed when I think of learning the subject matter online. | 271 | 3.76 | 4 | 4 | 1.055 | 4 | 1.112 | -.989 | .494 |
| I hardly prefer e-learning as it leads to social isolation. | 213 | 2.96 | 3 | 4 | 1.261 | 4 | 1.290 | -.093 | -1.156 |
| E-learning helps me compensate for missed classroom lectures. | 311 | 4.32 | 5 | 5 | .961 | 4 | .923 | -2.074 | 4.698 |
| feel nervous and tense when I fail to use e-learning effectively. | 215 | 2.99 | 3 | 2 | 1.261 | 4 | 1.591 | .070 | -1.065 |
| I hardly prefer e-learning over traditional learning because it lacks the direct interaction with the teacher. | 209 | 2.90 | 3 | 4 | 1.268 | 4 | 1.610 | -.111 | -1.177 |
| E-learning helps me acquire effective communication skills with other people. | 181 | 2.51 | 2 | 2 | 1.075 | 4 | 1.155 | .593 | .106 |
| I had a strong desire to continue with e-learning. | 262 | 3.64 | 4 | 4 | 1.259 | 4 | 1.586 | -.585 | -.863 |
| I find it difficult to learn the course using the internet. | 261 | 3.63 | 4 | 4 | 1.192 | 4 | 1.421 | -.870 | -.095 |
| The slowness of network is an obstacle to my learning online. | 181 | 2.51 | 2 | 2 | 1.342 | 4 | 1.803 | .634 | -.936 |
| Faculty members at my university are very motivated to use e-learning on a wide scale. | 255 | 3.54 | 3 | 3 | .887 | 4 | .787 | -.067 | -.076 |

n = 72 after deletion of outliers.

The student experience of e-learning domain was the only domain with a reliable Cronbach Alpha, Figure 6 is a histogram of the scores by participants. The histogram gives an overview of how favourable or unfavourable the domains content was reported as.

**Figure 6**

*Distribution of Total Scores for the Student Experience Domain*




## Student-Life Stress Inventory Item Descriptives

The participants' report of overall stress, the frequencies of physiological and emotional stress symptoms, and select maladaptive behaviours in response to stress were explored further. These factors were highlighted within the stress literature and participant responses to them were available through interpretation of the SSI categories and items. Table 10 below lists the categories and the items used, along with their descriptive statistics.

The reliable categories of "changes", "physiological", "emotional", and "cognitive appraisal" are explored further. The histograms showing distribution of scores for the reliable SSI categories are found below in Figures 7, 8, 9, and 10. As the SSI measures frequency of occurrences, the histograms give an overview of the trend in responses.

**Table 10**

*Descriptives of SSI Select Items and Categories*

| Category | Sum | Mean | Median | Mode | Standard deviation | Range | Variance | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|
| Physiological | 2754.85 | 38.26 | 38.5 | 42 | 9.18 | 44 | 84.26 | -.17 | .025 |
| Emotional | 1022 | 14.19 | 14 | 12, 13 | 3.4 | 14 | 11.57 | -.054 | -.47 |
| Cognitive appraisal | 326 | 4.53 | 4 | 4 | 2.06 | 8 | 4.25 | .891 | .616 |
| Changes | 690 | 9.58 | 9 | 12 | 3.31 | 12 | 10.92 | .03 | -.835 |
| Item Description | | | | | | | | | |
| With reference to 2021, rate your overall stress. | 159 | 2.21 | 2 | 2 | .67 | 2 | .449 | -.27 | -.758 |
| With reference to 2021, when under stressful situation, I have… | | | | | | | | | |
| Abused others (verbally, and / or physically). | 122 | 1.69 | 1 | 1 | 1.05 | 4 | 1.1 | 1.56 | 1.75 |
| Abused self. | 160 | 2.22 | 2 | 1 | 1.42 | 4 | 2.03 | .81 | -.744 |
| Smoked excessively. | 121 | 1.68 | 1 | 1 | 1.37 | 4 | 1.88 | 1.78 | 1.52 |
| Been irritable towards others. | 233 | 3.24 | 3 | 3, 4 | 1.28 | 4 | 1.65 | -.33 | -.85 |
| Attempted suicide. | 84 | 1.17 | 1 | 1 | .71 | 4 | .51 | 4.8 | 23.35 |
| Used defence mechanisms. | 207 | 2.88 | 3 | 3 | 1.36 | 4 | 1.86 | -.12 | -1.16 |
| Separated myself from others. | 267 | 3.71 | 4 | 5 | 1.34 | 4 | 1.79 | -.75 | -.62 |

n = 72 after outlier deletion

**Figure 7**

*Distribution of Response Totals to the Changes Category*

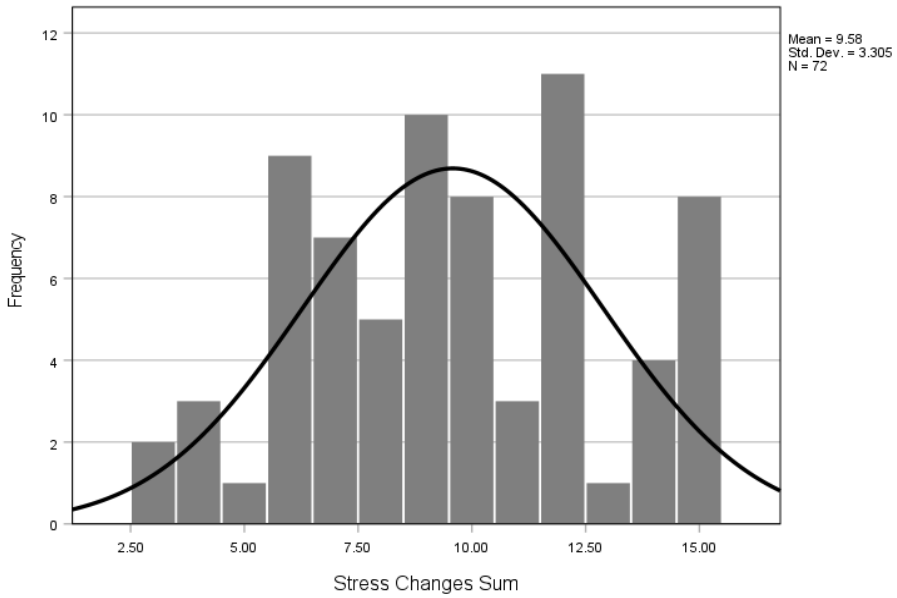



**Figure 8**

*Distribution of Response Totals to the Physiological Category*

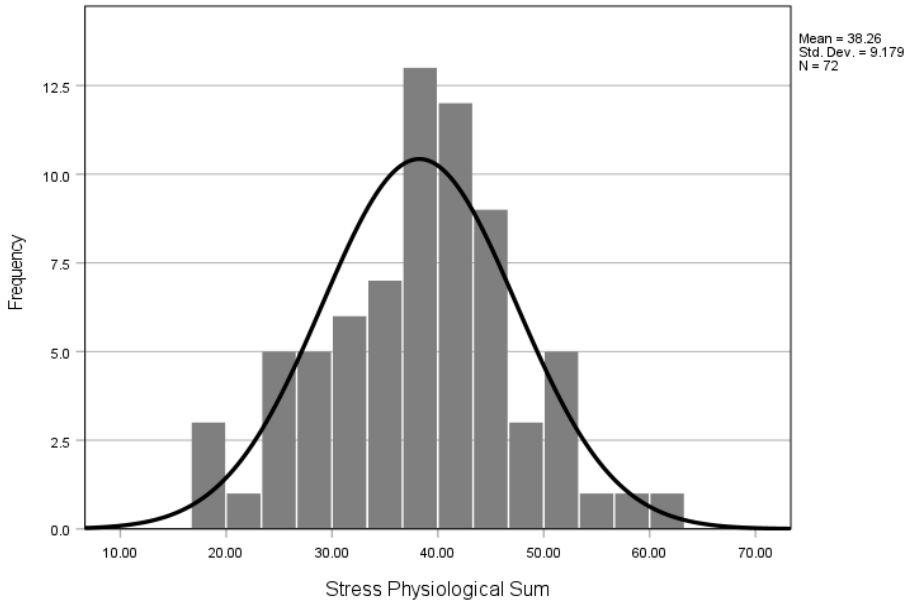


**Figure 9**

*Distribution of Response Totals to the Emotional Category*

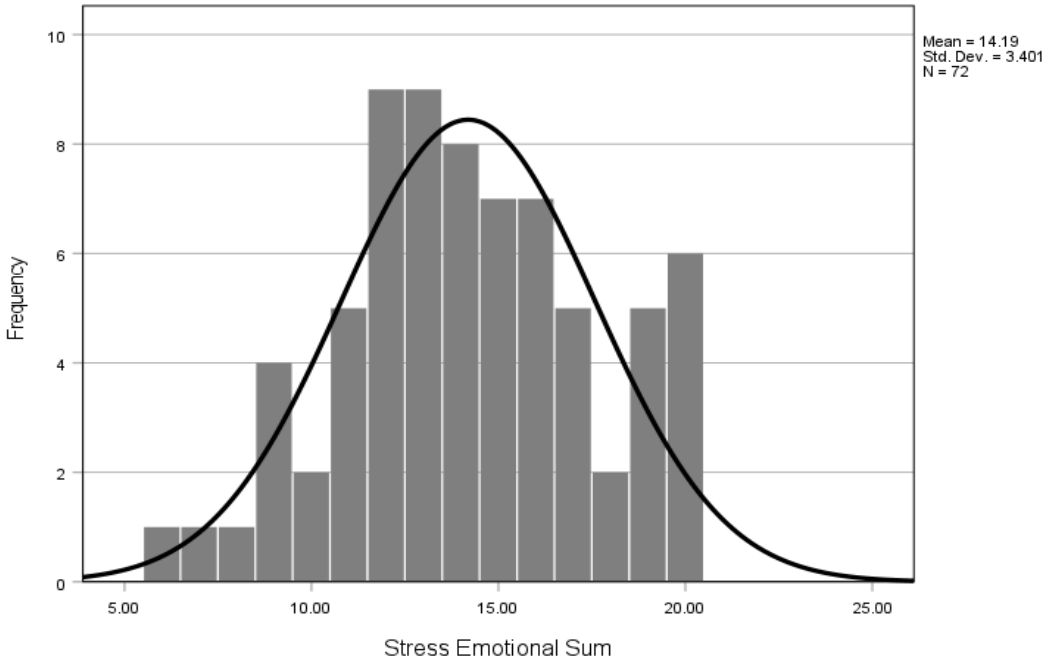
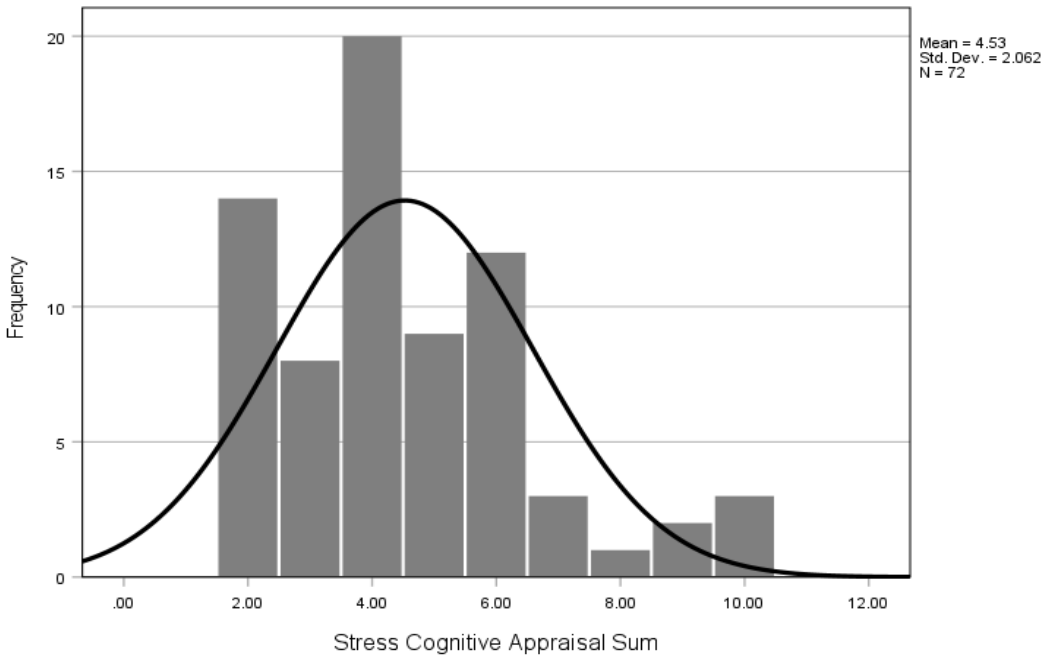



