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Research Article

University students' experiences of learning in an online environment in COVID-19 pandemic: A meta-methods research study of perceptions and attitudes of South African students

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The purpose of this meta-methods study was to examine challenges experienced by students that hinder their ability successfully to learn online during the emergency remote teaching of a South African University that began in April 2020 due to the COVID-19 pandemic. Specifically, 4,419 students completed an online questionnaire. Analyses of the open-ended responses via WordStat 8.0.29 topic modeling and VOSviewer 1.6.14 text mining, independently led to the identification of five meta-themes, indicating triangulation of findings. Most notably, mental health issues emerged as an important meta-theme, with 10% of the participants reporting mental health challenges. Implications of these findings are discussed.

Keywords: South African universities; COVID-19; Meta-methods research; Quantitizing; Mental health; Student online learning readiness

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1. Introduction

1.1. Higher Education in the 21st Century and the Major Shocks

Higher education is unquestionably critical to the 21st century knowledge economy (Marginson, 2010). However, it is at a crossroads as a result of the major shocks so far in this century. The world is different and technological advancement has reinvented our world, including higher education. The world witnessed a global economic downturn in 2008. Since December 2019, the incidence of SARS-CoV-2 infection, known as coronavirus or COVID-19, has disrupted and impacted higher education to a significant degree. This has greatly obstructed educational institutions in 2020 and the impact is still being felt globally. Indeed, this global pandemic has caused the greatest disruption of education (Aurini & Davies, 2021; Covaci, 2020), at least since World War II.

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The outbreak of the COVID-19 pandemic has resulted in several studies examining the impact on global higher education (Alamri et al., 2021; Ali, 2020; Anthonysamy et al., 2020; Aristovnik et al., 2020; Ojo & Lorenzini, 2021; Ojo & Onwuegbuzie, 2020; Ojo et al., 2020; Onwuegbuzie et al., 2020). These studies have produced a range of findings that are shaping our understanding of how higher education is changing. Although some researchers have reported broadly on the various strategies adopted by universities during this pandemic (Baloch et al., 2021; Mocanu et al., 2021; Morales-Rodríguez, 2021; Rafiq et al., 2021), others have reported on the widened inequality caused by the sudden migration to remote teaching and learning as a result of the global pandemic (Maphosa, 2021; Mseleku, 2020; Onwuegbuzie et al., 2020; Talib et al., 2021). Still others have concentrated on the effect this has had on university students, particularly on their mental health (Morales-Rodríguez, 2021; Onwuegbuzie et al., 2020; Son et al., 2020; Yang et al., 2021). Although this is not the focus of the present study, one significant factor affecting higher education as a result of the pandemic has been the inability of many universities that previously relied on international students to attract them back (Greenfield, 2021). Invariably, as a result of the pandemic, universities have reduced academic staffing levels (Maslen, 2021; Tasci, 2021). Finally, authors of numerous studies specifically related to the current study have concluded that the future of higher education will be quite dynamic, with blended learning becoming mainstream of how universities will engage in teaching and learning in the future (Alamri et al., 2020; Anthonysamy et al., 2020; Ojo & Lorenzini, 2021).

According to the United Nations (2020), "by mid-April 2020, 94 per cent of learners worldwide were affected by the pandemic, representing 1.58 billion children and youth, from pre-primary to higher education, in 200 countries" (p. 5). Evidence has demonstrated that universities took to online environments in a bid to save the 2020 academic year through the use of Internet and digital platforms (Bao, 2020; Crawford et al., 2020; Ojo & Onwuegbuzie, 2020; Onwuegbuzie et al., 2020). These initiatives steered global higher education into the Fourth Industrial Revolution (4IR). Xing (2019) claimed this is transforming higher education, including the key elements of a university: teaching and learning, research and innovation, service, and infrastructure (p. 107). Xing (2019) characterizes the impact of the Fourth Industrial Revolution (4IR) on higher education and the different key elements as "Higher Education 4.0" (p. 107). The current state of global higher education reaffirms Kerr et al.'s (1994) assertion regarding global higher education. According to these authors,

> higher education cannot escape history as it moves from serving royalty and the upper classes, the ancient professions and the church, to serving all persons and all institutions in the more democratic and industrialized societies of modern times and in societies based more on new knowledge and higher skills. (p. xvi)

Although higher education is changing in the period of the Fourth Industrial Revolution (4IR), academics still do not know the full impact of the pandemic on higher education. This has created a research gap to determine how the pandemic is disrupting and reshaping global higher education. As a result of this gap, Toquero (2020) made a call to educational institutions "to produce studies to proliferate and document the impact of the pandemic to the educational system" (p. 1). Indeed, knowledge gleaned from these studies will help various stakeholders to engage and to understand ongoing challenges and changes in order effectively to implement the appropriate policy and practices to strengthen university's key elements, as identified by Xing (2019). This gap is addressed in the current article. Specifically, the current article examines how university students are experiencing and adjusting to learning in an online environment as a result of the global pandemic's disruption. As claimed by Ojo and Lorenzini (2021), such insight offers global higher education the opportunity to adapt and to innovate in a future of uncertainties.

1.2. University Students' Experience of Online Learning in the Global South

The setting of this empirical article is the Global South, specifically a research-intensive university in South Africa. Only few South African universities were able to adopt what has now been termed

emergency remote teaching and learning as an adaptive strategy through this pandemic in 2020. Yet, little is known about how ready these students were to undergo a sustained period of online learning. This is the subject of the present investigation.

1.3. Research Questions

The following research questions were addressed:

1. What is the structural validity of the *Student Online Learning Readiness scale among students enrolled in a South African university*? (Quantitative Research Question)
2. What demographic variables (i.e., gender, age, the student's level of study, locality of students, enrolment status) best predict student online learning readiness among students enrolled in a South African university during the COVID-19 pandemic? (Quantitative Research Question)
3. What experiences do students enrolled in a South African university have learning in an online environment during the COVID-19 pandemic? (Qualitative Research Question)

It was hoped that findings from this study would provide useful information regarding the impact of COVID-19 on online learning readiness for instructors, curriculum directors, information technology personnel, and administrators of South African universities, as well as other stakeholders, including the most important stakeholder—students.

