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Impact of Emergency Remote Teaching on Student Anxiety: The Mediating Role of COVID-19 Knowledge and Religiosity/Spirituality at a South African Private Higher Education Institution

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Abstract

The COVID-19 pandemic caused pandemonium in the education, finance, and health sectors worldwide. The education sector had to respond quickly by moving teaching and learning activities generally designed for face-to-face to online delivery. These rapid changes and the negative impacts that accompanied them brought about an increase in anxiety for many students. Using a mixed-methods approach, this study described students' perceptions of emergency remote teaching (ERT) at a private Seventh-day Adventist higher education institution in Southern Africa and the relationship between their ERT experience and general anxiety levels. We also examined the mediating roles of COVID-related knowledge, conspiracy beliefs, perceived risk, and levels of religiosity/spirituality in this relationship. The results suggest that students experienced both positive and negative impacts of ERT, but negative ERT experiences were strongly associated with increased student anxiety. Within the study sample, perceived COVID-19 risk, and religiosity/spirituality partially mediated the effect of ERT on student anxiety, whereas conspiracy beliefs and COVID-19 knowledge did not. This study highlights faculty's role in reducing student anxiety through a holistic approach that addresses scholastic, social, psychological, and spiritual domains.

Introduction

The COVID-19 pandemic has perniciously impacted education worldwide (Jandrić et al., 2020). Reports of the challenges faced by educators have been published from all over the globe, including but not limited to Canada (Van Leeuwen et al., 2021), the Caribbean (Agu et al., 2021), Gulf Cooperation Council (GCC) Arab States (Al-Taweel et al., 2020), India (Mishra et al., 2020), Nigeria (Aliyu et al., 2020), Oman (Naqvi & Zehra, 2020), Portugal (Assunção Flores & Gago, 2020; Machado et al., 2023), Singapore (Müller et al., 2021), South Africa (du Plessis et al., 2022), the United Kingdom (Dhonncha & Murphy, 2021; Kim & Ashbury, 2020), and the United States of America (Delgado et al., 2021). Even institutions offering their programs fully online before COVID-19 found that the pandemic dramatically disrupted lecturers' and students' lives (Dove, 2021; Evans, 2020; Kyne & Thompson, 2020). But in reality, Emergency Remote Teaching (ERT) differs substantially from planned online course design (Hodges et al., 2020). Students reported challenges related to economic hardship, insufficient digital competence, technological challenges, lack of scope for meaningful interaction, role stress and strain, scheduling and time management conflicts, connectivity and power instability, lack of motivation and engagement, exacerbation of pre-existing educational and social inequities, physical discomfort, interruption by family or pets, fatigue from constant online presence, and increased stress and anxiety (Adedoyin & Soykan, 2020; Barton, 2020; Dandoval-Palis et al., 2020; Gillis & Krull, 2020;

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Ismail et al., 2021; Mishra et al., 2020; Petillion & McNeill, 2020; Shin & Hickey, 2020; Toney et al., 2021; Wallace et al., 2021). In a survey of 63 countries, Varma et al. (2021) found that 59% of the respondents had increased levels of anxiety. Young adults between 18-34 years old were the group most susceptible to COVID-19 related anxiety. Students were anxious about their academic work and concerned about their health, financial (in)stability, safety at home, and uncertainty regarding their living situations (Gillis & Krull, 2020). In a sample of 5074 South African university students, 45.6% reported heightened levels of anxiety (Visser & Law-van Wyk, 2021). While South African students may have experienced emotional distress appropriate to the situation through sufficient support from family and educational institutions, most did not warrant clinical concern (Laher et al., 2021). Factors significantly increasing the odds of heightened anxiety among students included female gender, younger age, lower levels of education, and staying alone (Sundarasen et al., 2020). On a positive note, some students also reported the development of resilience, new skills, deeper spirituality, greater flexibility and autonomy, self-pacing, and the incentivization needed to adapt to ERT (Adedoyin & Soykan, 2020; Visser & Law-van Wyk, 2021; Wallace et al., 2021).

In some instances, ERT allowed students to achieve learning outcomes comparable to conventional face-to-face classes (Kawasaki et al., 2021). However, to be effective in new technologies and respond to students' academic and socio-emotional needs, enhanced educator preparation and technological training are needed (Darling-Hammond & Hyler, 2020; van Wyk et al., 2020). While the pandemic has provided opportunities for growth for some, it has also highlighted and further entrenched the inequalities that directly impact education within and between countries (Correia, 2020). For example, the International Commission on the Futures of Education (2020) reported that only 11% of sub-Saharan African learners had a computer, and 18% had Internet access. In contrast, globally, 50% had a household computer and 57% had Internet access. How well lecturers managed design decisions required for effective ERT teaching and learning and the quality of the content-student interactions during ERT would have had a direct impact on the student experience during the pandemic (Crawford et al., 2020; Khan, 2005, 2021; Kumar et al., 2021; Rapanta et al., 2020; Walker & Koralesky, 2021; Whittle et al., 2020). In contexts where the ERT strategy was not adequately communicated, students were likely to have suffered increased anxiety (Gillis & Krull, 2020).

Factors Associated with Student Anxiety during the COVID-19 Pandemic

Students were particularly vulnerable to pandemic fatigue (MacIntyre et al., 2021). Pandemic fatigue involves collective exhaustion with high-cost behavioral restrictions, partly when constantly establishing the veracity of claims and bombardment by an "infodemic" characterized by wild speculation and conflicting theories circulated on social media (Petherick et al., 2021). Tang et al. (2021) estimated that without pandemic fatigue, total COVID-19 positive cases in the United States could have been reduced by 68%. Kiran and Shaur (2020) found that students often refrained from information about the pandemic to reduce the anxiety associated with pandemic fatigue. This likely impacted the students' knowledge of COVID-19. False and pseudo-scientific information directly influences people's beliefs and protective behaviors (Resnicow et al., 2021). Conspiracy theories negatively influence adherence to guidelines and acceptance of vaccines (Teovanović et al., 2021). The strength of the impact of disengaging from preventative behaviors is moderated by the perceived risk to oneself (Marinthe et al., 2020). Tunçel et al. (2021) found that medical students with uncertainty about transmission and risk and inadequate knowledge about COVID-19 experienced heightened levels of anxiety. However, Sögüt et