**Figure 10**

*Distribution of Response Totals to the Cognitive Appraisal Category*



## Discussion

The present study's first research question was whether there is a significant relationship between experienced stress and the perception of e-learning factors. The $r$ = -.178, n = 75, $p$ = .317, indicate that there is not a statistically significant relationship between the measures used to represent stress and e-learning as variables. This is in contrast to the studies done by Cofini et al. (2022); Kabir et al. (2021); Lawless and Allan (2004); and Satar et al. (2021) which show a relationship between stress and e-learning, either a positive or negative association. These previous studies differ from the present study in that none used the SSI or SSAE. The cited studies also had more specificity defining their construct of stress and e-learning factors being examined. These are relevant differences as the broad nature and reliability scores of the SSI and SSAE may be one of the causes for this study's non-significant result in contrast to previous stress and e-learning studies.

Both stress and e-learning as constructs are broad terms that have various facets to them. For stress this is reflected in the wide variety of sources stress can occur from and manifest in (Hurst et al., 2012; Joo et al., 2008). The SSI used in this study attempts to measure stress by comprehensively targeting nine different experiences of stress as categories. This had good reliability for measuring stress overall, with a Cronbach Alpha of .893, but this value is not an accurate reflection of the varying reliability its different categories have. The accepted minimum for a Cronbach Alpha to be significant is .7 (Field, 2005) and five of the nine categories had Cronbach Alphas (in parenthesis) below .7; frustrations(.69), conflicts(.698), pressures(.521), self-imposed(.661), and behavioural(.652). The lower reliability in this study partially mirrors the lower reliability of the categories as presented by Gadzella and Masten (2005). Though Gadzella and Masten's (2005) conflicts, pressures, and behavioural results were above the .7 threshold. The acceptably reliable categories over .7 for this study were the "changes", "physiological", "emotional", and "cognitive appraisal".

The SSAE measures the overall attitude towards e-learning by also accounting for the varying constituent factors of e-learning. It had a good Cronbach Alpha reliability of .853 but had a low Cronbach Alpha for reliability in its technical and pedagogical support domain and the advantages and disadvantages domain. The student experience domain was the only category that had a good reliability with a Cronbach Alpha of .937. Two thirds of the SSAE measure having a poor reliability, does call into question the practical ability of the SSAE to reliably measure e-learning in this study, despite its high total reliability score.

With low reliability affecting 56% of the SSI and 66% of the SSAE, the result that the SSI does not have a significant relationship with the SSAE is unsurprising. It also suggests that in this study these two measures do not accurately measure their constructs of experienced stress and attitude towards e-learning factors. The instances of good reliability for the overall SSI and SSAE measures may be due to both having more a high number of items. Measures with a high number of items may inflate the Cronbach Alpha beyond what it should be (Field, 2005).

As the relationship between stress and e-learning was not established with the SSI and SSAE measures, a Pearson Product-Moment correlation was done on the categories within the SSI and SSAE. The results in correlation Table 8 show that two of the stress categories correlated significantly with an e-learning domain, the “emotional” and “cognitive appraisal” categories with the technical and pedagogical support category. The correlation relationship does not indicate the direction of influence between the variables, only that as the one increases the other increases too. An increase in the emotional category indicates increased stress as identified by an increased occurrence of crying, anger, grief, anxiety, and depression. An increase in technical and pedagogical support indicates that an increase in responses that perceive e-learning resources as accessible and feel supported by university staff. The significant correlation between these two variables indicates that as emotional stress symptoms rise in frequency, the sense of being supported by the e-learning institution also rises. The nature of the relationship could be the inverse too, as perceived support through e-learning increases, emotional stress symptoms increase too. This could be a representation of when stress increases, institutional support is actively sought out and meets the expectation of support. The effect size of the relationship is less than .3, being a small effect (Lane, n.d). Folkman and Lazarus’s transactional theory and the TPB can intersect to explain this correlation. According to the transactional theory, the increased frequency of negative emotional responses to stress results in the secondary appraisal of how to cope with the experience (Folkman et al., 1986). This increase in negative emotions also leads to an increase in the negative evaluation of engaging with e-learning. This is according to the TPB, that the negative evaluation, informed by the negative emotions experienced.

The cognitive appraisal category of the SSI correlated with the technical and pedagogical Support category of the SSAE. An increase in cognitive appraisal scores indicates that there is increase in participants actively engaging with the experience of stress and determining whether their coping was effective. The relationship between the two variables is negative, indicates that as cognitive engagement with the experienced stress rises, the sense of being supported through the e-learning

model decreases. Or inversely, as perceived support with e-learning increase, cognitive engagement decreases. The latter interpretation could viably be explained that as support for e-learning increases, the experience of stress decreases and so less cognitive engagement with the stress is required. The correlation effect size was small at less than .3 (Lane, n.d).

To examine this relationship further, multiple regression was used with emotional and cognitive appraisal as the predictor variables and Technical and Pedagogical Support as the criterion variable. This showed to provide a good fit to the model with 35.9% of the variance in the e-learning category explained by changes in the two stress categories. When the cognitive appraisal category was kept constant the changes in the emotional category were statistically significant to predict changes in technical and pedagogical support. When the emotional category was kept constant however, the cognitive appraisal category did not significantly predict technical and pedagogical support.

When interpreting these results, it is important to refer to the reliability of the SSI and SSAE categories. The emotional and cognitive appraisal categories did have good Cronbach Alphas of .703 and .874 respectively, but the Cronbach Alpha of the technical and pedagogical Support category was at poor .264. Such a low reliability score undermines the correlation and prediction results, as it calls into question what it is that the emotional and cognitive appraisal categories are correlating against. The counterintuitive correlation result between an increase in emotional symptoms and perceived increase in e-learning support further invalidates the reliability of the technical and pedagogical Support category.

The second hypothesis was that if there was not a linear relationship, there would be a curvilinear relationship between the SSI and SSAE. The alternative hypothesis would be accepted if the relationship showed an increase in e-learning favourability as the stress scores increased. This increase would then invert and the relationship between stress and e-learning would be negative once the stress scores become too high. The null hypothesis, that there is no curvilinear relationship, failed to be rejected as curvilinear regression requires correlation between the variables. The correlation between the SSI and SSAE was non-significant as demonstrated by the first research question results, $r$ = -.178, n = 75, $p$ = .317.

The research question was to ascertain if there was a relationship between experiences of stress and perception of the e-learning factors. Null hypothesis one, that there was not a relationship, failed to be rejected. Null hypothesis two, that there was not a curvilinear relationship, failed to be rejected.

The theoretical implications of the study with regards to the stress – e-learning relationship cannot be definitively stated due to the poor reliability and correlation results of the SSI and SSAE. Rather, the theoretical and practical applications of the measures on their own will be discussed. The reoccurring low Cronbach Alpha in the SSI indicates the measure would benefit from a streamlining in its design. Potentially by reducing its total number of items, which can be done by removing entire unreliable categories. The research question of whether the participant responses to items within the measures could provide insight into their perceived stress and e-learning experiences is discussed further.

The reliable categories of “changes”, “emotional”, “physiological”, and “cognitive appraisal” constructs fit with Folkman and Lazarus’s transactional theory. Within the “changes” category, the changes according to the transactional theory are when the stimuli become too taxing and are then viewed as stressors. Figure 5 showing the distribution of scores for the “changes” category indicates that there was a high frequency of changes experienced, but the scores were also more evenly distributed on the lower end of frequency, rather than clustered around the mean. These changes, according to the transactional theory, are due to changes in the environment and the greatest change for the cohort in 2021 was, reasonably, the effects of lockdowns and the switch to e-learning. With e-learning occurring due to and in the context of the lockdowns, it is difficult to separate the two as the cause for the high scores in the “changes” category. The transactional theory indicates that the distribution of scores on the lower end of the histogram are due to the changes experienced being adequately coped with as they were encountered. These lower scores do not label the changes as stressors by respondents’ appraisal system.

The “emotional” category showed a clustering of negative emotions around the mean with a tendency towards higher frequency of occurrence than lower. These emotional responses would, according to the transactional theory be used by the primary appraisal system to gauge whether the context was potentially stressful. Higher responses of negative emotions feeds into the primary appraisal, indicating the need for a coping mechanism to reduce the stress experienced.

The “physiological” category showed a clustering of scores around the mean with a tendency towards a lower frequency of physiological responses occurring than higher frequency. These physiological responses, according to the transactional theory, are the responses the primary appraisal system would account for when determining a stressor. This indicates that the primary appraisal for

whether the context was stressful, received less input from the physiological responses and more from the emotional responses.

The “cognitive appraisal” category was a reverse scored category with the results showing a higher occurrence of cognitive engagement in stressful situations. This category aligns with the problem-based coping response of the transactional theory. The high frequency of identification and approaching the problem explored by this category, is explained by the transactional theory as the coping mechanism to the “emotional” category results, and to a lesser degree the “physiological” category.

Using the reliable categories of the SSI and Folkman and Lazarus’s transactional theory of coping and stress, participants were able to identify the changes in their lives during 2021 as a source of a stressor and engaged with problem-based coping techniques to reduce the experience of stress. This experience of stress was to a greater degree appraised through the emotional experience and to a lesser degree the assessment of the physiological responses to stress.