2. Method

2.1. Research Philosophical Approach

The study was conducted using a critical dialectical pluralistic (CDP) stance (Onwuegbuzie & Frels, 2013). This CDP stance involves researchers operating under the assumption that social injustices are ingrained in every society. Researchers using this stance particularly are concerned with the findings emerging from their studies helping to empower the participants. Therefore, the goal of the current researchers was to obtain information that would empower not only students enrolled in South African universities but also instructors, curriculum directors, information technology personnel, and administrators of these universities in an effort to negotiate successfully students' remote learning processes during the COVID-19 era.

2.2. Research Design

As noted previously, both quantitative data (via closed-ended items) and qualitative data (via open-ended items) were collected via an online questionnaire. This data collection format lent itself to a *fully mixed concurrent equal status design* (Leech & Onwuegbuzie, 2009), which involves mixing qualitative and quantitative research elements within or across the following four components: research objective, type of data and operations, type of analysis, and type of inference. In this inquiry, the quantitative and qualitative phases were mixed concurrently across all these components, with both the quantitative and qualitative components being given approximately equal weight.

2.3. Participants

The current study is part of a larger project investigating the impact of COVID-19 on online learning, teaching, and leadership for university students, instructors, and administrators, respectively across five continents and several countries—including Global South countries in general and Sub-Saharan African countries in particular. The current study focused on students studying in South Africa. These participants comprised 4,419 students attending a large university in South Africa, who were selected via convenience sampling. Nearly two thirds of the sample members were women (61.6%; n = 2,724) and approximately one third were men (37.1%; n = 1,641). The remaining participants self-identified themselves as *non-binary* (1.1%; n = 48), which represents a term used to describe gender identities other than strictly male or female, including agender, bigender, genderfluid, genderqueer, and third gender (also referred to as NB or enby).

With respect to age, the largest group was the 18-24 age group (77.0%; *n* = 3,402). The next largest group was the 25-35 age group (15.5%; *n* = 683), followed by the 36-45 age group (4.6%; *n* = 202), 17 year olds (4.0%; *n* = 16), the 46-55 age group (2.1%; *n* = 91), and the 56-65 age group (3.0%; *n* = 15), respectively.

Most of the students were local (95.6%; *n* = 4,223), with the remaining students (4.3%; *n* = 188) representing international students. Relating to year of study, approximately three fourths of the participants were undergraduate students (74.9%; *n* = 3,312), with approximately one fourth representing postgraduate students (1,078; 24.4%). In terms of registration status, most of the students were enrolled full-time (87.8%; *n* = 3,878). Finally, the participating students represented a diverse set of fields, with the Faculty of Humanities being the most represented (31.8%; *n* = 1,405), followed by the Faculty of Engineering and the Built Environment (19.6%; *n* = 867), the Faculty of Commerce, Law, and Management (19.6%; *n* = 864), the Faculty of Science (15.0%; *n* = 663), and the Faculty of Health Sciences (12.9%; *n* = 569).

2.4. Mixed Methods Sampling Scheme

The mixed methods sampling scheme used was a Concurrent Design using Identical Samples (Onwuegbuzie & Collins, 2007). The design was given this label because (a) all 4,419 participants contributed to both the quantitative (i.e., closed-ended items) and qualitative (i.e., open-ended items) phases of this research study and (b) the qualitative and quantitative data were collected concurrently. Collins et al. (2006) documented that this type of mixed sampling design is used in 14% of mixed methods research studies.

2.5. Instruments and Procedure

The online questionnaire was administered between 20 May 2020 and 8 June 2020 after the University's Human Research Ethics Committee had granted ethics clearance. This questionnaire was disseminated to all university students via an approved email administered through the Office of the University's Deputy Registrar.

The questionnaire extracted an array of information that included the following: (a) demographic information; (b) university students' perceptions of readiness and motivation for online teaching, learning, and assessment; and (c) the following open-ended item: "What personal challenges do you have that could hinder your ability to successfully learn online?"

University students' perception of readiness and motivation for online teaching, learning, and assessment was measured via McVay's (2000, 2001) 13-item Readiness for Online Learning (ROL) scale, which was adapted by Blankenship and Atkinson (2010) by changing Item 4 from "I am willing to dedicate 8 – 10 hours per week for my studies" to "I am willing to dedicate the necessary time per week for my studies." In the present study, we adapted the ROL scale further by adding a "neutral" response option to the scale, changing it from a 4-point, Likert-format scale to a 5-point, Likert-format scale because the latter had been found to be more appropriate for South African college students (see, for e.g., Mji & Onwuegbuzie, 2004).

2.6. Research Approach and Data Analysis

This study represented a *meta-methods study*, which, as conceptualised by Onwuegbuzie and Hitchcock (2019), involves the full(er) integration of both multiple methods research approaches and mixed methods research approaches. This meta-methods research study included at a *macro level* (Onwuegbuzie & Hitchcock, 2019), the use of both principal components analysis (PCA) and exploratory factor analysis (EFA) on the same set of students' responses to the Likert-format items, coupled with the use of two computer-assisted data analysis software programs to conduct text mining of the same set of open-ended responses; at a *meso level* (Onwuegbuzie & Hitchcock, 2019), the use of both an oblique rotation and an orthogonal rotation in the PCA; and, finally, at a *micro level* (Onwuegbuzie & Hitchcock, 2019), computation and examination of both the factor pattern matrix and the factor structure matrix that occurred after the oblique rotation to identify the most interpretable factor solution.

As noted previously, both a PCA and EFA were conducted in an attempt to assess the dimensionality of the ROL Scale (Research Question 1). With respect to the PCA, the Kaiser-Meyer-Olkin (KMO) measure suggested good sampling adequacy, KMO = .92 (Field, 2018). Additionally, the anti-image correlation matrix revealed that all KMO values for the items exceeded the acceptable limit of .5 (Field, 2018). Also, Bartlett's test of sphericity indicated that the correlations between the items were sufficiently large to justify for the PCA, $X^2(91) = 27101.20$, $p < .0001$.