al. (2021) found no relationship between anxiety and knowledge of COVID-19 among a sample of Turkish midwifery students. However, their sample suffered from range restrictions, making it difficult to correctly measure the relationship between variables. More research is needed to establish the relative influence of mainstream knowledge, compared to belief in conspiracies, on anxiety related to COVID-19. Another factor that impacted COVID-related behavior and anxiety was religiosity and spirituality. Research suggests that religious beliefs, behaviors, and spiritually integrated interventions are effective coping strategies for reducing depression and anxiety in both adults and adolescents (Mahmood et al., 2021; Sanaeinasab et al., 2020; Schapman & Inderbitzen-Nolan, 2002; Sögüt et al., 2021). Individuals with strong religious beliefs generally felt less anxious about COVID-19 but were more prone to accepting conspiracy theories related to the pandemic (Kranz et al., 2020). When participants have high levels of conscientiousness and agreeableness, the impact of religiosity on anxiety is enhanced (Sultan et al., 2020). One possible mechanism by which religiosity reduces anxiety is heightened optimism and hopefulness (Prazeres et al., 2021; Visser & Law-van Wyk, 2021). However, higher levels of conspiracy ideation are associated with higher anxiety levels (Leibovitz et al., 2021). This paradoxical relationship between anxiety, conspiracy belief, and religiosity require further investigation.

Research Questions

This study used a concurrent nested mixed method design to investigate students' experience of ERT and how this affected their levels of general anxiety. It also examined how religiosity/spirituality, COVID-19 knowledge, perceived risk, and affinity to conspiracy beliefs mediated this relationship.

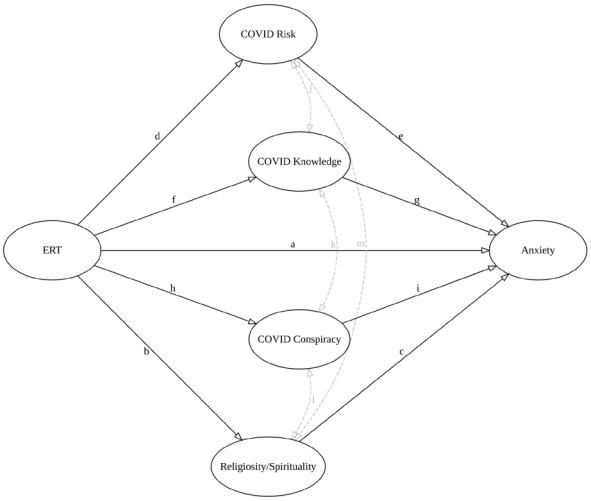
Using a qualitative approach, the researchers attempted to form a rich description of (a) the aspects of ERT students were most happy with, (b) the aspects of ERT students were most unsatisfied with, (c) in various aspects of their lives, how COVID-19 had impacted students' lives; and (d) what role religiosity/spirituality played, if any, in their experiences of ERT and ability to cope during the pandemic.

Using a quantitative approach, the researchers explored the extent to which students' COVID-19 perceived risk, knowledge, conspiracy belief, and religiosity/spirituality mediated the impact of ERT on students' level of anxiety during the pandemic. The cross-sectional data prevents inferring causal mediation, so only indirect effects can be tested (Kline, 2016). To perform these analyses, the following hypotheses were tested (see Figure 1 for a path diagram showing the regression coefficients referred to below):

1. Satisfaction with ERT is associated with changes in levels of anxiety (H_0: $a = 0$)
2. COVID-19 knowledge has an indirect effect on student anxiety ($H_{0:}$ $f+g = 0$)
3. Perceived COVID-19 risk has an indirect effect on anxiety (H_0: $d+e = 0$)
4. Affinity with COVID-19 conspiracy beliefs has an indirect effect on anxiety (H_0: $h+i = 0$)
5. Levels of religiosity/spirituality have an indirect effect on anxiety (H_0: $b+c = 0$)
6. Perceived COVID-19 risk covaries with COVID-19 knowledge (H_0: Cov [Risk, Knowledge] = 0)
7. COVID-19 knowledge covaries with affinity to COVID-19 conspiracy beliefs (H_0: Cov [Knowledge, Conspiracy] = 0)
8. Student's perceived COVID-19 risk covaries with level of religiosity/spirituality (H_0: Cov [Risk, Rel/Spirit] = 0)

Figure 1

Path Model for the Structured Equation Mediation Model Tested in this Study



Methodology

This study used a concurrent nested mixed-methods design to investigate students' qualitative understanding of ERT and COVID-19, along with quantitative analyses of various factors influencing the severity of anxiety experienced by students. The Delve tool (Twenty to Nine LLC, 2023), a computer-assisted qualitative data analysis software (CAQDAS), was used to perform thematic analysis (Braun & Clarke, 2006) to identify and explore students' salient and frequent descriptions of ERT and the pandemic. From a quantitative perspective, structural equation modeling (SEM) was employed to examine the relationship between students' perceptions of ERT and the severity of their anxiety. Specifically, SEM was used to evaluate the extent to which anxiety was mediated by COVID-19 knowledge, belief in conspiracies, perceived risk of infection, and religiosity/spirituality.

Participants

Most published research on the response to COVID-19 in academia comes from large public universities. The participants in this study were 168 students from a private SDA higher education institution in Southern Africa, an understudied population in this field of research. Twenty-nine percent of the original sample included observations with at least one missing item. Participants with more than eight missing items were removed, resulting in a dataset of 110 participants. Of the sample, 55.36% were female, 35.12% were male, one student identified as non-binary/gender diverse, and another chose 'other,' while 8.3% did not respond to this question. The participants had a mean age of 25.66, median of 23.16, and ranged from 18.1 to 57.43 years old. Of the sample, 50.6% described themselves as single, 26% were in a dating relationship, 11.9% were married, 2.38% selected others, one participant was identified as bisexual, and one preferred not to disclose their relational status. When the study was conducted, 58.18% of the students were residing at home with parents or other families, 6.36% stayed in their own private residences, and only 26.36% of the respondents were living on campus. The remaining participants either stayed in privately owned student accommodations (1.8%), other forms of residence (1.8%), shared accommodations with others (1%), or preferred not to say (1.8%).