The issue with the SSI’s unreliable categories applies to the SSAE with its large number of items and varied category themes. With such a multitude of factors that contribute to e-learning, the SSAE may benefit from removing its advantages and disadvantages of e-learning domain and technical and pedagogical support domain, while reassessing the student experience of e-learning domain. The SSAE as a measure attempts to determine how favourably or unfavourably respondents have experienced e-learning. This measure of favourability is congruent with TPB principles of determining intention to perform a behaviour. The student experience of e-learning domain was normally distributed as seen by Figure 5, with most of responses clustering around the mean and slight leaning towards higher scores, indicating favourability towards the e-learning experience. This increased favourability according to the TPB is needed to generate the intent to engage with e-learning. The inclination towards positively evaluating e-learning indicates that participants may believe e-learning to have a favourable outcome for them. The results of this domain indicate that participants would be favourable to further e-learning, should it contain the factors explored by the student experience of e-learning domain.

Examining the items in Table 9 shows that communication does not suffer through e-learning but is not viewed as an important factor in the e-learning context. Importantly, through the lens of SLT, is that the communication did not worsen and from there, negatively impact the efficacy of learning through the e-learning medium. However, e-learning can be a difficult medium for learning to be conducted in, and that the face-to-face skills of learning are not directly transferable. If e-learning has an

advantage such as flexibility, this is recognised by participants and may contribute to their motivation to use e-learning. Student efficacy with e-learning is an important factor in determining their motivation to use the medium, and the academic outcomes for the students (Wang et al., 2013). This is particularly important in the South African context where access to and fluency with information technology is a point of concern for students (Mafenya, 2013). The results of Table 9's items show themes of engaging well with e-learning as a behaviour and identifying the advantages of the e-learning behaviour. These are important features of the TPB when determining the intention to adopt a behaviour. These results indicate that the intention to adopt e-learning would be higher for this cohort due to the identified advantages of it, and the opportunity to become more efficient at engaging with it.

Conversely, the disadvantages of e-learning highlighted in Table 9 were also identified by the participants. The results suggest that e-learning requires specific skills that are not directly transferable from face-to-face learning such as how to effectively communicate and how to use the additional information technology resources. These information technology resources would be using the internet and its varied sources of information to augment the e-learning process. The use of the internet in the e-learning model is critical from the Connectivism perspective of learning, and if students are struggling to engage with e-learning because of this, it may impact the efficacy of their learning (Siemens, 2004). The Connectivism theory of learning requires learners to engage with the internet to facilitate the learning process (Siemens, 2004). This engagement with the internet is analogous to the learner-facilitator dynamic of SLT, whereby the learner becomes their own facilitator, scaffolding and engaging with simple knowledge and increasing the complexity of engagement as they gain proficiency. This would require aptitude and skills on the learner's side with information technology. If students are not equipped with these skills, then the returns on e-learning are diminished. Through the TPB lens, the results show that these challenges of e-learning would negatively affect the participants' willingness to engage with the learning medium. This is congruent with the previous paragraph, that the intent to engage with e-learning, and the extent to which this is done, is moderated by how the participants' belief of how well they can make use of e-learning technology.

The SSI in isolation also revealed some findings of interest. Stress can be beneficial within the academic space. The benefits of stress are increased motivation to achieve and developing coping skills for when stress does occur. These benefits require stress to be experience in mild levels (Gadzella et al, 2012). Once stress becomes too high the disadvantages of stress can be lowered self-esteem, adverse physiological symptoms, maladaptive coping mechanisms, and decrease in academic performance (Dlungwane et al., 2017; Hooda & Saini, 2017; Joo et al., 2008; Maykrantz & Houghton, 2020). Of the 72

respondents in this study, 10(13.89%) rated their stress as mild, 37(51.39%) rated their stress as medium, and 25(34.72%) rated their stress as high. According to Gadzella et al (2012), 13.89% of the respondents were experiencing stress within manageable levels that could possibly benefit them academically. The remaining 86.11% percent of respondents reported stress that was beyond their normal coping levels and experiencing the adverse effects of stress. The adverse effects that are physiological and emotional were reliably captured by the SSI categories of "physiological" and "emotional". The results of both categories showed that the emotional and physiological effects of stress were experienced, on average, occasionally by the sample with a trend towards often. The transactional theory views this as a normal response to stress, with the secondary appraisal accounting for this during coping Folkman et al. (1986). One of the factors that assists in managing stress is social support (Jain & Singhai, 2017). As stress occurs due to the inability to manage increasing demands, support from friends, family and even an academic institution, can help increase the resources to cope with the demands, or even distribute the demands amongst a supportive network. Results of the items indicate that the use of social support to alleviate the stress experience appears to be lacking in this sample. Another indication of coping by the participants is through examination of Table 10's items in the "behavioural" category.

The results of these items show that there was not an increase in maladaptive coping behaviours in response to the stress. The exception to this was the item "separated myself from others", which had a high frequency of participants often seeking isolation. This would indicate that the low social support being used is in part due to participants isolating themselves from the social network. However, considering the COVID-19 context of this study, seeking increased privacy during lockdowns would be normal and the lack of privacy has been reported in literature as a potential stressor.

An important consideration when interpreting the results of this study is that both the SSI and SSAE were created and tested outside of the South African context. Both the SSI and SSAE are concerned with contextual factors that affect the experience of stress and the perception of e-learning factors. The sources and mitigators of stress may vary wildly from a Western university sample where the SSI has been formulated, to the South African university sample. The same applies to the SSAE that was created in Middle Eastern universities. The sample of students used to develop this measure may have different experiences, expectations, and access to e-learning factors compared to the South African cohort.

The limitations of this study involve the poor reliability of the measures. This affects how the results are interpreted. Additionally, the study while cross-sectional in design was also retroactive as it required participants to answer items concerning their opinions and feelings on a topic that took place a

year earlier. This may have affected the accuracy of their reporting and their investment to engage with the measures. Relative to investment, the study recruited participants on a voluntary basis from a similar cohort. This may have led to a sampling bias, where the sample was homogonous in certain characteristics. If the structure of the cohort's study programs was favourable towards the e-learning medium in terms of content delivery and student expected outcomes, it may have affected the overall perception of e-learning as an instruction medium. This structure of the study program could vary between different courses leading to varied integration of the e-learning medium. The SSI and SSAE used may not have been culturally sensitive, and the SSAE had not been used in any other studies. While the SSI and SSAE attempt to provide an overall impression of the stress and perception of e-learning constructs, they may be too broad in doing so. This study targeted e-learning during the lockdown period when e-learning was mandatory. It did not isolate the effects of the lockdown on stress for examination, nor the effect of being forced to use e-learning as a learning model as opposed to voluntarily adopting it.

Future research related to the relationship between experienced stress and perceptions of e-learning factors, may do well to focus on a particularly relevant factor of e-learning and use a more established measure than the SSAE. A more focused stress measure that aligns with how the stress construct is operationalized may be more reliable too than the broad approach. These suggestions are particularly relevant when examining a relationship between stress and e-learning as variables, to reduce the broad field of factors that stress, and e-learning encompass. When researching e-learning it would be beneficial to establish through the study the context in which the e-learning occurred. Factors such as choice, forced by circumstances, access to technology, history of technology access, support systems, and internet access are relevant when interpreting results in South Africa. The importance of communication and how it functionally manifests within the e-learning setting compared to the face-to-face setting, would be a valuable study topic when exploring factors that affect the quality and efficacy of e-learning for learners.

## Conclusion

Examining the relationship between attitudes towards e-learning factors and the experience of perceived stress as broad concepts does not yield meaningful insight if using a singular measure for each construct. Correlation between the more specific categories that constitute these two broad concepts could yield more meaningful results into the nature of the relationship between e-learning attitudes and experiences of stress. This requires the constructs to be well defined and represented by measures specifically designed for the stress or e-learning construct being studied. Examination of the SSAE items that address the advantages and disadvantages of e-learning suggests that participants recognised the advantages of e-learning, particularly the flexibility of it. However, these advantages are not necessarily enough to promote acceptance of e-learning with the presence of the disadvantages they experienced. The disadvantages experienced showed that a lack of skills to engage with the e-learning medium mitigated motivation and enthusiasm towards the learning medium. Participants are more willing to engage with e-learning if the advantages of it are accessible and known to them. This includes the ability to effectively use e-learning technology. Stress amongst the sample was higher than manageable for most participants. Social support appears to have been available but there was a pattern of the participants as individuals isolating the stress experience to themselves, limiting the effectiveness of their support system. The emotional experience of stress was more frequent with the sample. There was also indication that problem-based coping was used by the participants in response to the stress. Interpreting these results needs consideration that they stemmed from a retroactive reflection. Due to the COVID-19 pandemic, they were also from a period of additional strain and uncertainty and when the e-learning model had been implemented out of necessity.

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## Appendix A – SSAE Items

1) E-learning can solve many of the educational problems.

2) E-learning gives the chance to reinforce student's information and to sharpen his/her skills in the field of specialization.

3) Online learning makes teaching and learning more flexible.

4) Adopting e-learning as a learning style shall help students strike a balance between study and family requirements.

5) My colleagues advise me to use the multiple benefits of e-learning.

6) I think that e-learning made the learning process more enjoyable.

7) I believe that e-learning has contributed little to teacher-student interaction and communication.

8) I think that e-learning has limited effectiveness in improving teaching and learning.

9) E-learning saves time for both teachers and students.

10) I think that e-learning had little impact on my achievement.

11) Online learning increases my ability to understand subject matter.

12) E-learning will improve my achievement in the online courses.

13) E-learning allows me to deliver the course requirements in time.

14) I find it difficult to use e-learning to express my ideas in writing.

15) E-learning encourages me to conduct research in my field.

16) I find it difficult to get significant information through e-learning.

17) I feel depressed when I think of learning the subject matter online.

18) I hardly prefer e-learning as it leads to social isolation.

19) I find using e-learning both easy and possible.

20) E-learning helps me compensate for missed classroom lectures.

21) I prefer face-to-face learning to learning by using Internet.

22) I advise my friends to use the Internet for reading lecture notes online.

23) I avoid using electronic sources for learning and research because I fail to use them efficiently.

24) I feel nervous and tense when I fail to use e-learning effectively.

25) E-learning at home consumes much of my time and effort.

26) I hardly prefer e-learning over traditional learning because it lacks the direct interaction with the teacher.

27) E-learning helps me acquire effective communication skills with other people.

28) I feel comfortable with performing the e-learning activities and tasks related to the e-course.

29) I had a strong desire to continue with e-learning.

30) I find it difficult to learn the course using the Internet.

31) I prefer reading from a printed source rather than from websites or e-books.

32) I wish I could choose more online courses at home to study.

33) The slowness of network is an obstacle to my learning online.

34) My university has the technological base that is necessary to deliver e-learning.

35) My university systematically updates the e-learning websites.

36) Faculty members at my university are very motivated to use e-learning on a wide scale.

37) The faculty members at my university are inclined to use the internet for research more than for teaching purposes.