Both the eigenvalue-greater-than-one rule (i.e., K1; Kaiser, 1958) and scree test (Cattell, 1966) (not presented) suggested that two factors be retained. This two-factor solution was confirmed by a follow-up parallel analysis, which provided the third criteria (i.e., multiple methods) for identifying the number of factors to retain. As declared by Thompson (2004), "parallel analysis appears to be among the best methods for deciding how many factors to extract or retain" (p. 34).

Because PCA does not involve the use of *p* values, both an orthogonal rotation and an oblique rotation (i.e., multiple methods approaches; Onwuegbuzie & Hitchcock, 2019) were conducted, which enabled both sets of solutions to be compared and contrasted. These comparisons revealed that (a) the pattern/structure matrix stemming from the varimax (i.e., orthogonal) rotation and both (b) the pattern matrix and (c) the structure matrix stemming from the direct oblimin (i.e., oblique) rotation with a delta value of zero (i.e., direct quartimin rotation; Field, 2018) yielded very similar matrices (not presented due to space constraints but available upon request). Therefore, the interpretation of the two-component solution was clear. Specifically, using a cutoff correlation of 0.3 recommended by Lambert and Durand (1975) as an acceptable minimum value for pattern/structure coefficients, all three matrices revealed that Factor 1 (7 items) explained 28.91% of the variance and Factor 2 (6 items) explained 26.79% of the variance. These two factors combined to explain 62.06% of the total variance, which is larger than that typically explained in factor solutions (i.e., $M = 44.92\%$, $SD = 16.55\%$, Range = 12.80% to 70.20%; Henson & Roberts, 2006), and which represents a large effect size. Interestingly, both Factor 1 and Factor 2 contained exactly the same items as did Blankenship and Atkinson (2010) who administered the ROL scale to 146 undergraduate students at a mid-sized, public university in the United States. Therefore, as did Blankenship and Atkinson (2010), Factor 1 was labelled as *Self-Management of Learning* and Factor 2 was labelled as *Comfort with Non-Face-to-Face Communication*. With respect to score reliability, Cronbach's alpha pertaining to scores yielded by the Self-Management of Learning (SMOL) subscale was .86 (95% confidence interval [CI] = .85, .87) and for scores yielded by the Comfort with Non-Face-to-Face Communication (CWNFTFC) subscale was .84 (95% CI = .83, .84). For the full 13-item scale, scores yielded a Cronbach's alpha of .89 (95% CI = .89, .90). This full-scale score reliability in the current investigation was higher than Smith et al.'s (2003) full-scale score reliability of .83 yielded by 107 undergraduate students from the United States ($n = 45$) and Australia ($n = 62$); and Smith's (2005) full-scale score reliability of .79 yielded by 314 Australian university students. The score reliability for the full scale and the two subscales in the present study supported our decision to change the ROL to a 5-point, Likert-format scale. Table 1 presents the descriptive statistics associated with both the SMOL and CWNFTFC subscales, as well as the ROL scale.

Table 1

Mean and Standard Deviation for the Self-Management of Learning subscale, the Comfort with Non-Face-to-Face Communication subscale, and the Readiness for Online Learning Scale

Measure	*n*	*M*	*SD*	*Skewness (SD)*	*Kurtosis (SD)*
Self-Management of Learning	4,417	22.47	6.19	−0.096 (0.037)	−0.494 (0.074)
Comfort with Non-Face-to-Face Communication	4,417	24.19	5.59	−0.285 (0.037)	−0.027 (0.074)
Readiness for Online Learning	4,417	41.59	11.49	−0.083 (0.037)	−0.504 (0.074)

3. Results

3.1. Predictors of Student Online Learning Readiness

A canonical correlation analysis was undertaken to address Research Question 2—namely to examine the relationship between the five demographic variables (i.e., gender [men vs. women]; age group (18-24 vs. ≥ 25); level of student [i.e., undergraduate vs. postgraduate]; locality status [i.e., local vs. international student]; registration status [i.e., full-time vs. part-time]) and the two perception variables (i.e., self-management of learning; comfort with non-face-to-face communication). The two perception variables were treated as the dependent set, whereas the five demographic variables were used as the independent set. Although univariate normality "does not *guarantee* multivariate normality" (Field, 2018, p. 753, italics in original), the departure from univariate normality means that caution should be exercised in interpreting the findings stemming from the canonical correlation analysis. However, the very large sample in this study likely assisted in generating a robust model (Fedelis & Anthonia, 2018).

This analysis revealed that the two canonical correlations combined were statistically significant (F[10, 7966] = 18.61, $p < .0001$; Canonical $R_{c1} = .21$). However, when the first canonical root was excluded, the remaining canonical root was not statistically significant (F[4, 3984] = 1.19, $p = .31$; Canonical $R_{c2} = .03$). Together, these results suggested that the first canonical function was both statistically significant and practically significant (Cohen, 1988), but the second root was not statistically significant.

Data pertaining to the first canonical root are presented in Table 2, which provides both standardized function coefficients and structure coefficients. Using a cutoff correlation of 0.3 (Lambert & Durand, 1975), the standardized canonical function coefficients revealed that level of student and registration status made important contributions to the prediction of perceptions of online learning readiness—with both variables making approximately equal contributions. With respect to the self-perception set, self-management of learning made a noteworthy contribution. The structure coefficients pertaining to the first canonical function revealed that age group, level of student, and registration status made important contributions (i.e., were practically significant) to the first canonical variate, in an approximately equal manner. The square of the structure coefficient indicated that these variables explained 50.4%, 62.4%, and 64.0% of the variance, respectively. With regard to the self-perception cluster, both self-management of learning and comfort with non-face-to-face communication made extremely large contributions. Both variables explained 99.8% and 98.4% of the variance, respectively.