To ensure that the data were of high quality, they were examined for careless responses or insufficient effort (Curran, 2016; Dunn et al., 2018). Participants were identified with eight or more consecutive repeated responses (12 participants), very low intra-individual response variability (0 participants), or negative intra-individual correlations on psychometric synonym items (6 participants). As there was no overlap among identified participants in these categories of careless responses, they were not removed. Multivariate outliers were identified using both the high-dimensional principal component approach of Filzmoser et al. (2008) and robust Manhalanobis distances using the minimum covariance determinant (MCD) estimator of location and scatter (Filzmoser et al., 2005). Sensitivity analysis suggested that the outliers detected in common for items on both the anxiety and ERT scales resulted in a maximum absolute deviation in the polychoric correlation coefficients of .03 among the anxiety items and

.009 among the ERT items. The outliers had little impact on the covariance of the data; therefore, these participants remained in the analysis.

Measures

Data were collected using an online questionnaire hosted on SurveyMonkey.com consisting of three sections: (a) demographic information, (b) five open-ended qualitative questions related to students' experience of ERT, and (c) close-ended, Likert-type response format questions that measured the following variables:

ERT Learning Experience. A multidimensional scale was developed based on challenges and opportunities students reported during ERT in four dimensions: technological literacy, social connections, learning management quality, and learning environment quality. Thirteen items were rated using a six-point Likert-type response format, from "always" to "never," resulting in higher scores indicating higher levels of satisfaction with ERT (see Appendix). Kaiser-Meyer-Olkin and Bartlett's tests suggested good partial inter-correlations among the items in this sample (KMO = .76, $\chi^2_{(78)} = 488.83$, $p < .001$). Mokken Scale Analysis (MSA) suggested that the items do not form a strong unidimensional scale ($H = 0.27$) but have improved scaling with either three or four subscales when the lower-bound constant is set at $5 > c > 3$. Full-Information Item Factor Analysis within a Multidimensional Item Response Model framework revealed that a unidimensional model had a superior fit to the data compared to the theoretical model ($\Delta\chi^2_{(6)} = 29.59$, $p < .001$). Three items had poor IRT discrimination and difficulty parameters and were dropped from the final scale. Further evaluation of the factor structure within an EFA framework using Parallel Analysis (PA) recommended three factors: Velicer's Minimum Average Partial (MAP) test suggested two factors, and the Very Simple Structure (VSS) criterion with complexity set at two identified three factors as ideal. Therefore, a three-factor hierarchical model with a superior fit to the originally proposed theoretical model was used ($\Delta\chi^2_{(18)} = 24.612$, $p = .136$). Overall, the final model had adequate fit ($\chi^2_{(25)} = 39.03$, $p = .56$; CFI = 1; IFI = 1.004; SRMR = .074; CRMR = 0.081; RMSEA = 0, CI 95% [0, 0.068]). The scale was found to have high internal consistency and reliability in the current sample ($\alpha = 0.83$, G6 = 0.86, $\omega_T = 0.88$).

Generalized Anxiety. The Generalized Anxiety Disorder Scale 7 (GAD-7; Spitzer et al., 2006) was used to measure the extent of students' generalized anxiety. The GAD-7 is a 7-item self-report screening measure for anxiety that can be used in the general population. The scale asks how often each item stem occurred over the preceding 2 weeks on a four-point Likert-type response format, ranging from not at all to nearly every day. Scores can range from 0 to 21, with scores of 5, 10, and 15 taken as the cutoff points for mild, moderate, and severe anxiety, respectively. The GAD-7 has demonstrated good reliability, discriminant validity, and unidimensionality in a non-clinical sample of South African employees (Bezuidenhout & Henn, 2019, as cited in Henn & Morgan, 2019). Henn and Morgan (2019) reported high internal consistency in a sample of white ($\omega = 0.93$) and African ($\omega = 0.91$) South African participants. Although they identified two items (items 1 and 3) with significant DIF at the upper end of the theta distribution, the magnitudes were small enough to justify continued cautionary use of the GAD-7 in South Africa. In the present sample, a unidimensional model of the scale demonstrated a good fit to the data ($\chi^2_{(14)} = 3.08$, $p = .99$; CFI = 1; IFI = 1.009; SRMR = .028; CRMR = 0.032; RMSEA = 0, CI 95% [0, 0]) and high internal consistency ($\alpha = 0.95$, G6 = 0.92, $\omega_T = 0.95$).

COVID-19 Risk Perceptions. The perceived risk of COVID-19 infection was measured using four items on a 7-point Likert-type response format, with items re-scored so that higher scores indicated higher perceived risk. The design of the scale was informed by Brug et al. (2004) SARS risk perception Scale (Iorfa et al., 2020). It included the following additional questions: "What level of threat do you think the COVID-19/Coronavirus pandemic poses to your job or studies?" (R); "How confident are you

that you can prevent getting the Coronavirus?"; "How likely do you think it is that you may get Coronavirus compared to other people your age and gender?"; and "If you were to contract Coronavirus, how likely do you think you are to develop serious complications or die from the disease?" MSA suggested that the four items did not scale well (H = 0.191), even though PA and MAP suggested that the correlations between items were best explained by a single factor. Although this scale would benefit from revision, the univariate model fit the data adequately ($\chi^2_{(2)}$ = 0.21, p = .90; CFI = 1; IFI = 1.076; SRMR = .014; CRMR = 0.019; RMSEA = 0, CI 95% [0, 0.12]), but with poor internal consistency (α = 0.47, G6 = 0.43, ω_T = 0.55).