38) I think that in the visible future my university should be a completely electronic facility.

39) I think that the adoption of e-learning as a learning style at the university will help solve the students' problems effectively.

40) My university's library really lacks electronic periodicals necessary to conduct research and to perform activities.

41) In my university, faculty members encourage me to use e-learning in doing educational research and activities.

42) I assume that the slowness of network decreases the level of effectiveness of e-learning at home.

43) The e-learning system at my university lacks the technical support necessary for the management of e-courses.

Appendix B – SSAE Items Positively and Negativily Grouped

| Domain | Positive Items | Negative Items |
|---|---|---|
| Advantages and disadvantages of e-learning use. | 1, 3, 5, 18, 19, 33 | 15, 30, 31, 42 |
| Student experience in using e-learning at home. | 2, 4, 6, 11, 16, 17, 22, 27,32, 34, 44 | 7, 12, 13, 14, 20, 23, 24, 25, 26, 36, 38 |
| Technical and pedagogical support from home. | 9, 10, 28, 37, 40 | 8, 21, 29, 35, 39, 41, 43 |

## Appendix C – SSI

Student-Life Stress Inventory by B. M Gadzella, as modified for use in this study.

The following are questions or statements relating to perceived stress during your 2021 online studies.

Please answer as accurately as possible.

With reference to 2021, rate your overall stress. ◯ Mild ◯ Medium ◯ High

**This inventory contains statements dealing with student-life stress. Read it carefully and respond to each statement as it has related to you as a student.**

**As a student:**

| | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| I have experienced frustrations due to delays in reaching my goals. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I have experienced daily hassles which affected me in reaching my goals. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I have experienced lack of resources (money for auto, books, ect.) | ◯ | ◯ | ◯ | ◯ | ◯ |
| I have experienced failures in accomplishing the goals I set. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I have not been accepted socially (became a social outcast). | ◯ | ◯ | ◯ | ◯ | ◯ |
| I have experienced dating frustrations. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I feel I was denied opportunities in spite of my qualifications. | ◯ | ◯ | ◯ | ◯ | ◯ |

**With reference to 2021, I have experienced conflicts which were:**

| | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| Produced by two or more desirable alternatives. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Produced by two or more undesirable alternatives. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Produced when a goal had both positive and negative alternatives. | ◯ | ◯ | ◯ | ◯ | ◯ |

| With reference to 2021, I have experienced pressures: | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| As a result of competition (on grades, work, relationship with spouses and/or friends). | ○ | ○ | ○ | ○ | ○ |
| Due to deadlines (papers due, payments to be made, ect). | ○ | ○ | ○ | ○ | ○ |
| Due to overload (attempting too many things at one time). | ○ | ○ | ○ | ○ | ○ |
| Due to interpersonal relationships (family and/or friends expectations, work, responsibilities). | ○ | ○ | ○ | ○ | ○ |

| With reference to 2021, I have experienced: | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| Rapid unpleasant changes. | ○ | ○ | ○ | ○ | ○ |
| Too many changes occurring at the same time. | ○ | ○ | ○ | ○ | ○ |
| Changes which disrupted my life and/or goals. | ○ | ○ | ○ | ○ | ○ |

| As a person: | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| I like to compete and win. | ○ | ○ | ○ | ○ | ○ |
| I like to be noticed and be loved by all. | ○ | ○ | ○ | ○ | ○ |
| I worry a lot about everything and everybody. | ○ | ○ | ○ | ○ | ○ |
| I have a tendency to procrastinate (put off things that have to be done). | ○ | ○ | ○ | ○ | ○ |
| I feel I must find a perfect solution to the problems I undertake. | ○ | ○ | ○ | ○ | ○ |
| I worry and get anxious about taking tests. | ○ | ○ | ○ | ○ | ○ |

| With reference to 2021, during stressful situations I experienced the following: | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| Sweating (sweaty palms, ect). | ○ | ○ | ○ | ○ | ○ |
| Stuttering (not being able to speak clearly). | ○ | ○ | ○ | ○ | ○ |
| Trembling (being nervous, biting fingernails, ect). | ○ | ○ | ○ | ○ | ○ |
| Rapid movements (moving quickly from place to place). | ○ | ○ | ○ | ○ | ○ |
| Exhaustion (worn out, burned out). | ○ | ○ | ○ | ○ | ○ |
| Irritable bowels, peptic ulcers etc. | ○ | ○ | ○ | ○ | ○ |
| Asthma, bronchial spasms, hyperventilation. | ○ | ○ | ○ | ○ | ○ |
| Backaches, muscle tightness (cramps), teeth-grinding. | ○ | ○ | ○ | ○ | ○ |
| Hives, skin itching, allergies. | ○ | ○ | ○ | ○ | ○ |
| Migraine headaches, hypertension, rapid heartbeat. | ○ | ○ | ○ | ○ | ○ |
| Arthritis, overall pains. | ○ | ○ | ○ | ○ | ○ |
| Viruses, colds, flue. | ○ | ○ | ○ | ○ | ○ |
| Weight loss (can't eat). | ○ | ○ | ○ | ○ | ○ |
| Weight gain (eat a lot). | ○ | ○ | ○ | ○ | ○ |

| With reference to 2021, when under stressful situations, I have experienced: | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| Fear, anxiety, worry. | ○ | ○ | ○ | ○ | ○ |
| Anger. | ○ | ○ | ○ | ○ | ○ |
| Guilt. | ○ | ○ | ○ | ○ | ○ |
| Grief, depression. | ○ | ○ | ○ | ○ | ○ |

| With reference to 2021, when under stressful situations, I have: | Never | Seldom | Occasionally | Often | Most of the time |
|---|---|---|---|---|---|
| Cried. | ○ | ○ | ○ | ○ | ○ |
| Abused others (verbally and/or physically). | ○ | ○ | ○ | ○ | ○ |
| Abused self. | ○ | ○ | ○ | ○ | ○ |
| Smoked excessively. | ○ | ○ | ○ | ○ | ○ |
| been irritable towards others. | ○ | ○ | ○ | ○ | ○ |
| Attempted suicide. | ○ | ○ | ○ | ○ | ○ |
| Used defence mechanisms. | ○ | ○ | ○ | ○ | ○ |
| Separated myself from others. | ○ | ○ | ○ | ○ | ○ |

| With reference to stressful situations in 2021, I have: | | | | | |
|---|---|---|---|---|---|
| | Never | Seldom | Occasionally | Often | Most of the time |
| Thought and analysed about how stressful the situations were. | ○ | ○ | ○ | ○ | ○ |
| Thought and analysed whether the strategies I used were most effective. | ○ | ○ | ○ | ○ | ○ |

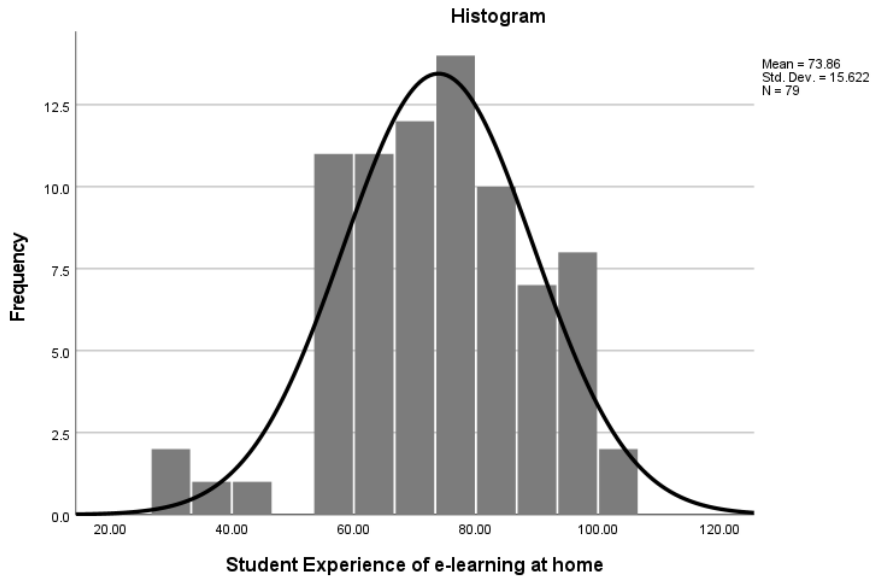
## Appendix D – Demographic Items

Demographic questions to be included as part of questionnaire data gathering.

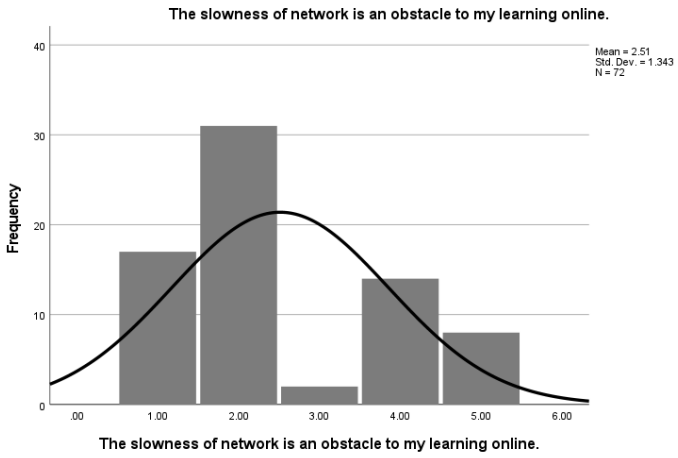
1. What is your gender:
    a. Male
    b. Female
    c. Prefer not to say
    d. Other (Please specify)
2. What is your race:
    a. Black African
    b. White African
    c. Asian
    d. Indian
    e. Coloured
    f. Prefer not to say
    g. Other (Please specify)
3. What year of study were you in during 2021 at the University of Witwatersrand?
    a. First year
    b. Second year
4. What faculty are you studying under?
    a. Please specify
5. What is your major? (I.e psychology, engineering, et al)
    a. Please specify

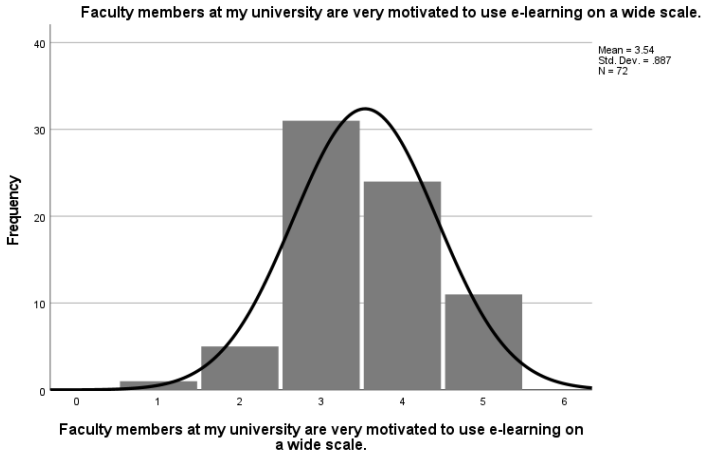
## Appendix E – Histograms of SSAE Select Items