Table 2
Canonical Solution for First Function: Relationship Between the Five Demographic Variables and the Two Self-Perception of Online Learning Readiness Variables

Variable	*Standardized Coefficient*	*Structure Coefficient*	*Structure² (%)*
Demographic			
Age group	20	.71*	50.4
Level of student	−.49*	−.79*	62.4
Gender	−.17	−.19	3.7
Locality status	−.08	−.17	2.9
Registration status	.52*	.80*	64.0
Self-Perception of Online Learning Readiness			
Self-management of learning	.78*	.99*	99.8
Comfort with non-face-to-face communication	.22	.98*	98.4

Note: *Coefficients with the effect sizes larger than .3 (Lambert & Durand, 1975).

Comparing the standardized and structure coefficients identified age group as being collinear within the demographic set because the standardized coefficient associated with this variable was small, whereas the corresponding structure coefficient was relatively large (Onwuegbuzie & Daniel, 2003). Similarly, comfort with non-face-to-face communication was collinear within the self-perception set. Overall, the canonical correlation solution indicated that the multivariate relationship was mostly characterized by the relationship between level of student and registration status on the demographic side and self-management of learning on the perceptions of online learning readiness side. More specifically, students with the least positive perceptions regarding their self-management of learning were more likely to be undergraduate students and full-time students.

3.2. Students' Online Learning Experiences during the COVID-19 pandemic

3.2.1. Topic Modeling of Responses

WordStat 8.0.29 (Provalis Research, 2020) was used to conduct topic modeling via an exploratory factor analysis to extract the main themes from the responses to the open-ended question (Research Question 3). Table 3 presents the high-probability terms from the k = 5 topic model for each of five topics in the corpus of responses. For each topic, and as advanced by topic modelists (e.g., O'Callaghan et al., 2015; Provalis Research, 2014), this table lists the 10 high-probability terms that best distinguish the topics from each other. Overall, the following five topics emerged from the corpus: Mental Health, Online Learning/Lecture, House Chores/Young, Internet Connection /Load Shredding, and Study at Night. Also presented in Table 3 is the topic coherence—which provides the semantic interpretability of the terms used to describe a particular topic—and the relative proportion pertaining to documents underlying these five topics. In what follows, the topics and themes extracted from Table 3 are presented, such that the topics and terms are presented in boldface text and the theme[s] derived from these topics are presented in italics.

Table 3
Topics Extracted from the Responses Delineating the University Students' Experiences of Learning in an Online Environment During the COVID-19 Pandemic (n = 4,419)

No	*Topic Labels*	*High Probability Terms*	*Coherence*	*Relative Proportion*
1	Mental Health	mental health issues; anxiety; stress; workload; mental health; complete assignments; time to complete; online assessments; online exams; online tests	.32	13.47
2	Online Learning/Lecture	Online lectures; lecturers; online classes; online learning; difficult; understand; communicate; interaction; content; face to face	.32	22.29
3	House Chores/Young	Household; small house; children; parents; family members; house chores; care; noise; room; taking care	.37	19.19
4	Internet Connection / Load Shredding	Data; download; Sakai; Internet connection; network connection; Internet access; network coverage; electricity; expensive; load shedding	.37	25.13
5	Study at Night	Study at night; time to study; study environment; table; sleep; conducive; bed; late; study area; quiet place	.38	19.91

It can be seen from Table 3 that **Internet Connection/Load Shredding** (Topic 4) had the highest relative proportion of extracted statements (25.13%), with high-probability terms including *Data, download, Sakai, Internet connection, network connection, Internet access, network coverage, electricity,*

expensive, and *load shedding*. This topic indicates that access to the Internet and other technological devices is central to the online learning process for these students. The prevalence of this topic has intuitive appeal because Internet/Network connectivity is vital for online learning to take place. Of those who mentioned Internet (n = 95; 2.15%) or network (n = 5; 0.11%) access, there was unanimity regarding their difficulty in (consistently) getting access. For example, a woman participant in the 18-24 age group, who was a full-time, local undergraduate student, representing the Health Sciences field stated the following: "my Internet access is very dependent on the weather, both the computer Internet and the cell service. This makes accessing online material difficult and very unpredictable." For some, lack of Internet/Network access stemmed from insufficient network data: "Internet access: When my data expires I feel like I lost a loved one" (Woman, 25-35, full-time, local undergraduate student, Humanities field). With regard to connectivity, some students had certain expectations for their university, as exemplified by the following excerpt:

> I often have data struggles. Due to connectivity issues. So when this happens, I usually rely on the data provided by the university to continue with my school work. But now this might be a problem because the university has not given us any data, since the first data has expired. (Woman, 18-24, full-time, local postgraduate [i.e., Master's] student, Humanities field)

A particularly compelling comment that has implications for the design and use of video materials emerged as follows: "The files uploaded on SAKAI [Learning Management Systems], especially videos are too large and at times I don't have enough data to download them" (Woman, 18-24, full-time, local undergraduate student, Science field).

Several students described the problems they had been experiencing with poor network coverage succinctly but vividly, including the following:

> "The network coverage in my house is pretty much non-existent, I have to go to the gate to get network coverage." (Woman, 18-24, full-time, international undergraduate student, Humanities field)
>
> "Network coverage. I failed a test because I had to run around the house looking for network while writing the test." (Woman, 18-24, full-time, local undergraduate student, Science field)
>
> "The network coverage in my area is really bad, the network cuts me off when attending class, I struggle to hear clearly during class and group meetings." (Woman, 25-35, part-time, local postgraduate student, Commerce, Law and Management field)
>
> "Network coverage is also a problem, sometimes emails take time to go through and for me to receive them." (Woman, 18-24, full-time, local undergraduate student, Engineering and Built Environment field)
>
> "The network coverage is another thing, it tends to be very poor, to such an extent that it causes much frustration and my day gets ruined." (Woman, 18-24, full-time, local undergraduate student, Health Science field)

Load-shedding involves deliberately shutting down electric power in one or more parts of a power-distribution system, in an attempt to prevent the failure of the entire electric system at times when the demand causes a strain in the capacity of this system. This was mentioned by a significant proportion of students (n = 102; 2.31%). Several of them mentioned the randomness and length of load-shedding. For example, a student revealed that "Load shedding is a problem as electricity could be gone without being warned for 5 hours or more" (Woman, 18-24 part-time, international undergraduate student, Engineering and the Built Environment field). Another student stated the following: "My area is continuously affected by load shedding and that holds me back every time as I'm using a desktop for my online studies" (Man, 18-24, full-time, local undergraduate student, Science field). Interestingly, one student had a solution for combatting load shedding, as follows: "I'm planning to buy a printer, because if we have load shedding, I will keep Hard copies so I can read" (Man, 25-35, part-time, local postgraduate student, Engineering and the Built Environment field).