COVID-19 Conspiracy Beliefs. Belief in conspiracy theories was measured using six items adapted from the scales developed by Teovanović et al. (2021) and Resnicow et al. (2021). The scales were originally developed to measure alignment with some of the most popular conspiracies circulating on digital media and social network conversations regarding COVID-19. The original scale developed by Teovanović et al. (2021) had 13 items measured using a 5-point Likert-type response format and demonstrated a high reliability coefficient in an adult Serbian sample (α = .90). The scale developed by Resnicow et al. (2021) included three items that were also measured using a 5-point Likert-type response format, with adequate internal consistency in a representative US sample (α = .74). The scale was designed so that higher scores would indicate higher levels of conspiracy belief, based on responses to the following statements: "The media is making COVID-19 seem more dangerous than it really is"; "I think that coronavirus is lab-made, it was not transmitted from animals to humans by accident", "Since coronavirus mostly kills the elderly and chronically ill, I think it is possible that it serves to reduce the financial burden on the state", "One should be careful of the vaccines developed against coronavirus because no one knows what they will inject in us", "It is clear that the pharmaceutical industry, which will make astronomical amounts of money by producing vaccines and drugs, stands behind this pandemic", "People in power are using COVID-19 as an excuse to monitor and control the public and/or manipulate the economies of the world." The items were scaled into a unidimensional scale in the current sample, according to MSA (H = 0.39) and VSS, PA, and MAP analyses. The unidimensional conspiracy beliefs scale demonstrated a good fit to the data ($\chi^2_{(9)}$ = 8.41, p = .49; CFI = 1; IFI = 1.002; SRMR = .062; CRMR = 0.073; RMSEA = 0, CI 95% [0, 0.12]) and high internal consistency (α = 0.78, G6 = 0.77, ω_T = 0.78) in the current sample.

COVID Knowledge. A scale measuring COVID-19 knowledge was initially constructed using eight items from a scale developed by Miller et al. (2021). Their scale consisted of 15 true/false questions based on publicly available knowledge and myths about COVID-19. Two additional items were added based on knowledge of variants of the virus and vaccine efficacy, aspects of the pandemic that were not topical at the time Miller et al. (2021) did their study because vaccines were not yet being distributed. Scoring was calculated as the percentage of correct items (see Appendix). In the final analysis, the item describing common symptoms was removed, as everyone in the sample got it correct. MSA suggested that the items do not scale well (H = 0.086), with items 2 (Hi = -0.05) and 6 (Hi = -0.005) having negative item scalability coefficients. Through the evaluation process, ensuring that all Mokken item-pair scalability coefficients were positive, and by looking at Rasch IRT parameters, a monotonic scale with four items (items 1, 3, 4, and 6) was retained. This final scale demonstrated adequate structural validity ($\chi^2_{(2)}$ = 1.16, p = .56; CFI = 1; IFI = 1.111; SRMR = .073; CRMR = 0.073; RMSEA = 0, CI 95% [0, 0.19]) but poor internal consistency (α = 0.54, G6 = 0.51, ω_T = 0.56) in the current sample.

Religiosity / Spirituality. Religiosity and spirituality were measured using eight items from the Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS) originally developed by the Fetzer Institute (1999;

see Appendix). This scale's factor structure and reliability have been investigated for college students (Masters et al., 2009) and South African populations (Carver, 2015). The items were reversed so that higher scores corresponded to higher levels of religiosity/spirituality. MSA suggested that the measurement model should consist of two dimensions: the first with items 1, 3, 6, 7, 8, and 9 (H = 0.547), and the second with items 2 and 4 (H = 0.34). Using an EFA framework, PA suggested that three factors should be extracted, whereas the MAP test and VSS suggested 1 factor. To reduce complexity and ensure a scale with high internal consistency, items 2 and 4 were dropped from the scale, resulting in a unidimensional religiosity scale with a good factorial structure ($\chi^2_{(9)}$ = 4.02, p = .91; CFI = 1; IFI = 1.025; SRMR = .057; CRMR = 0.068; RMSEA = 0, CI 95% [0, 0.062]) and high internal consistency (α = 0.8, G6 = 0.84, ω_T = 0.85) in the current sample.

Ethics

Ethical approval was obtained from the Helderberg College of Higher Education Institutional Ethics Review Board (IRB) before conducting the study (Clearance number: RCC2021-06). All participants provided informed consent and personal information was removed from the dataset when no longer needed. Email addresses were initially collected to contact prize-winners and used as an incentive to encourage participation in the study. These were kept confidential, were not shared with anyone outside the research project, and were removed from the dataset when they were no longer required.

Quantitative Results

A multiple mediating variable structured equation model (SEM) (Figure 1) was fitted to the sample data using the Iavaan (Rosseel, 2012) and blaavan (Merkle et al., 2021) packages within the R statistical environment (R Core Team, 2023). The diagonally weighted least-squares estimator (DWLS) was used to calculate the parameter estimates for the model with conventional standard errors based on ordinal measurements. Bayesian estimates were obtained using 10,000 samples after 4,000 burn-in iterations, with the default uninformed priors of *normal* (0, 10) for coefficients used in Rstan (Stan Development Team, 2023). The SEM model explained between 67.5% (Frequentist estimate) and 78.9% (Bayesian estimate) of the variance in student anxiety scores and had adequate fit to the data ($\chi^2_{(649)}$ = 736.37, p = .01; CFI = .991; IFI = 0.991; SRMR = .107; CRMR = 0.100; RMSEA = .035, 95% CI [.014, 0.049]; BRMSEA = .06, 95% CI [.056, .063]; Bmc = .29, 95% CI [.25, .33]). Overall, these statistics suggest that the model had a reasonable fit. The potential scale reduction factors (Rhat) values were all close to 1, indicating good convergence. Still, the lower Bayesian non-centrality index figures suggest that the model is not capturing all the variance in the data. This is not unreasonable, as a construct such as anxiety is influenced by various biological, cognitive, environmental, social, and spiritual factors. In terms of the direct effect in the mediation models, the data suggested that a positive experience of ERT was significantly associated with lower levels of general anxiety (β = -0.34, se = 0.15, p = .003; Bayesβ = -0.27). Table 1 presents the model's frequentist and Bayesian parameter estimates, including their confidence intervals.