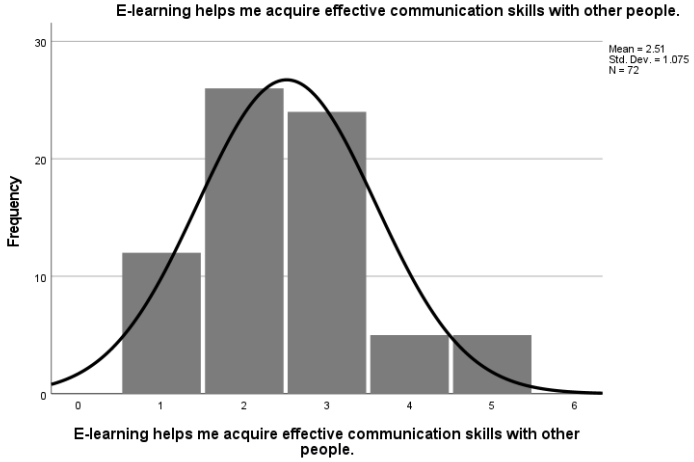
*Histogram of student experience of e-learning at home.*

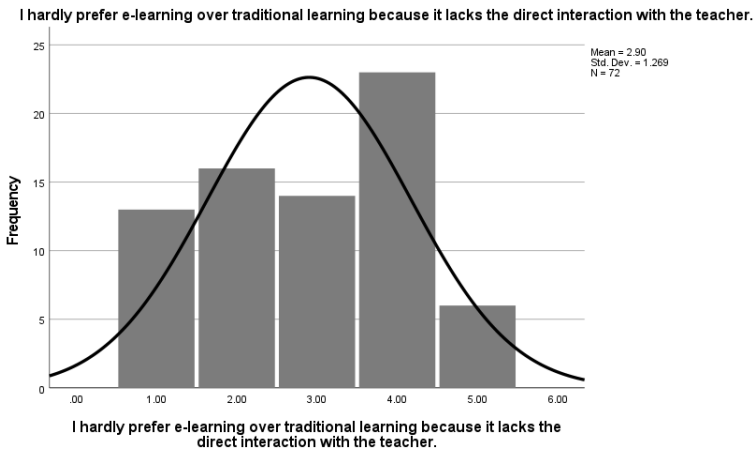


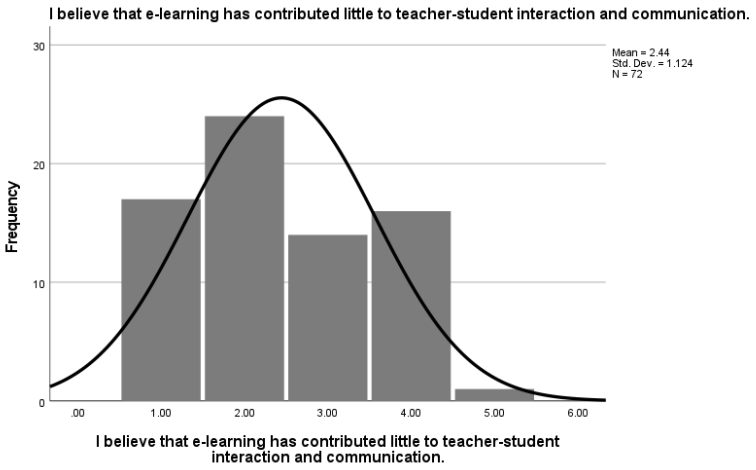

*Histograms of items relevant to the participants' experience of communication for learning through e-learning.*



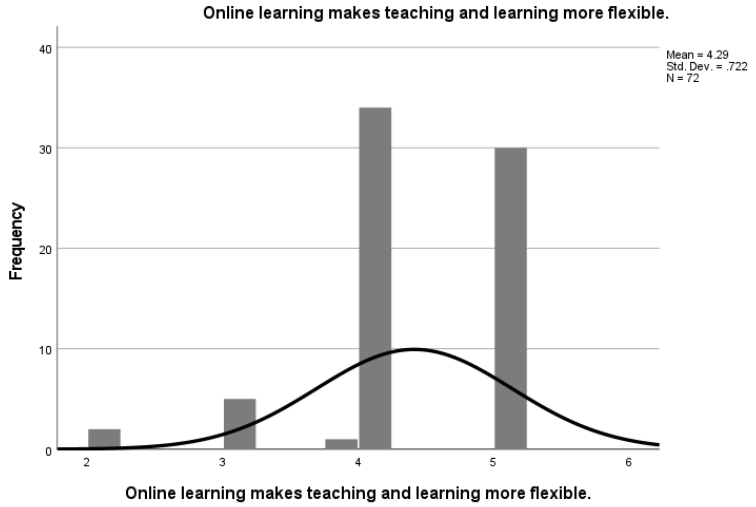

Faculty members at my university are very motivated to use e-learning on a wide scale.
Mean = 3.54
Std. Dev. = .887
N = 72
Frequency
Faculty members at my university are very motivated to use e-learning on a wide scale.

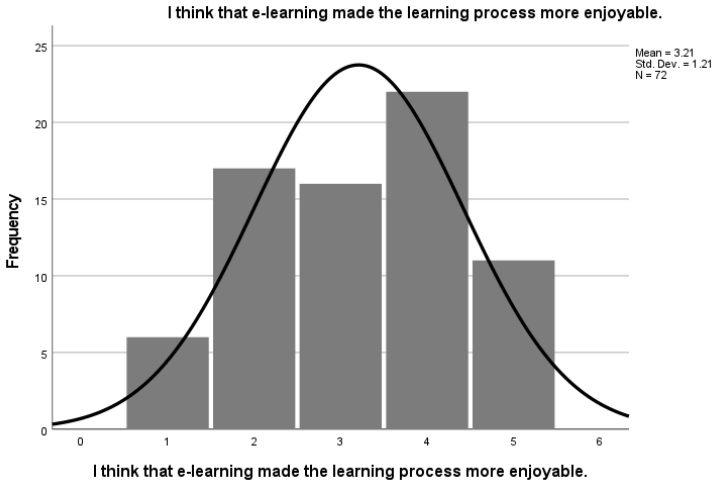

E-learning helps me acquire effective communication skills with other people.
Mean = 2.51
Std. Dev. = 1.075
N = 72
Frequency
E-learning helps me acquire effective communication skills with other people.

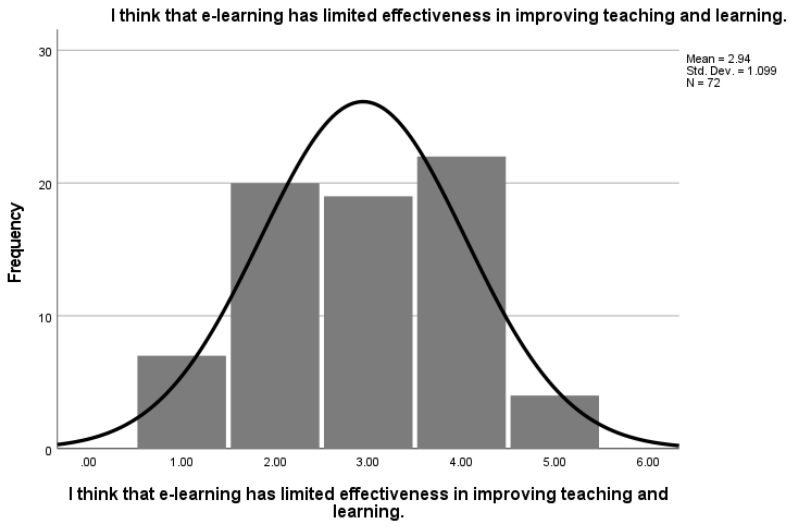

I hardly prefer e-learning over traditional learning because it lacks the direct interaction with the teacher.
Mean = 2.90
Std. Dev. = 1.269
N = 72
Frequency
I hardly prefer e-learning over traditional learning because it lacks the direct interaction with the teacher.

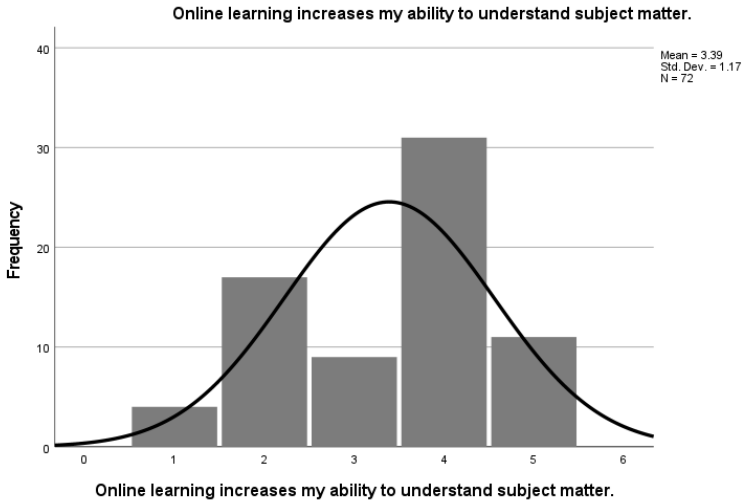


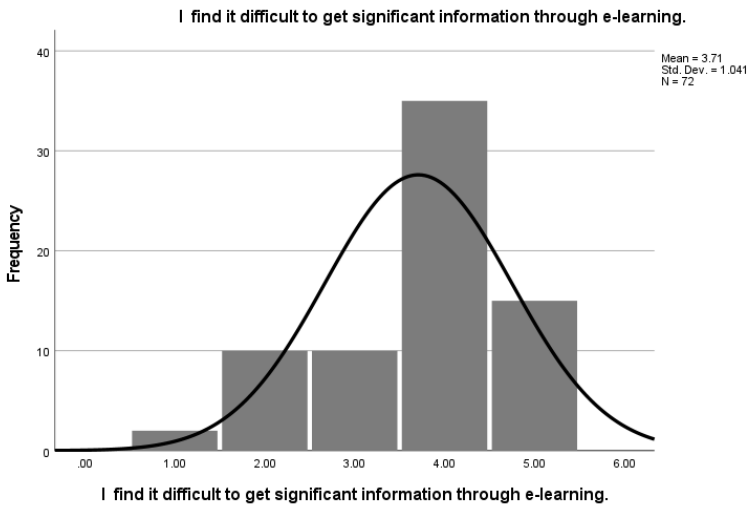

*Histograms of items relevant to the participants' experience of e-learning as an effective method of learning.*