The Internet Connection/Load Shredding topic is followed closely (22.29% of the extracted statements) by the **Online Learning/Lecture** topic (Topic 2), with high-probability terms such as *Online lectures, lecturers, online classes, online learning, difficult, understand, communicate, interaction, content, and face to face*. This topic indicates that online learning is the central focus of the students during the pandemic, in contrast to other types of learning. Apart from the challenges associated with Internet Connection/Load Shredding (see Topic 1), the participating students described challenges that appeared to be particular to the online learning context, as opposed to the face-to-face learning context. In particular, compared to *face-to-face* learning, the reduction in *direct interaction* and *communication* with their lecturers made it more *difficult* for the students to *understand* the *content*, as exemplified by the following comment:

> Time management is one of my problems, however online lectures and time taken by students to finish lectures would be longer than in class, going through a lecture that takes a lecturer 45 minutes to explain would take a student much longer as they have to comprehend and do extra readings as guidance of lecturers are limited to emails. (Woman 18-24, full-time, local undergraduate student, Science field)

Further, online learning provided an excuse for some students to procrastinate by

> Putting off listening to online lectures because I can "always do it tomorrow" whereas if I physically attended the lectures at XXX University then I would have no choice but to go to lectures; but at home it is so much easier to just "do it tomorrow". (Woman, 18-24, full-time, local undergraduate student, Science field)

The next most frequent topic for the students (19.91% of the extracted statements) was **Study at Night** (Topic 5), with high-probability terms that include *Study at night, time to study, study environment, table, sleep, conducive, bed, late, study area,* and *quiet place*. This topic demonstrates an important adjustment that many students have had to make, namely, studying at a time when the home is at its quietest, when chores that compete with academic learning are minimal, there is more physical space for engaging in the learning process, and there is less demand among household members for sharing the available technology. As a result of the challenges that students face, many of them had to consider studying at night. An account that best captures an array of problems that forced a student to attempt to study at night is the following:

> Disruptions at home due to the number of people in the household, noise and lack of a proper study area, sometimes lack of network connection and having to delegate my time between house chores and academics such that I end up having to study at night which also does not work out because sometimes I hear gunshots and I am forced to sleep; so, I fall behind even more with my work because it keeps on piling in from one week to the other and it is a lot to grasp properly in one go, all by myself. (Woman, 18-24, full-time, local undergraduate student, Engineering and the Built Environment field)

And for students who are able to work at night, there were some negative consequences: "I actually do not have a quiet place for me to study, I study at night when everyone is asleep which sometimes makes it difficult for me to attend online lectures the next day" (Woman, 18-24, full-time, local undergraduate student, Engineering and the Built Environment field).

The next most frequent topic (19.19% of the extracted statements) for the students was **House Chores** (Topic 3), with high-probability terms that include *Household, small house, children, parents, family members, house chores, care, noise, room,* and *taking care*. This topic indicates that online learning must take place in the context of home chores and that there is a conflict between home chores and receiving online lectures. Some students believed that their parents did not know the importance of their online learning or did not care:

> We have to do household chores parents do not understand this online learning and they do not care. (Woman, 18-24, full-time, local undergraduate student, Humanities field)

> A lot of chores and duties parents are assigning to us with no consideration for the fact that I have school work to do. By the time I complete those chores and duties, I am already tired, left with no motivation to study. (Man, 18-24, full-time, local undergraduate student, Science field)

The expectation of parents that because students were at home due to the Governmental lockdown measures they should undertake household chores led to tensions between some students and their family/household members:

> Being expected to keep up with household chores while also being expected to perform well in academics. The hostile environment created by me speaking out against doing all the household chores while studying. (Woman, 18-24 age group, full-time, local undergraduate student, Engineering and the Built Environment field)

Clearly, undertaking daily chores is not a challenge that they would have faced if not for the lockdown:

> Having not enough time to study because of chores and being at home. It would work if we were at Res [Residence Halls] because we have all time to do our work. Universities must allow us to go back to residence and study online there. (Woman, 18-24, full-time, local undergraduate student, Commerce, Law and Management field)

The final topic (13.47% of the extracted statements) is **Mental Health** (i.e., Topic 1), with high-probability terms that include *mental health issues, anxiety, stress, workload, mental health, complete assignments, time to complete, online assessments, online exams,* and *online tests*. This topic indicates that the students' affective needs are an important consideration within the online learning context. In fact, although this fifth topic was not as prevalent as was the case for the four other topics, it was by far the most compelling. For some students, their mental health issue stemmed directly from the lockdown itself: "Being at home negatively affects my mental health. I am depressed most of the time which makes it difficult for me to feel motivated to work, even though I know I need to" (Woman, 18-24, full-time, local undergraduate student, Humanities field). Interestingly, one student did not blame the university for their mental health challenges:

> I suffer from mental health issues that have become more difficult to deal with as a result of the lockdown. This is not the fault of the university of course but I wish I felt more supported and that mental health was somehow more visible. (Woman, 18-24, full-time, local undergraduate student, Commerce, Law and Management field)

For other students who mentioned having mental health challenges, their online learning context either brought on mental health issues or exacerbated existing ones. The latter is exemplified by the following statement: "As someone who deals with mental health issues, the transition has been even more difficult than that of the ordinary student" (Non-binary, 18-24, full-time, local undergraduate student, Science field).