Table 1

SEM model parameter estimates and confidence intervals

Parameter	Coefficient	95% CI	z	p	β Coef.	Bayes. Coef.	95% HDI
(a) ANX ⇐ ERT	-0.47	-0.77,-0.16	-2.28	.022	-0.34	-0.42	-1.31, 0.72
(b) REL ⇐ ERT	0.35	0.09,0.60	2.67	.008	0.27	0.41	0.06, 0.92
(c) ANX ⇐ REL	-0.33	-0.65,-0.01	-2.03	.042	-0.31	-0.27	-0.59, -0.02
(d) RSK ⇐ ERT	-0.32	-0.56,-0.09	-2.67	.008	-0.51	-0.11	-0.45, 0.01
(e) ANX ⇐ RSK	1.05	0.13,1.98	2.22	.026	0.48	3.35	0.08, 11.52
(f) KNW ⇐ERT	0.17	0.09,0.43	1.34	.189	0.27	0.01	-0.03, 0.09
(g) ANX ⇐ KNW	-0.01	-2.41,2.39	-0.01	.995	0.00	0.17	-17.83, 17.78
(h) CSP ⇐ ERT	-0.09	-0.21,-0.02	-1.58	.115	-0.16	-0.05	-0.20, 0.05
(i) ANX ⇐ CSP	0.08	-2.05,2.21	0.07	.942	0.03	0.57	-2.05, 3.80
(j) KNW ⇔RSK	-0.01	-0.08,0.06	-0.25	.803	-0.07	0.00	-0.01,0.00
(k) KNW ⇔CSP	-0.12	-0.18,-0.06	-3.79	.000	-0.8	0.00	-0.01,0.00
(l) CSP ⇔ REL	0.05	0.03,0.08	4.08	.000	0.17	0.05	-0.01,0.15
(m) RSK ⇔REL	0.05	-0.00,0.10	1.96	.050	0.17	0.01	-0.06,0.10

Note. ANX is student generalized anxiety; Bayes Coef. is the Bayesian standardized coefficient; β Coef is the standardized loading; CSP is affinity with COVID-19 conspiracy beliefs; ERT is experience of emergency remote teaching and learning; KNW is COVID-19 knowledge; REL is level of religiosity/spirituality; RSK is perceived level of COVID-19 risk; ⇐ should be read as "is predicted by"; ⇔ should be read as "covaries with."

The estimated coefficients suggest that among the mediators, ERT experience had the strongest impact on perceived risk of COVID-19 (β = -0.51, se = 0.057; Bayesβ = -0.37), followed by COVID-19 knowledge (β = 0.27, se = 0.069; Bayesβ = 0.21), religiosity/spirituality (β = 0.269, se = 0.051; Bayesβ = 0.31), and affinity for COVID-19 conspiracy beliefs (β = -0.155, se = 0.024; Bayesβ = -0.13). Bayesian parameter estimates suggest that ERT experience is unlikely to have much impact on COVID-19 perceived risk, knowledge, or belief in conspiracy beliefs. On the other hand, ERT experiences were significantly related to religiosity/spirituality. Generalized anxiety was most strongly predicted by perceived COVID-19 risk (β = 0.484, se = 0.391; Bayesβ = 0.67) and then religiosity/spirituality (β = -0.311, se = 102; Bayesβ = -0.23). The hypothesized mediators COVID-19 knowledge (β = -0.003, se = 0.995, Bayesβ = 0.01) and affinity for COVID-19 conspiracy beliefs (β = 0.034, se = 0.859, Bayesβ = 0.14) did not have a significant impact on the level of anxiety experienced by students. The total effects of each mediation model were greater than the direct effects of ERT on anxiety. However, the mediation models for COVID-19 knowledge and COVID-19 conspiracy beliefs do not meet the requirements for the test of joint significance for mediation (Fairchild & McDaniel, 2017).

Looking at each of the original hypotheses, the data supported the hypothesis (a) that levels of satisfaction with ERT were significantly associated with student anxiety (β = -0.34, se = 0.155, p < .001, Bayesβ = -0.27). The data did not support hypothesis (b), that COVID-19 knowledge had an indirect effect on the relationship between ERT and students' anxiety. The indirect effect was minimal and not significant (β = -0.001, se = 0.171, p = .994; Bayesβ = 0.001). Although the total effect on anxiety was significant (β = -0.34, se = 0.213, p = .028; Bayesβ = -0.27), the proportion mediated effect size of COVID-19 knowledge was minuscule (PM = 0.002). The data supported hypothesis (c) that COVID-19 risk significantly indirectly affected students' anxiety (β = -0.246, se = 0.128, p = .008; Bayesβ = -0.25). The combined total effect of ERT on anxiety and the indirect effect of COVID-19 risk was greatest for this predictor (β = -0.584, se = 0.109, p < .001; Bayesβ = -0.52) of all the mediators, and the proportion mediated effect size was fairly large (PM = 0.42). The data did

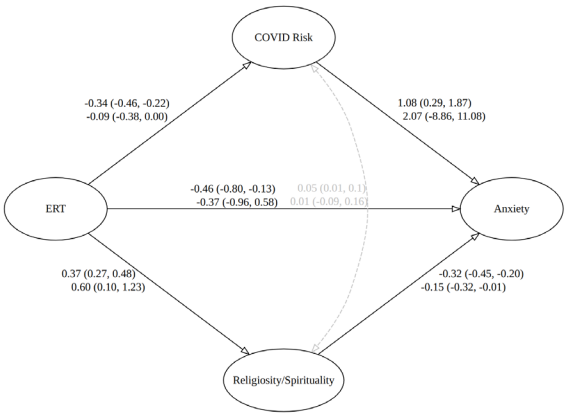
not support the hypothesis (d) that affinity with COVID-19 conspiracy beliefs has an indirect effect on anxiety (β = -0.005, se = 0.08, p = .927; Bayesβ = -0.02), and its proportion mediated effect size was extremely small (PM = 0.015). Finally, the data supported hypothesis (e) that religiosity/spirituality had an indirect effect on anxiety (β = -0.084, se = 0.04, p = .002, Bayesβ = -0.07). However, the proportion mediated effect size was approximately half of that explained by COVID-19 risk (PM = 0.199).

In terms of hypothesized covariates, the data did not support hypothesis (f) that COVID-19 risk covaries with COVID-19 knowledge (Cov = -0.009, 95% CI [-0.08, 0.06], p = .803). However, the data supported the hypotheses that (g) COVID-19 knowledge covaries with affinity to COVID-19 conspiracy beliefs (Cov = -0.12, 95% CI [-0.18, -0.06], p = .000) and that (h) students' perceived COVID-19 risk covaries with their level of religiosity/spirituality (Cov = 0.047, 95% CI [.00, .095]).