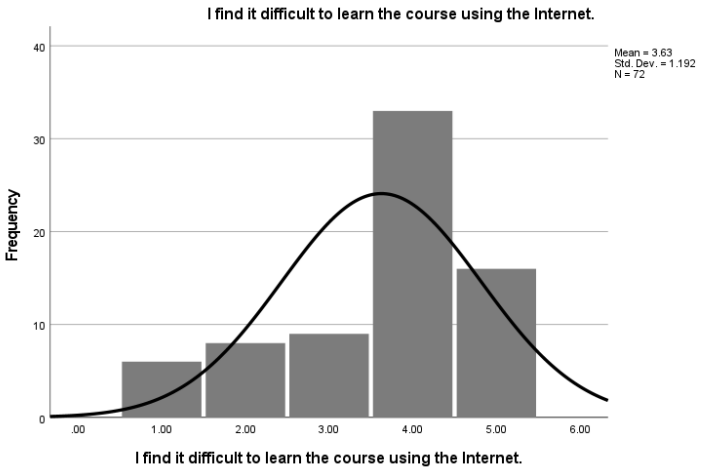


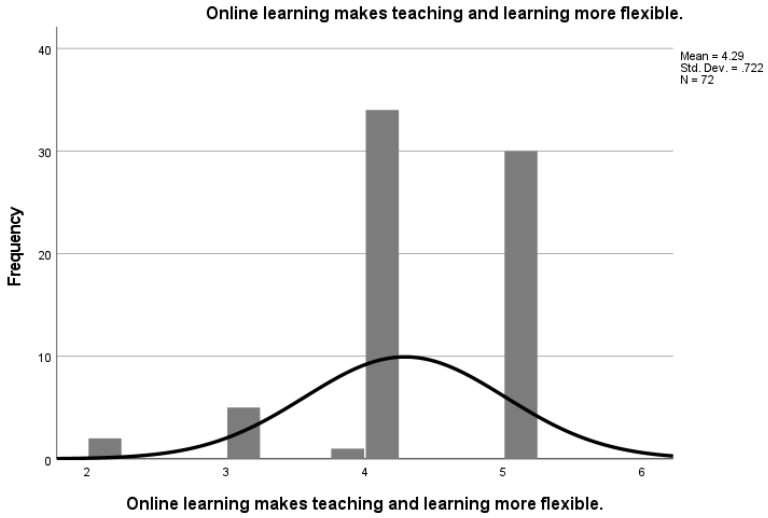

I think that e-learning has limited effectiveness in improving teaching and learning.
Mean = 2.94
Std. Dev. = 1.099
N = 72
Frequency
30
20
10
0
.00
1.00
2.00
3.00
4.00
5.00
6.00
I think that e-learning has limited effectiveness in improving teaching and learning.

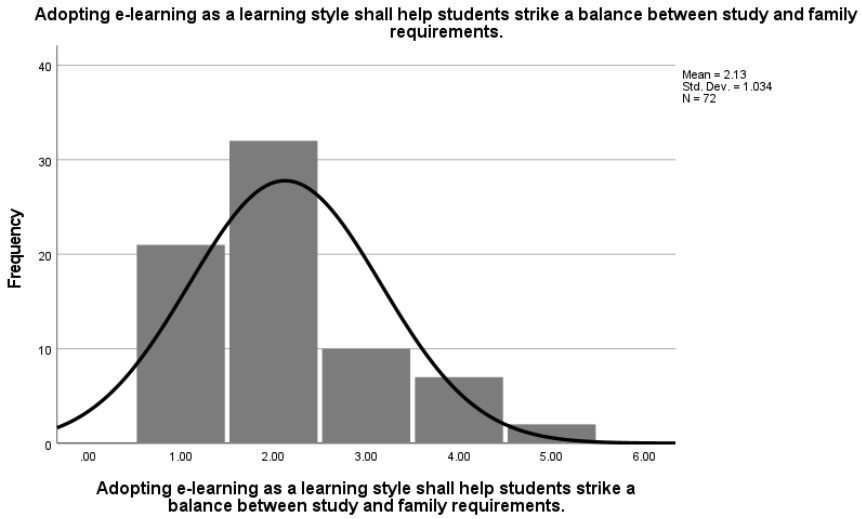

Online learning increases my ability to understand subject matter.
Mean = 3.39
Std. Dev. = 1.17
N = 72
Frequency
40
30
20
10
0
0
1
2
3
4
5
6
Online learning increases my ability to understand subject matter.

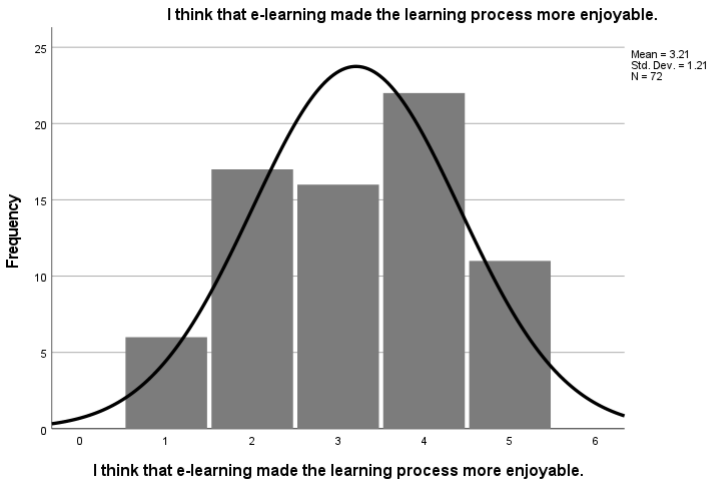

I find it difficult to get significant information through e-learning.
Mean = 3.71
Std. Dev. = 1.041
N = 72
Frequency
40
30
20
10
0
.00
1.00
2.00
3.00
4.00
5.00
6.00
I find it difficult to get significant information through e-learning.

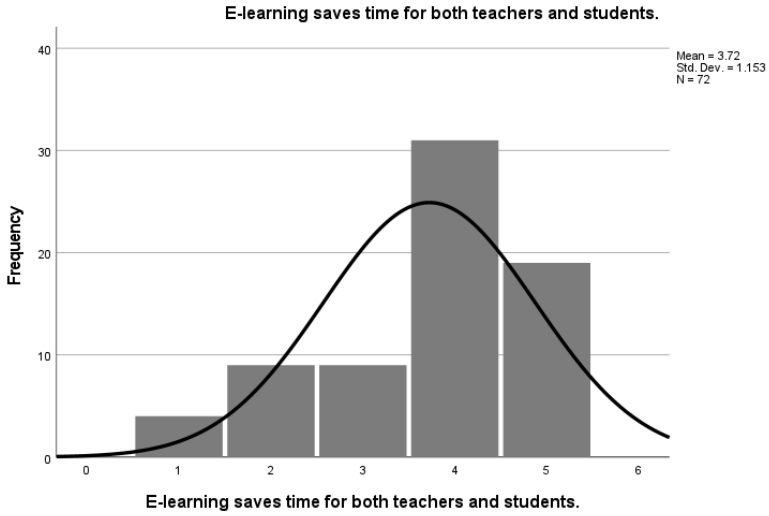


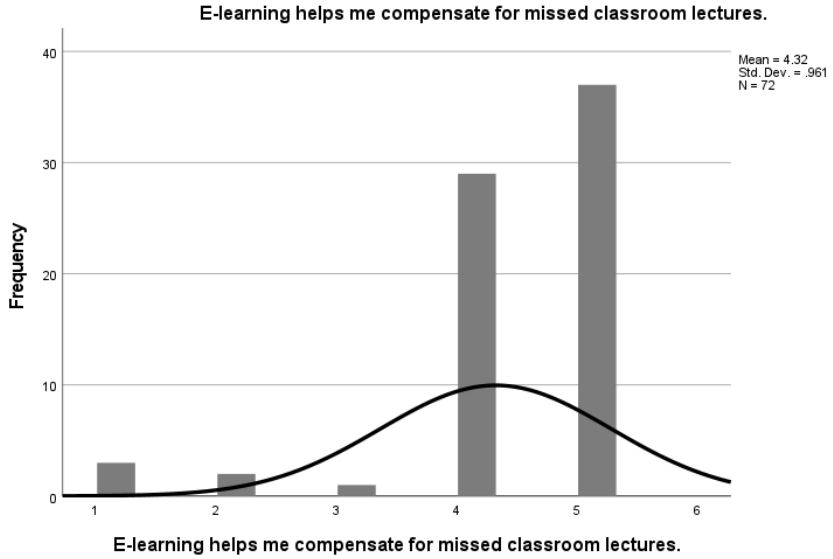

*Histogram of items that presented potential advantages for participants during e-learning.*

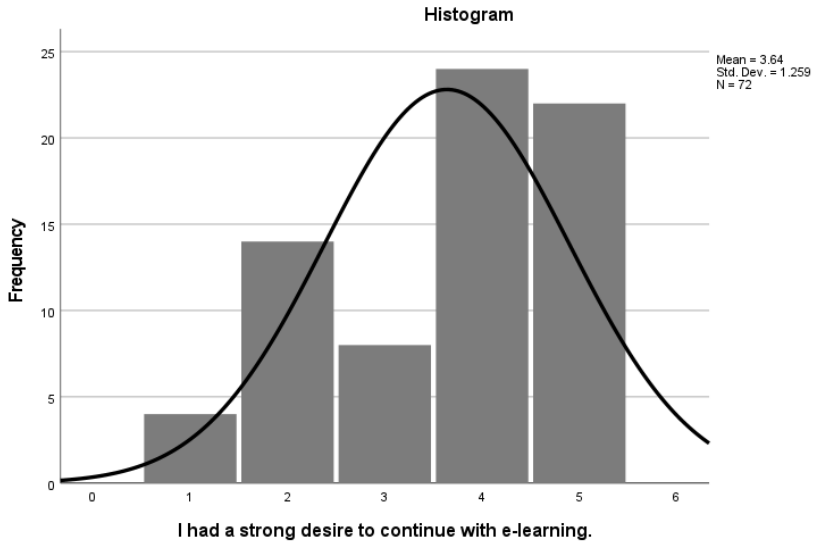


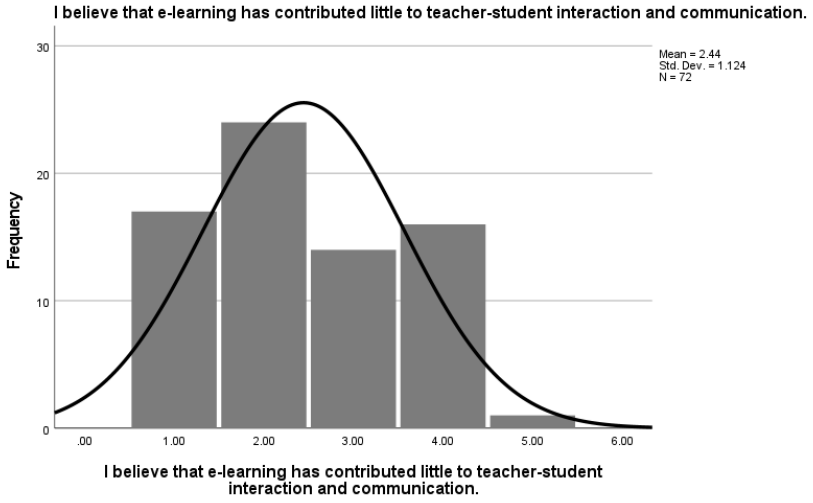

I think that e-learning made the learning process more enjoyable.
Mean = 3.21
Std. Dev. = 1.21
N = 72
Frequency
0
5
10
15
20
25
0
1
2
3
4
5
6
I think that e-learning made the learning process more enjoyable.