The majority of students who discussed mental health issues with which they were experiencing directly linked their challenges to the online learning environment:

> Mental health is an issue that has been on the rise since the commencement of lockdown. It's overwhelming to see all these assignments and content with no proper guidance from lecturers or the institution. (Woman, 18-24 age group, full-time, local postgraduate student, Commerce, Law and Management field)

Disturbingly, almost every comment relating to this topic of mental health was negative in nature. Even more alarmingly, two students mentioned suicide ideation:

> I have clinical depression that I'm taking pills for, and the place that really triggers me is the same place I'm supposed to study in, it's impossible. I don't even know how many times I've thought of suicide. (Woman, 18-24, full-time, local undergraduate student, Engineering and the Built Environment field)

> I have depression and anxiety, I'm on medication which have some undesirable side effects, I get medical help from public hospitals and it takes months before I could even see a doctor or psychiatrist. I suffer from suicidal ideation, I've attempted countless times to end my life, and with my current mental state I would possibly do it again, not proud of it but there's just no other way of receiving help. (Woman, 18-24, full-time, local undergraduate student, Engineering and the Built Environment field)

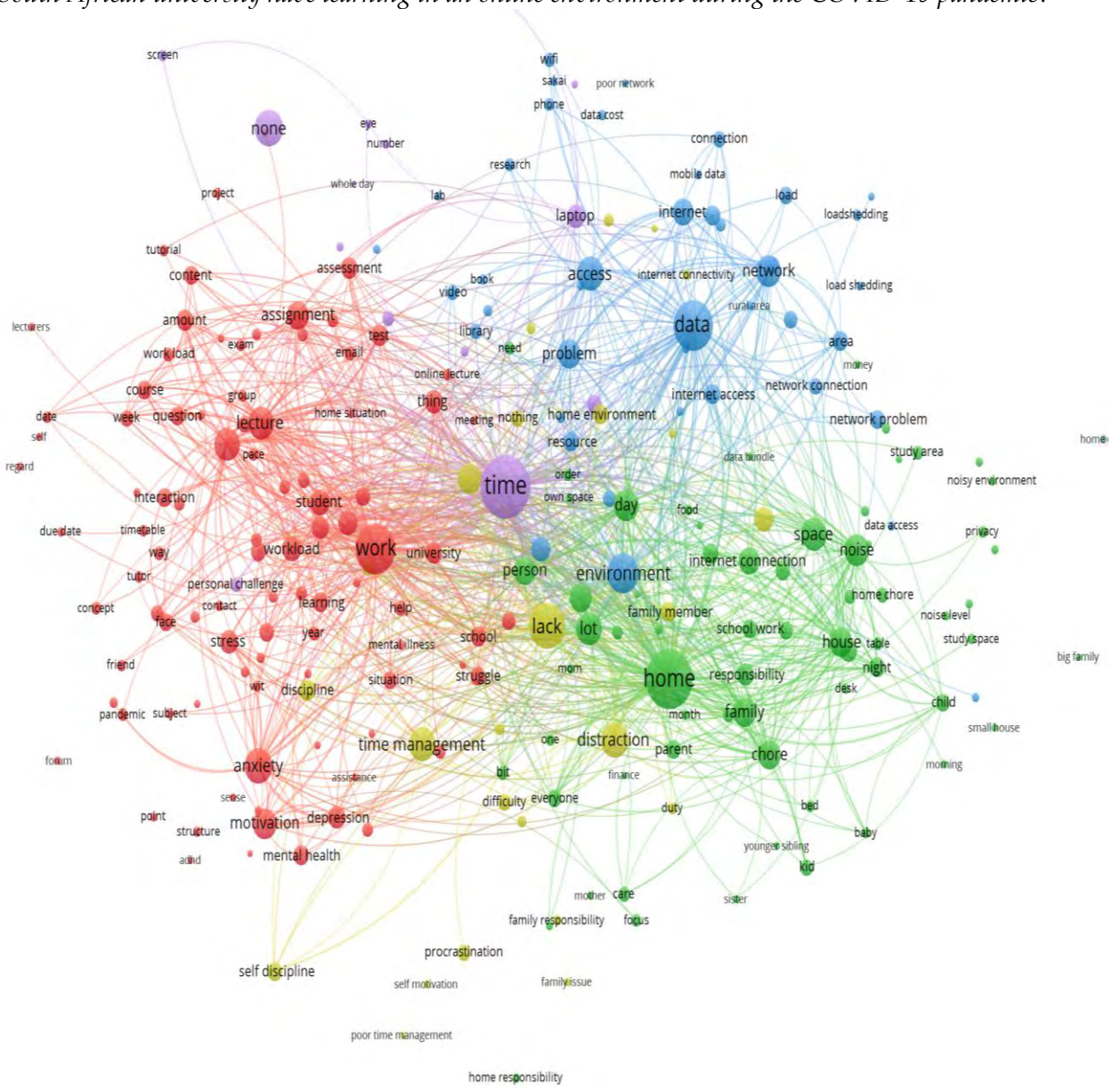
Unfortunately, because the survey in the present study was completed anonymously, as researchers, we were unable to intervene with these two students by contacting them and referring them to counseling services.

3.2.2. Co-word Analysis of Responses

VOSviewer 1.6.14 text mining (Van Eck & Waltman, 2017) was used to construct and to display co-occurrence networks (i.e., network maps) of important words extracted from the same corpus of words. Figure 1 displays the key responses provided by the participants to address Research Question 3. The most frequently co-occurring keywords, respectively, were as follows: time, home, data, work, lack, environment, distraction, anxiety, time management, access, space, lecture, lecturer, day, noise, network, motivation, challenge, family, house, problem, and chore. Represented in Figure 1 are five co-word clusters. Each of these clusters is discussed very briefly (due to space constraints), with the metatheme(s) derived from these cluster elements presented in bolded italics, and the extracted theme(s) presented in italics.