These results suggest that ERT experience has a significant impact on the level of anxiety experienced by students and that their perceived risk of infection by COVID-19 and religiosity/spirituality are likely to partially mediate the effect of ERT on students' anxiety levels. Neither COVID-19 knowledge nor COVID-19 conspiracy belief seemed to have played a significant role in this study, possibly because of mediocre measurement properties, or perhaps these are not as significant in determining anxiety among students. When testing whether these could be re-specified as predictors of perceived COVID-19 risk, their coefficients were once again not significant. Based on these results, a simpler model could be proposed in which religiosity/spirituality and perceived risk of COVID-19 partially mediated the effect of ERT experience on student anxiety. This revised model explains between 65% (Frequentist) and 71.1% (Bayesian) of the variation in anxiety scores, and has a very good fit to the data ($\chi^2_{(342)}$ = 346.61, p = .42; CFI = 1; IFI = 1; SRMR = .085; CRMR = 0.077; RMSEA = .011, 95% CI [.000, 0.041]; BRMSEA = .061, 95% CI [0.056, 0.066]; Bmc = .54, 95% CI [.48, .59]). The simplified model has improved parsimony, and Bayesian non-centrality statistics show that it explains approximately twice the amount of variance in the data compared to the original model. All paths were statistically significant and provided a significantly better fit to the data ($\Delta\chi^2$ = 389.76, Δdf = 307, p < .001). The parameter estimates and model specifications are shown in Figure 2.

Figure 2

Parameter Estimates and Path Diagram for the Reduced SEM Model



***Note*:** *Frequentist estimates with 95% CI are provided in brackets; unstandardized parameters are provided on the top row, and Bayesian estimates with 95% probable limits are provided on the bottom row*

Qualitative Findings

The qualitative analysis focused on aspects of Emergency Remote teaching in which students expressed the most satisfaction with the areas in which they reported feeling the most dissatisfaction, and the potential influence of religiosity/spirituality on their overall experience of ERT.

Positive Aspects of ERT

Four main themes were identified regarding the positive aspects of ERT, and three themes were identified regarding the negative aspects. These are presented in the order of importance, where importance is assumed from the frequency. Nine responses indicated no positives, and six indicated no negatives. Positive themes included the utility of technological interfaces, comfort

and flexibility of learning online, reduced expenditure associated with studying online, and helpful and communicative lecturers (*n*=120):

Technological Interface. The most frequently cited positive aspect of ERT was the technological interface, specifically access to lecture material and live online interaction. One student noted the convenience of the medium, stating the most positive aspect being "*recorded lessons, being able to refer back to a whole lecture.*" The technology not only facilitated real-time interactions as one student claimed, "*I enjoy the live interactions via Google meet and Zoom as this allows students to interact with lecturers…*", but also contributed to a preferred class dynamic for some students. Importantly the technology provided improved accessibility for students with disabilities: "*...access to working at home will help people with disabilities since the college isn't disability friendly.*"

Comfort and Flexibility. Students widely appreciated the comfort of a home-learning environment, with several mentioning the benefits of not having to start their day early to commute to campus. A particularly illustrative quote stated, "a*ttending classes in the comfort of my warm bed on cold winter mornings*" as the most positive aspect. Closely aligned with this comfort was the flexibility that came from being able to adapt one's schedule more easily, as one student said what they appreciated most was "*...the flexibility of teaching and learning anywhere, at any time.*" ERT provides the ability to remotely learn and adapt to daily routines. This flexibility allowed students to spend more time on other activities, including further study.

Lower Cost of Living. Another positive factor is the lower cost of living associated with remote learning. Notable areas of savings were in "*petrol/fuel*" and other basic necessities. One student elaborated, saying, "*I've also been able to save money on food, transportation costs, hospital costs and other basic necessities as I am living with my parents*," with another saying: "*I honestly think that classes should remain online because a lot of costs are being saved.*"

Helpful Staff. The students also valued assistance and constant communication from the teaching staff. One participant remarked, "*the constant communication between lecturer and student is the number one [positive] aspect.*" This point did seem to vary among respondents and might depend more on the specific staff encountered by the students. Some staff members might have increased their attentiveness to compensate for their perceived loss of in-person interaction. One student said: "w*henever I had challenges I could just send a message to my lecturers and they will [sic] help me*."

Negative Aspects of ERT

Three main themes were identified as negative aspects of Emergency Remote Teaching (*n*=119): negative experiences in accessing and engaging with the online learning environment; increased workload and individual learning; and increased isolation and a loss of the immersive, connective, and vibrant physical university environment.

Online Learning Environment. Contradictory views existed around tools such as Google Classroom and Zoom, suggesting that satisfaction might hinge more on execution than on the tools themselves. The most frequently mentioned negative aspect was the online learning environment, particularly the reduced in-person time with lecturers and inconsistent or ineffective use of technology – pointing to variable skill levels among staff and the need for widespread training, as one student pointed out: "*...lecturers some are totally confused and it affects our marks, so training is also needed in terms of using the given technology platforms*". Students complained about a variety of issues ranging from "*...[in] Zoom classes I always experience connection problems and it is heavy on data,*" to the limitations of "*...writing exams in Google forms…the technology is daunting, not for us students but also our lecturers.*" Internet access, often taken for granted in urban settings, poses challenges for students in rural

areas, where the Internet can be expensive and unreliable.

Increased Workload. Many students reported an increased workload as a negative aspect. "*I think some lecturers increased the workload by adding additional work due to the lack of class discussions,*" one student observed. Another claimed: "*The workload is a lot. And I do not think it's equivalent or goes hand in hand with that of contact classes*". Interestingly, some of the perceived increase in workload could be attributed to the lack of social interaction among students and with the lecturer, which could also mentally lessen the load.

Isolation. The third theme regarding the negatives of ERT was isolation. One student who found this challenging mentioned, "*I am not able to experience being a student on campus as I enjoy making new friends and I am a sociable person.*" As everything moved online, some students experienced a general feeling of isolation. One student said, "*It feels like you have to do everything alone*." It is important to keep in mind that some negatives, such as technological glitches, may be mitigated through better planning and execution. However, issues such as isolation due to lack of social interaction are inherent limitations of remote learning.