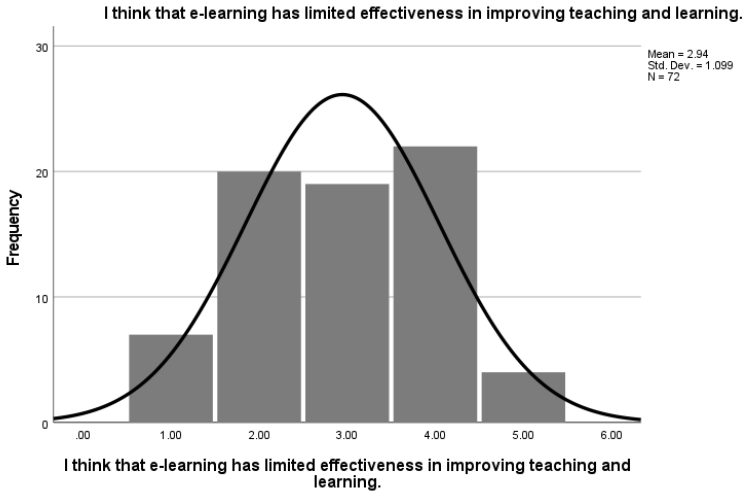

E-learning saves time for both teachers and students.
Mean = 3.72
Std. Dev. = 1.153
N = 72
Frequency
0
10
20
30
40
0
1
2
3
4
5
6
E-learning saves time for both teachers and students.

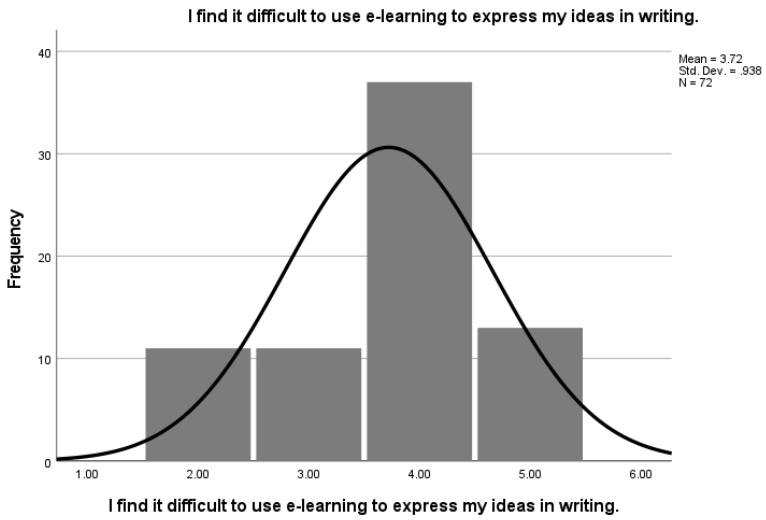

E-learning helps me compensate for missed classroom lectures.
Mean = 4.32
Std. Dev. = .961
N = 72
Frequency
0
10
20
30
40
1
2
3
4
5
6
E-learning helps me compensate for missed classroom lectures.

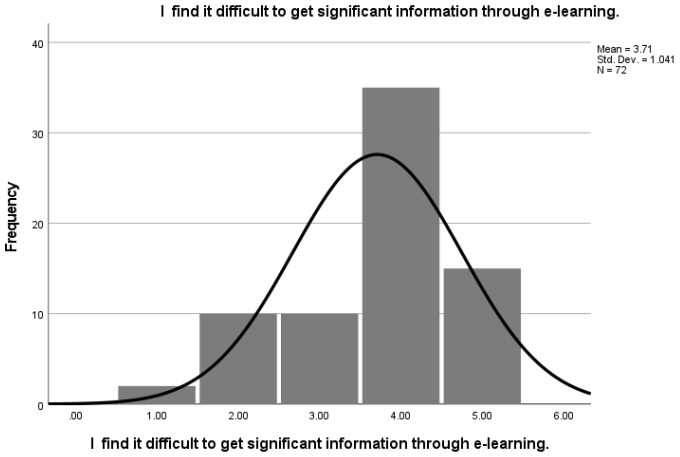


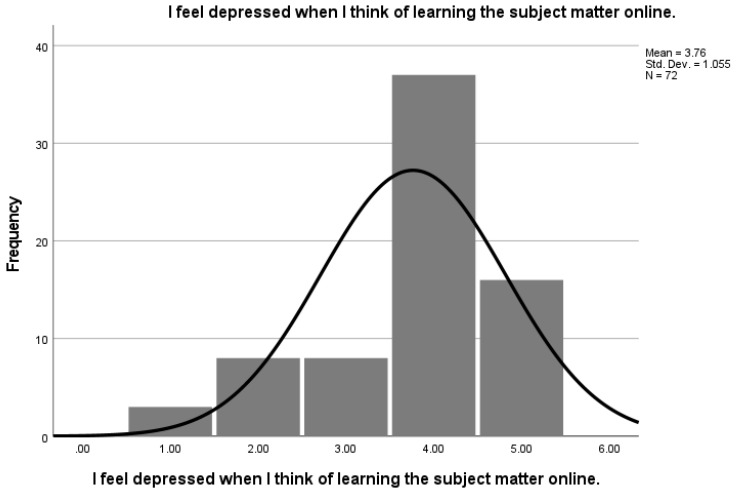

*Histogram of items that presented potential disadvantages for participants during e-learning.*

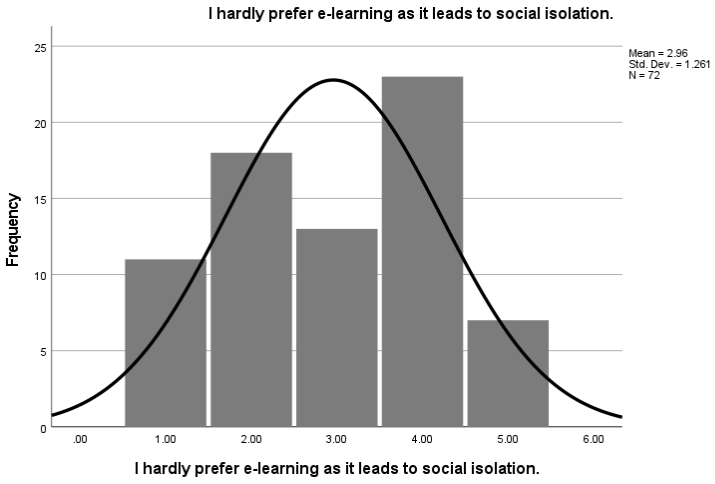


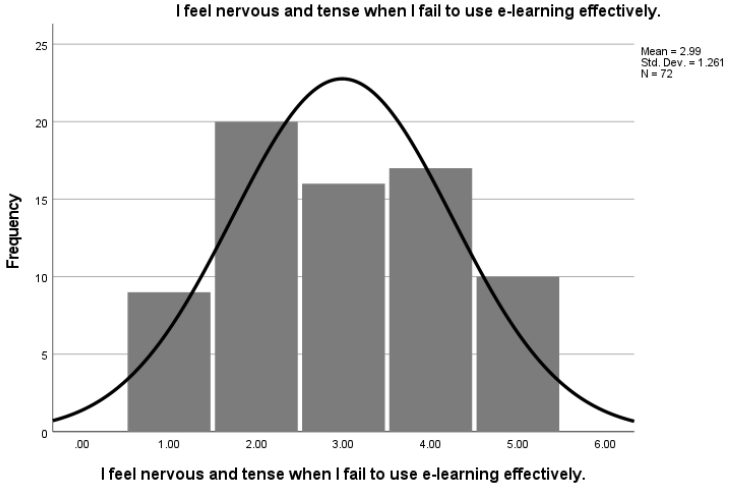




I find it difficult to use e-learning to express my ideas in writing.
Mean = 3.72
Std. Dev. = .938
N = 72
Frequency
40
30
20
10
0
1.00
2.00
3.00
4.00
5.00
6.00
I find it difficult to use e-learning to express my ideas in writing.


I find it difficult to get significant information through e-learning.
Mean = 3.71
Std. Dev. = 1.041
N = 72
Frequency
40
30
20
10
0
.00
1.00
2.00
3.00
4.00
5.00
6.00
I find it difficult to get significant information through e-learning.

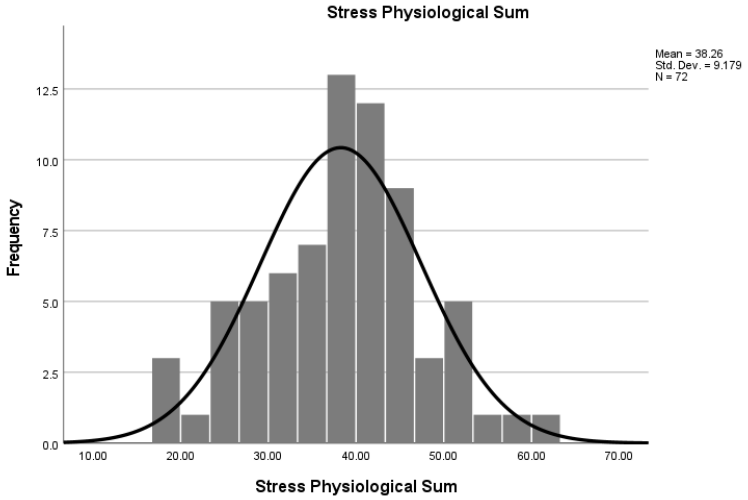

I feel depressed when I think of learning the subject matter online.
Mean = 3.76
Std. Dev. = 1.055
N = 72
Frequency
40
30
20
10
0
.00
1.00
2.00
3.00
4.00
5.00
6.00
I feel depressed when I think of learning the subject matter online.


I hardly prefer e-learning as it leads to social isolation.
Mean = 2.96
Std. Dev. = 1.261
N = 72
Frequency
25
20
15
10
5
0
.00
1.00
2.00
3.00
4.00
5.00
6.00
I hardly prefer e-learning as it leads to social isolation.

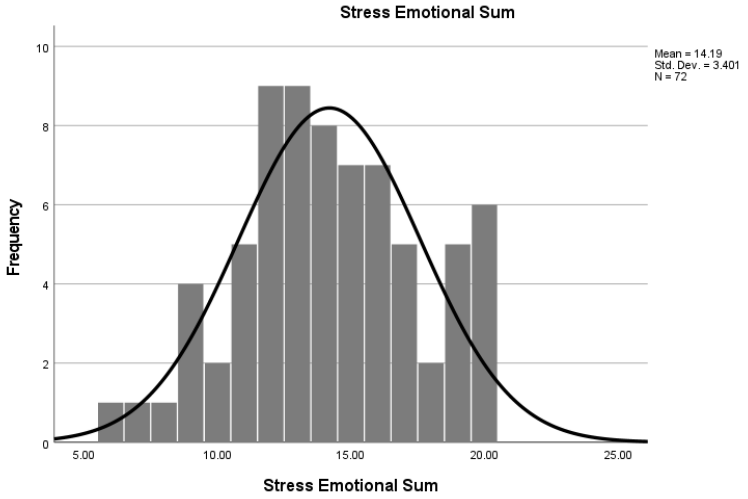

I feel nervous and tense when I fail to use e-learning effectively.
Mean = 2.99
Std. Dev. = 1.261
N = 72
Frequency
25
20
15
10
5
0
.00
1.00
2.00
3.00
4.00
5.00
6.00
I feel nervous and tense when I fail to use e-learning effectively.