Figure 1

Keyword co-occurrence map of responses to the following question: What experiences do students enrolled in a South African university have learning in an online environment during the COVID-19 pandemic?



Note: Keyword threshold was set at a minimum of 10 with 242 keywords selected for display.

Cluster 1 (Red color) characterizes ***Current Work Situation*** (i.e., metatheme) that represents a focus that centers on lecturer/lecture/lectures (i.e., themes) that includes workload, assignment, assessment, and motivation; and *mental health* (i.e., theme) that includes anxiety and depression. *Cluster 2* (green color) characterizes ***Current Home Situation*** (i.e., meta-theme) that represents a focus that centers on *day* (i.e., theme) that includes house, noise, chores, space, study, and person. *Cluster 3* (cyan color) characterizes ***Data*** (i.e., metatheme) that represents a focus that centers on *environment* that includes area and resource; and *access* (i.e., theme) that includes problem, network, issue, Internet, electricity, device, and video. *Cluster 4* (brown color) characterizes ***Deficiency*** (i.e., metatheme) that represents a focus that centers on *challenge* (i.e., theme) that includes time management; and *distraction* (i.e., theme) family member, disruption, and campus. Finally, *Cluster 5* (blue color) characterizes *Time* (i.e., metatheme) that represents a focus that centers on *hour* (i.e., theme) that includes moment and whole day; and *laptop* (i.e., theme) that includes online test.

3.3 Emergent Analysis

The emergence of mental health via both the WordStat topic modeling and the VOSviewer text mining led to the identification of an emergent research question, which, as Plano Clark and Badiee (2010) defined, refers to a new or modified research question that arises during the design, data collection, data analysis, or interpretation phase. In this case, the following mixed methods research question arose during the data analysis phase: What demographic variables are associated with mental health issues among students enrolled in a South African university during the COVID-19 pandemic?

3.3.1 Descriptive-Based Quantitizing

As defined by Onwuegbuzie and Johnson (2021), descriptive-based quantitizing involves the use of descriptive analyses to convert qualitative data—in this case, responses to the open-ended question regarding students' experiences—into numerical codes that can be analyzed statistically. The descriptive-based quantitizing of the students' statements revealed that, of the 4,419 participants, 9.5% indicated negative sentiments (e.g., depression, anxiety) associated with mental health challenges. Bearing in mind that these sentiments were as disturbing as revealing suicide ideation and even suicide attempts, 9.5% represents a significant effective size. Of these negative sentiments, 31.0% included the word "mental health" in the statement. A series of Fisher's Exact Tests, using the Bonferroni adjustment to ensure that the total experimentwise error rate did not exceed 5% (i.e., adjusted α = .05/5 = .01), was conducted to determine the relationship between mental health status and the select demographic variables.

The first Fisher's Exact Test revealed that women (11.0%) were statistically significantly (p < .0001; Cramer's V = .08) more likely than were men (6.5%) to report having mental health issues. More specifically, women students were 1.70 (95 % confidence interval [CI] = 1.37 to 2.10) times more likely than were men to report having mental health issues. Second, students in the 18-24 age group (10.6%) were statistically significantly (p = .003; Cramer's V = .05) and 1.54 (95% CI = 1.15, 2.07) times more likely than were other students (6.9%) to report having mental health issues. Third, undergraduate students (10.6%) were statistically significantly (p < .0001; Cramer's V = .06) and 1.74 (95% CI = 1.33, 2.28) times more likely than were postgraduate students (6.3%) to report having mental health issues. Fourth, full-time students (10.3%) were statistically significantly (p < .0001; Cramer's V = .08) and 3.61 (95% CI = 2.17, 5.99) times more likely than were part-time students (2.9%) to report having mental health issues. Fifth, although local students (9.7%) were more likely than were international students (5.3%) to report having mental health issues, this difference was not statistically significant (p = .04; Cramer's V = .03) after making the Bonferroni adjustment. Interestingly, a Bonferroni-adjusted (nonparametric) Mann-Whitney U test indicated no statistically significant difference (U = 830138.00, p = .71) between students who reported mental health issues (M = 22.41, SD = 5.57) and students who did not report mental health issues (M = 22.47, SD = 6.25) with respect to self-management of learning. Similarly, no

statistically significant difference (U = 833646.00, p = .82) between students who reported mental health issues (M = 19.10, SD = 4.85) and students who did not report mental health issues (M = 19.13, SD = 5.38) with respect to comfort with non-face-to-face communication. Finally, no statistically significant difference (U = 831793.00, p = .76) between students who reported mental health issues (M = 41.51, SD = 10.37) and students who did not report mental health issues (M = 41.60, SD = 11.60) with respect to overall online learning readiness.

As can be seen, analyses of the open-ended responses (i.e., Research Question 3) yielded numerous findings. Most notably, the WordStat 8.0.29 topic modeling led to the identification of the following five topics: Internet Connection/Load Shedding, Online Learning/Lecture, Study at Night, House Chores, and Mental Health. Similarly, the VOSviewer 1.6.14 text mining software program yielded the following five metathemes that emerged from the same corpus: Current Work Situation, Current Home Situation, Data, Deficiency, and Time. As can be seen from Table 4, wherein these two sets of themes are mapped onto each other, findings stemming from these two analyses are very consistent. Simply put, these two sets of findings have triangulated each other, providing incremental validity for them.

Table 4
A Comparison of the Metathemes Extracted from the VOSviewer 1.6.14 Text Mining and WordStat 8.0.29 Topic Modeling

VOSviewer 1.6.14 text mining Cluster	*WordStat 8.0.29 topic modeling Topic*
Current Work Situation	Mental Health
	Online Learning / Lecture
Current Home Situation	House Chores
Data	Internet Connection / Load Shedding
Deficiency	House Chores
Time	Study at Night

Therefore, to summarize, students who reported experiencing mental health issues were statistically significantly and practically significantly more likely than were their counterparts to be women, in the 18-24 age group, undergraduate students, and full-time students. However, their mental health status did not discriminate their online learning readiness.

4. Discussion

The findings of this research indicate important points to consider. First, both PCA and EFA of the Readiness for Online Learning (ROL) scale (i.e., Research Question 1) revealed two subscales, namely, Self-Management of Learning and Comfort with Non-Face-to-Face Communication—both of which were shown to have excellent psychometric properties. Second, correlating these subscales revealed that students with lower levels of online learning regarding their self-management of learning were more likely to be undergraduate students and full-time students (i.e., Research Question 2). These findings are new because a comprehensive literature review did not reveal any study in the area of online learning readiness in which undergraduate and postgraduate students were directly compared or wherein full-time and part-time students were compared. However, in terms of level of study, the present finding relating to undergraduate students is consistent with Hung et al.'s (2010) finding that junior and senior students demonstrated greater online readiness than did freshman and sophomore students. That undergraduate students have lower levels of online learning readiness has intuitive appeal because postgraduate students tend to have more self-regulation abilities than do undergraduate students (Shen & Liu, 2011). Similarly, the finding that part-time students have higher levels of online learning readiness has logical appeal because part-time students tend to adopt a "workplace attitude" to their studies, which "often includes a clear understanding of the career benefits of gaining a degree, and therefore a link between study ambitions and work ambitions" (Davies,

2008, p. 6). Further, time management is a significantly more important variable for part-time students than for full-time students (MacCann et al., 2012), presumably because part-time students—at least those who are engaged in full-time employment—tend to have less time to devote to their online learning. Therefore, they have greater incentive to be ready for online learning.

In the canonical correlation solution, age also was positively related to online learning readiness, with students in the 18-24 age group having statistically significantly lower levels of online learning readiness associated with both self-management of learning (Cohen's [1988] d = 0.40) and comfort with non-face-to-face communication (d = 0.39). This finding regarding age confirms the findings of Firat and Bozkurt (2020). Also, confirming this finding, Kim and Frick (2011) documented that gender was one of the best predictors of motivation to begin self-directed e-learning, alongside perceived relevance, and reported technology competence.

Interestingly, no gender difference emerged in online learning readiness. This finding is consistent with several findings (e.g., Atkinson & Blankenship , 2009; Bunz et al., 2007; Chung, Noor, et al., 2020; Chung, Subramaniam, et al., 2020; Hung et al., 2010; Masters & Oberprieler, 2004). As such, online learning readiness does not appear to have a gender context.

Third, the multiple analysis of the open-ended responses (i.e., WordStat 8.0.29 topic modeling, VOSviewer 1.6.14 text mining)—which yielded consistent findings—indicate what students believe to be the most important issues related to experiences that students have had learning in an online environment during the COVID-19 pandemic, which, in turn, should provide useful information for teachers, administrators, advisors, and mentors to design and to implement interventions to assist students at the underlying university to navigate successfully their online learning experiences.

Of the five emergent meta-themes, the most compelling meta-theme—and one that needs the most immediate attention—is the mental health needs of students. In South Africa, one third of individuals develop a psychiatric disorder sometime during their lives (Herman et al., 2009; Kim et al., 2020). Yet, the present study has indicated that at least 10% of the participants reported having mental health challenges *at the time of the investigation*. These mental health challenges ranged from anxiety and depression to suicide ideation, and, in at least one case, to a suicide attempt. Regardless of whether the etiology of the reported mental health is the online learning environment, the lockdown, or some non-COVID-19 factor, it should be addressed with urgency at the institutional level.

4.1. Implications of the Findings

The size (n = 4,419) and representativeness of the sample justifies generalizing the array of findings to the university where the study took place. Moreover, generalizations might be justified to other South African universities, especially those that are most similar to the university under study in terms of student demographics—at least to some degree. Therefore, based on the major findings that emerged in the present investigation, and using our critical dialectical pluralistic stance (Onwuegbuzie & Frels, 2013), the following recommendations are made:

- **Pedagogic Implications**: Bearing in mind that online learning efficacy has been linked to student outcomes in online courses, including course performance (Joosten & Cusatis, 2020), the fact that online learning readiness varies as a function of some demographic variables suggests that course instructors, curriculum directors, instructional designers, and information technology personnel should refrain from adopting a one-size-fits-all approach (Armatas et al., 2003; Firat & Bozkurt, 2020; Morse, 2003) and, instead, provide more individualized (i.e., tailored) learning opportunities via adaptive learning systems (Anderson, 2004). Additionally, online learning processes should be designed that have "multiple entry points and adaptive systems that provide…learning opportunities based on changing needs, competencies, and skills" (Firat & Bozkurt, 2020, p. 122). For example, administrators of South African universities might consider designing and implementing age-specific online learning platforms.

- **Administrator Implications**: Administrators of South African universities, and perhaps beyond, should develop and distribute online learning platforms that can be implemented on multiple platforms (i.e., cross-platform support) and be used with a wide range of technological devices (e.g., desktop computers, laptops/notebook computers, smartphones) such that different learning approaches (e.g., e-learning, m-learning, u-learning) are supported (Firat & Bozkurt, 2020).

Administrators also should be more proactive in addressing mental health challenges faced by students—especially those who appear to be most at risk that have been identified in the present investigation, namely: women, students in the 18-24 age group, and undergraduate students.

- **Governmental Implications**: Bearing in mind the findings categorized under the meta-theme of Internet Connection/Load Shedding, the South African Government and telecommunication companies should invest in developing Internet infrastructure across South Africa to meet the need for online learning that likely will continue for the foreseeable future, and might even increase as the Fourth Industrial Revolution continues to unfold.

Rather than implementing a cut in higher education funding by R10 billion (National Treasury, 2020), the South African Government should seriously consider providing more funding to universities to address mental health challenges so that university centers that provide interventions (e.g., counseling centers) can be bolstered.

- **Research Implications:** The present study should be replicated and extended so that the concept of online learning readiness throughout South Africa is fully understood. Such research also should be conducted in as many Sub-Saharan countries/communities as possible, as well as other Global South countries/communities. Funding agencies can play an important role here in providing resources for such research.

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