Role of Religiosity/Spirituality in ERT and Anxiety

The final qualitative inquiry revolved around the role of religiosity and spirituality in students' experience of ERT and COVID-19. The main themes that emerged included religion as a coping mechanism, the presence and protection of God, prayer, calmness and peace, hope and comfort, God's word, faith and affirmation, gaining strength, and drawing close to God (n = 114). Other salient codes included the value students obtained from being able to attend worship services virtually, despite really valuing being able to attend church physically when possible, because of the comfort and encouragement provided by a community of faith (Hebrews 10:25). For some students, the events surrounding the pandemic were experienced as a wake-up call – an affirmation that we are living in the last days and experiencing the final events of earth's history (2 Timothy 3:1). Overall, religion and spirituality had a positive impact on students' ability to cope with the pandemic and difficulties experienced with ERT, resulting in hope, optimism, and positive coping mechanisms. Five of the 114 respondents in this inquiry spoke of a decline in their spirituality. They mentioned finding it difficult to pray and experienced feeling distant from God, which often led to experiencing anxiety, depression, and being overwhelmed by the challenges of ERT and COVID-19. Finally, eight respondents said that religion/spirituality did not play any role in their experience of ERT or coping with anxiety. This suggests that the data gathered was fairly representative and encompassed different aspects and facets of spiritual experience. These themes and codes can be collapsed into three categories:

Religion Fostered Positive Coping and Fortitude. For most students, religion provided them with support during difficult times, giving them balance, direction, and several coping skills such as emotional regulation and patience. Indeed, these are cited in Scripture as outcomes of the working of the Holy Spirit in the believer's life even in difficult times (e.g., Proverbs 19:11, James 1:3-4). Respondents expressed that religion was a source of calmness, peace, and hope, giving them strength amidst difficult times. For example, one student reported "*meditating in the Lord has made it easier to cope with anxiety. When I feel very anxious, I take time away from my work. I would read a few verses in the bible, watch a sermon on YouTube, or pray for strength.*" Another student said, "*it's literally the only thing that's been anchoring me down and giving me a sense of hope during this time.*" Another respondent stated, ' *Religiosity has helped me to stay resilient and vigilant. Despite the increased fear of uncertainty and perhaps the probability of losing a loved one, my religious and spiritual beliefs provided me with a certain level of comfort and peace during this time. Reminding myself that there is a time for*

*everything, a time to be born, to cry, to grieve, to be happy, a time of loss and it shall all at some point come to pass."*Respondents described their beliefs and experience of God's mercy and presence as a source of strength, endurance, and resilience in difficult times: "*I would have never made it through without God in my life. He kept me in peace throughout this process. What is a mentally draining, depressing, and worrying time for many has been a joyous, peaceful, and fulfilling process only because God has been with me all the way. Through all the heartache I've endured in this pandemic, God and God alone has sustained me.*"

Spiritual Growth and Affirmation of Faith. Several respondents expressed that their faith provided them with a solid grounding and allowed them to experience post-traumatic growth during the pandemic. They emphasized the importance of feeling or believing in the presence and protection of God during this difficult time of their lives and how this affirmed their faith, lowered their anxiety, and provided evidence of the veracity of their beliefs (Hebrews 11:1). For example, one student stated that "*I have questioned His existence and really had time to think about my beliefs and values. ERT has given me the opportunity to explore my faith and outlook on life. It has tested me spiritually in many ways; however, I have not felt anxious. When it came to assignment workloads and exam prep. I put my trust in God, and He is giving me the strength.*" Respondents mentioned that their experiences during ERT helped to reaffirm that God is in control, is trustworthy, provides protection and guidance, is merciful, and sustains them through the pandemic. One student recalled feeling God's presence amid being infected with COVID: "*I never felt alone at any point, even when I was on quarantine due to having been affected by COVID-19. God has protected me and calmed me down; moreover, he blessed me with full recovery as I do not experience any post-COVID-19 effects such as problems with breathing or strong headaches/body pains*." For some students, the onset and global response to the pandemic provided evidence that they are living in the last days, and they saw these events as the unfolding of Biblical prophecy and a call to consecration. This provided an impetus for existential reflection and spiritual reconnection.

Mechanisms of Religious Growth. Respondents reported various mechanisms by which they either experienced spiritual growth and deepening of their experience with God, or alienation and a religious crisis that deepened their anxiety and compounded the challenges experienced during ERT. One of the most common ways in which respondents experienced religious growth and anxiety reduction was by experiencing a communication channel with God through prayer. For example, one student stated "*I was able to spend time in devotion and prayer. By doing this, I am able to overcome my anxiety because I know that the Lord is with me every step of the way.* Another stated, "*Praying has kept me sane. The lecturers pray positivity over us before classes*." Respondents felt that God hears and listens when they pray, which greatly impacted their ability to negotiate online learning and their lives during the pandemic. Other participants reported finding comfort and meaning through the study of God's Word: *"I have spent more time in the Word to cope with anxiety and other life challenges.*" Some respondents expressed appreciation for the modules taught by the chaplain, addressing values, character, and spiritual development. These were of value in spiritual growth and guided how to practically apply this knowledge to attain calmness and comfort. Students also expressed appreciation for the integration of faith and learning in the classroom, mentioning that prayers offered in class and spiritual applications made while discussing class topics were appreciated. For example, "*having values class has helped me to know the Bible and know how to use it to meditate to calm myself down*." Students who felt alienated from God or struggled with interruptions to their traditional religious routines tended to report experiencing existential crises and higher levels of distress and anxiety. Outcomes on each end of the continuum of this relationship seem to be antithetical; a few respondents suggested that

when faced with loss and personal distress, they felt that God was silent and distant in the face of their distress. One student stated, "*I have been finding it hard to pray during this time because I lost so many people who meant the world to me,*" and another stated, "*my spirituality has drastically declined from before; I find myself being more depressed and anxious, as church contact has been limited.*" Such experiences negatively impact religious growth.

Discussion

Using a mixed method approach, this study demonstrated that in a sample of private higher education students, the experience of ERT had a significant impact on student anxiety levels. This echoes previous research findings in public universities that sudden, unanticipated changes in teaching and learning processes may negatively impact student mental health (Laher et al., 2021; Petillion & McNeill, 2020; Visser & Law-van Wyk, 2021; Wallace et al., 2021). This is most likely to occur when students experience challenges with isolation, increased workload, difficulty with Internet access, and faculty ill-equipped to effectively utilize available online learning tools. The perceived risk of contracting COVID-19 significantly mediated this relationship and explained most of the variance in anxiety scores of all the mediators tested. Considering this, reducing the perceived risk of infection should be a primary target for interventions aimed at reducing anxiety among students in pandemic situations. This is best achieved by training on personal control in prevention rather than negating the severity of infection, while at the same time reducing anxiety may also bidirectionally reduce risk perceptions (Lyu et al., 2021; Rubin et al., 2009; Sobkow et al., 2020).

Interestingly, this study found no covariance between COVID-19 knowledge and COVID-19 risk perceptions. Another mediator in the relationship between ERT experience and anxiety was religiosity/spirituality. Religiosity has been found to foster hope, resilience, affective adjustment, optimism, and peace in the face of traumatic events (Krok et al., 2021; Roberto et al., 2020; Schwalm et al., 2021). Unlike knowledge or conspiracy beliefs, religiosity/spirituality significantly covaried with perceived COVID-19 risk, suggesting a complex relationship between COVID-19 risk, religiosity/spirituality, and anxiety. In other African countries, religious and political discourse around the pandemic is seen as a key driver in reducing the perceived risk of infection (Chilanga et al., 2022). This is likely to have reduced anxiety but could contribute to higher transmission rates. During the pandemic, religiosity/spirituality played an important role in mitigating infection and assisting congregants positively adjusting to the mental health impacts of COVID-19, while at the same time religious gatherings and conspiracy beliefs around the pandemic contributed to increased transmission of the virus (Ayub et al., 2023; Lee et al., 2022). This study concurs with others that religiosity/spirituality is able, in very practical ways, to reduce anxiety and depression surrounding pandemics by lowering the perceived risk of infection, fostering resilience, positive emotions, and coping methods in ways that contribute to personal and public health (Koenig, 2020).

Conclusion

Based on data from a sample of students from a private SDA higher education institution, this study revealed significant associations between ERT experience, perceived COVID-19 risk, religiosity/spirituality, and anxiety levels. The study found that students experienced both positive and negative ERT aspects, which could significantly impact their anxiety levels. Positive aspects include greater use of technological interfaces, comfort and flexibility, and lower cost of living. Negative aspects included limited effective use of the online learning environment, increased workload, and isolation from fellow students and lecturers. Perceived risk played the largest role in mediating the relationship between ERT experience and anxiety, followed by religiosity/spirituality, likely because of its ability to foster hope, resilience, and positive coping mechanisms. Interventions aimed at reducing student anxiety in the context of a pandemic

should focus on prioritizing interventions aimed at targeting students' perceived risk of infection. This should involve greater perceived control of prevention and include religious beliefs and practices that have been shown to covary with risk perceptions. Ideally, academic staff should play a positive role in reducing student anxiety by maximizing the effective use of technological affordances, maintaining contact and communication, balancing student workload, fostering self-efficacy in risk exposure and control, and encouraging positive spiritual and psychological coping strategies. The limitations of this study include the fact that the sample is limited to a single private higher educational institution, which reduces generalizability. The study used a cross-sectional design, preventing the possibility of causal inferences.

Furthermore, the measurement properties of some scales were mediocre, which likely introduced higher levels of unexplained variance. This could be a function of the measurement instrument, respondent fatigue, ambivalence during the COVID-19 pandemic, or both. Future research could use a longitudinal design and measurements with improved psychometric properties to obtain more precise measures and better understand the causal mechanisms involved in the relationship between the identified variables. Overall, this study offers valuable insights into the complex interplay between ERT, student anxiety, and mediating factors, such as perceived risk and religiosity/spirituality during the COVID-19 pandemic. This underscores the importance of a holistic approach when designing interventions to support students' mental health in such challenging circumstances.

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Declaration of Interest

Conflicts of interest: none

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Appendix

Items on the ERT experience scale:

Dimension 1: Technological literacy and availability

- Q14) I felt competent or was able to learn to make use of all online tools and platforms required of me during ERT. (R)
- Q15) I struggled with the stability and/or bandwidth of my Internet connection.
- Q16) I had consistent access to a laptop and/or other technologies needed in my studies. (R)

Dimension 2: Social connections and interaction

- Q17) I felt disconnected and isolated from my lecturers and classmates.
- Q18) I found it easy to ask questions, receive updates, and communicate with my lecturers.
- Q19) The learning platforms used did not allow for personal and meaningful interaction.

Dimension 3: Quality of learning management

- Q20) The amount of work prescribed during the pandemic was comparable to what I would have expected prior to the pandemic.
- Q21) I found the scheduling of teaching and learning activities chaotic or conflicted between different modules.
- Q22) Methods used for teaching and assessment were fair and aligned with stated learning outcomes.
- Q23) The content provided online by my lecturers during ERT was of a high quality.

Dimension 4: Quality of learning environment

- Q24) I found it difficult to balance the different roles and responsibilities I had to assume during the pandemic.
- Q25) Load shedding and interruptions in basic services negatively impacted on my studies.
- Q26) My family, friends, and/or others I live with impeded or interfered with my studies during ERT.

Items on the COVID-19 Knowledge scale:

- The virus is a severe form of the flu. (f)
- Pets can spread the virus to humans. (f)
- The virus spreads more quickly than most others including SARS. (t)
- Individuals without symptoms can spread the virus. (t)
- The virus can cause severe respiratory problems impacting the nose, throat, and lungs. (t)
- The incubation period of COVID-19 is within 14 days of initial symptoms. (f)
- Existing vaccines provide virtually no protection against new variants of the COVID-19 disease. (f)
- The virus causing COVID-19 mutates over time the more it replicates, some new strains or variants that emerge may be more easily transferable or severe. (t)

Items included in the measurement of Religiosity/Spirituality included:

- I find strength and comfort in my religion. (1 to 6)
- I believe in a God who watches over me. (1 to 4)
- I try hard to carry my religious beliefs over into all my other dealings in life. (1 to 4)
- How often do you pray privately; that is, how often do you pray in settings other than a church, synagogue, mosque or other place of worship and at times when you are not attending functions of a religiously based group? (1 to 8)
- How often do you read sacred religious texts (e.g., Bible, Torah, Talmud, Koran, etc.) or other religious literature? (1 to 8)

- I look to God for strength, support, and guidance. (1 to 4)
- To what extent do you consider yourself a religious person? (1 to 4)
- To what extent do you consider yourself a spiritual person? (1 to 4)

Figure 3

Standardized CFA loadings on the final ERT scale