# Appendix F – Histograms of SSI Select Items

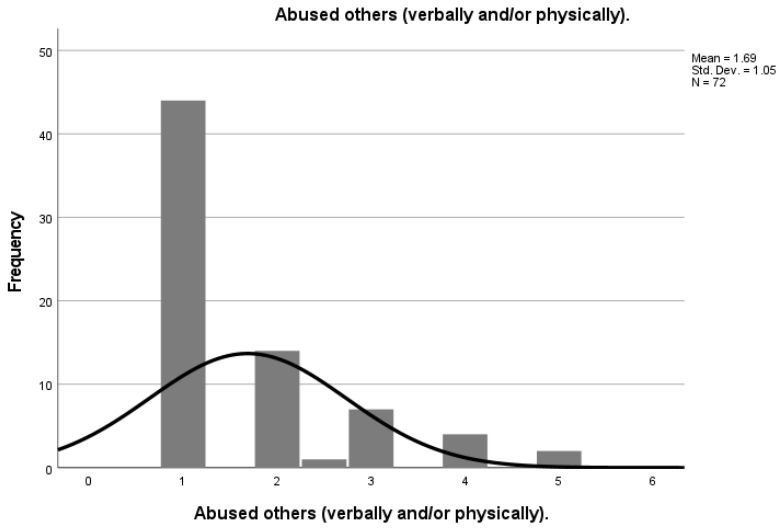
*Physiological category histogram*

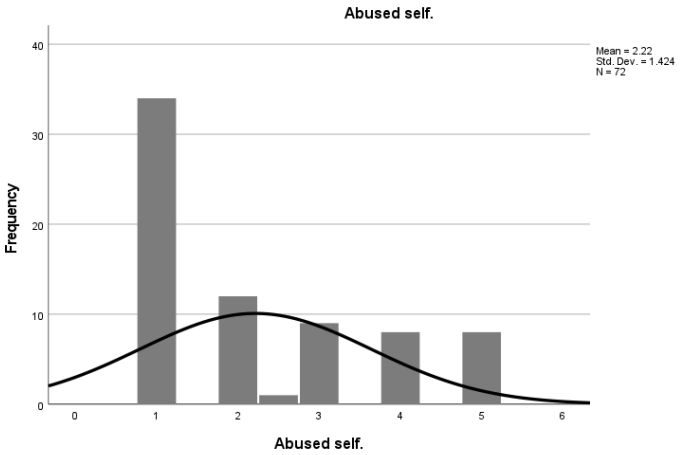


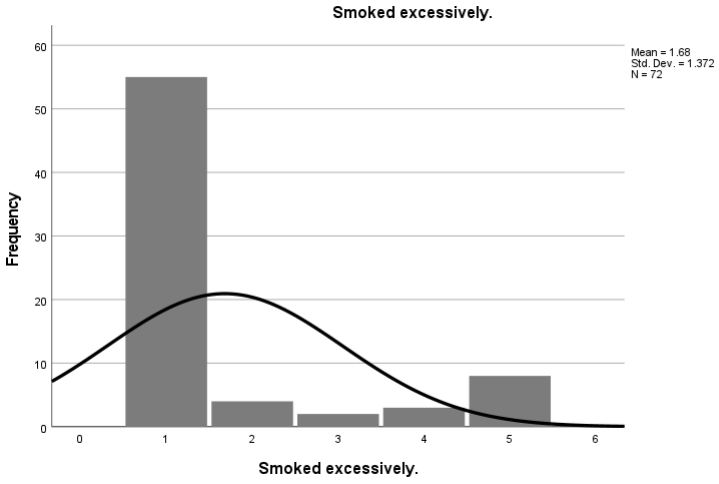

*Emotional category histogram*

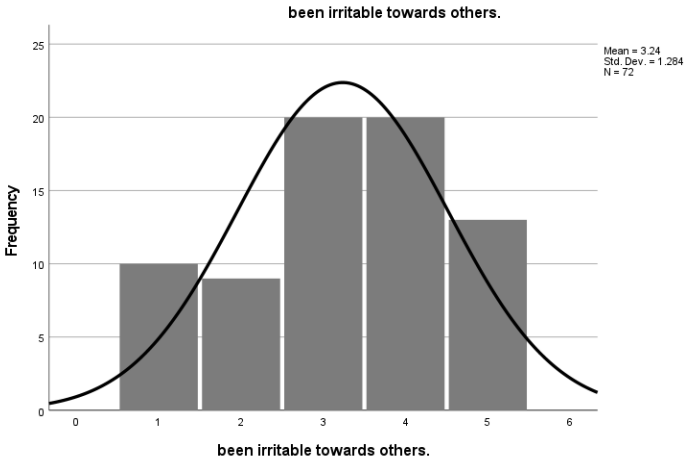


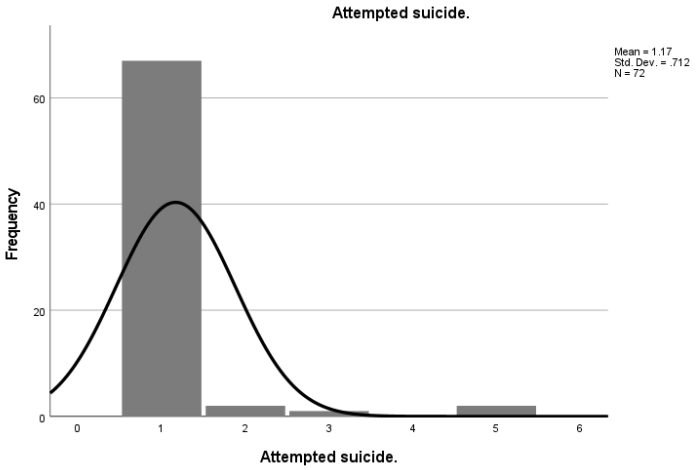

*Behavioural category with maladaptive behaviour items selected.*

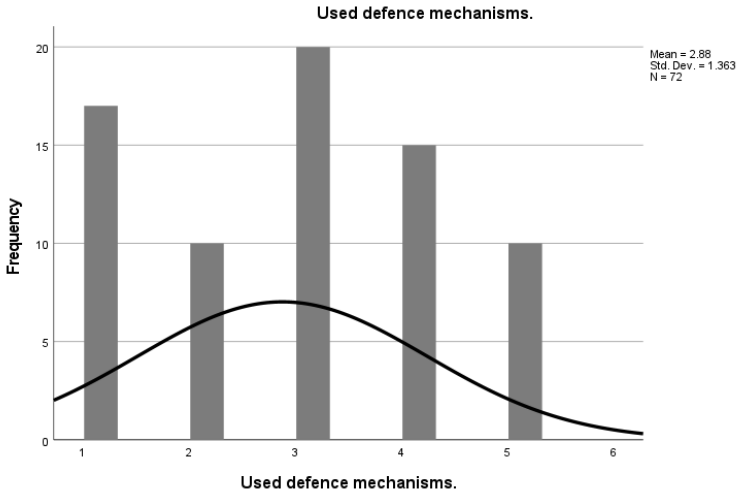

Abused others (verbally and/or physically).
Mean = 1.69
Std. Dev. = 1.05
N = 72
Frequency
0
10
20
30
40
50
0
1
2
3
4
5
6
Abused others (verbally and/or physically).

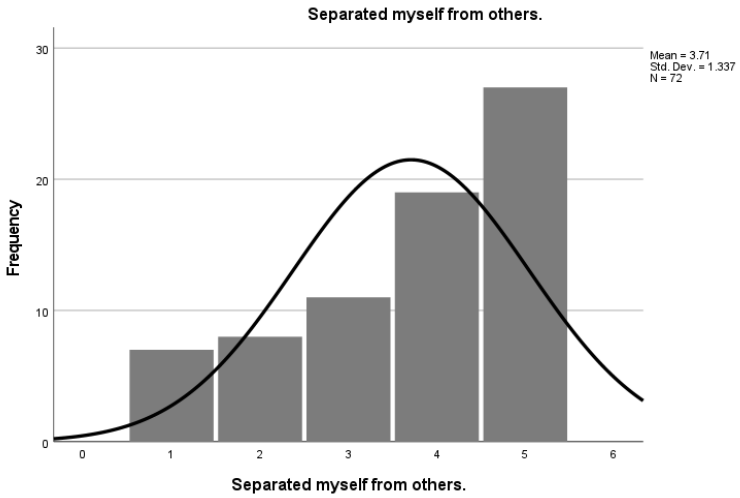

Abused self.
Mean = 2.22
Std. Dev. = 1.424
N = 72
Frequency
0
10
20
30
40
0
1
2
3
4
5
6
Abused self.


Smoked excessively.
Mean = 1.68
Std. Dev. = 1.372
N = 72
Frequency
0
10
20
30
40
50
60
0
1
2
3
4
5
6
Smoked excessively.


been irritable towards others.
Mean = 3.24
Std. Dev. = 1.284
N = 72
Frequency
been irritable towards others.


Attempted suicide.
Mean = 1.17
Std. Dev. = .712
N = 72
Frequency
Attempted suicide.


Used defence mechanisms.
Mean = 2.88
Std. Dev. = 1.363
N = 72
Frequency
Used defence mechanisms.


Separated myself from others.
Mean = 3.71
Std. Dev. = 1.337
N = 72
Frequency
30
20
10
0
0
1
2
3
4
5
6
Separated myself from others.

# Appendix G – Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

**SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT ETHICS COMMITTEE**
**CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)**

| | |
|---|---|
| **CLEARANCE CERTIFICATE:** | **PROTOCOL NUMBER: MAPSYC-22-08** |
| **PROJECT TITLE:** | Determining a relationship between factors of e-learning and stress levels in higher education students. |
| **INVESTIGATOR** | Persello Byron Franco (1768452) |
| **SCHOOL/DEPARTMENT OF INVESTIGATOR** | SHCD/Psychology |
| **DATE CONSIDERED** | 20 June 2022 |
| **DECISION OF THE COMMITTEE** | Approved unconditionally |
| **RISK LEVEL** | No Risk |
| **EXPIRY DATE** | 31 December 2024 |

**ISSUE DATE OF CERTIFICATE** 11 July 2022 **CHAIRPERSON** (Dr Nkululeko Nkomo)

cc: Dr Michael Pitman (Supervisor)

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**DECLARATION OF INVESTIGATOR**

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

**Signature** **Date** 12 / 7 / 2022

**PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES**