The dark side of online transition of exams in higher education: a perspective of an emerging nation

Isuru Koswatte
Division of Management, Organisations and People, School of Business and Creative Industries, University of the West of Scotland, Paisley, UK

Chandrika Fernando
School of Electrical Engineering Computing and Mathematical Sciences, Curtin University, Perth, Australia, and

Nirma Sadamali Jayawardena
Department of Marketing, OP Jindal Global University, Sonipat, India and Department of Marketing, Griffith University, Brisbane, Australia

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Abstract

Purpose – Higher educational institutes (HEIs) are experiencing a significant shift towards online education, which has been fast-forwarded with the global pandemic of COVID-19. The forced shift has also exposed many vulnerabilities in online education, especially assessments. The purpose of this study is to investigate the potential dark side of the digital transformation of examinations through the lens of university students.

Design/methodology/approach – This study involves a sample of 127 university students from the fields of business and science, technology, education and management (STEM) and the key factors affecting student perception were assessed quantitatively to explore the interrelationships.

Findings – Results revealed that both business and STEM students have a similar impression of the use of online examinations, and the majority still have mixed feelings about them as a replacement for physical examinations. The regrouping of the factors revealed two key dimensions, trustworthiness and apprehensible education, as key areas of student perception in the context of online examinations.

Research limitations/implications – This study aims to strengthen the understanding of Kolb's experiential learning mechanism through a discussion on the importance of abstract conceptualization as opposed to concrete experience in the establishment of the online assessment and learning space. Practically speaking, increasing investment in internet infrastructure and forming strategic alliances with important parties, like internet providers, to create uninterrupted network coverage, are an effective place to start if one wants to make sure that the process of moving to online learning is becoming more and more accepted by educators, students, and the general public.

Originality/value – The online transition to higher education has seen expedited growth since the pandemic and has not given much room for many HEIs globally to adjust. The procedures and techniques implemented take a Western lens, and less attention is given to the emerging context and its context-specific characteristics in such implementation. This study takes the theoretical lens of Kolb and proposes the key learnings for a successful online transition to assessment in emerging contexts.

Keywords Online education, Examinations, Student perception, COVID-19, Higher educational institutes, Emerging nation

Paper type Research paper

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1. Introduction

Early history has suggested the growth of online education has been fuelled by the breakthrough and advancement of technology on a mass scale (Schindler *et al.*, 2017). Many institutions pursue such transformations as an early mover or because of competitive pressures. This is common in the education sector, where initiatives to develop online education are implemented by leading universities, pushing experts and professionals to redesign the educational experience (Dykman and Davis, 2008; Kumar Basak *et al.*, 2018). However, this transition has been heightened by the COVID-19 outbreak, which has forced many higher educational institutes (HEIs) to shift to online learning platforms rather than an organic shift towards digitalization (Khan *et al.*, 2020). The transformation into digital platforms involves many steps, such as content, lecture planning, grouping of students, learning process management and, crucially, the student assessment component (Ahmed *et al.*, 2021). The pandemic has had a detrimental impact on the global education sector, especially higher education. The effects of the pandemic on education are felt in the West as well as the Global South. However, the key issue with Western universities has been securing relevant funding for research, whereas the effects of the pandemic seem far more adverse in the emerging Global South, which is trying to address fundamental issues of poverty and food security on top of other concerns (University of Oxford, 2022).

Many HEIs globally were unprepared for the sudden transition to the online platform. This meant that the challenges and concerns regarding online learning substantially outnumbered most of the benefits to be reaped from this environment (Babbar and Gupta, 2022). The shift to online exams was a key concern, especially with questions on its fairness and whether enough time was given to develop such transitions for both teachers and students (Burgess and Sieversten, 2020). This type of unplanned short-term transition is concerning in the emerging context, which is already facing resource constraint issues (Mumtaz *et al.*, 2022). Emerging nations face many challenges, such as limited access to ICT resources, a lack of previous experience in online education and gaps in ICT literacy, to name a few (Afacan Adanır *et al.*, 2020). Especially, the lack of technical knowledge and monetary issues have become key barriers for many emerging nation students to be able to adapt to the online learning environment (Adnan and Anwar, 2020). The financial concern is even more serious, as it is not only the adoption of expensive equipment and tools for online education but also the loss of income during the pandemic that has made the situation far worse for learners (Akhter *et al.*, 2022). The lack of access to technology has also raised serious concerns about assessment and evaluation, given the combination of a lack of access to facilities as well as knowledge to conduct assessments with the right standards (Tadesse and Muluye, 2020). The challenge is also viewed as a socio-economic factor, as seen in the work of Adedoyin and Soykan (2023), which states the growth of poverty in such communities further widens the gap between the availability of internet access and leads to additional challenges and a fall behind others who rapidly adopt the online learning space.

Moreover, such transformations need careful consideration to avoid malpractices and safeguards to ensure the confidentiality and privacy of the data to be managed (García-Peñalvo, 2021). The integrity of such transitions into online systems to avoid cheating and other malpractices is questioned in existing work (Noorbehbahani *et al.*, 2022). There is also emphasis required to understand the shift to online from a holistic stakeholder viewpoint, which includes the student perception of online examinations and their potential dark side (Reedy *et al.*, 2021). Many of the studies that have looked at the phenomenon have taken a Western lens to explore the phenomenon, which highlights the need to address the online transformation of higher education from an emerging nation perspective (Basuony *et al.*, 2020; Mumtaz *et al.*, 2022). This means that the perceptions of online examinations,

including the learners themselves in multiple cultural contexts, need further analysis (Afacan Adanır *et al.*, 2020). The South Asian region, which accounts for over a quarter of the world population, is one key segment in the emerging context that requires attention in its movement towards digitalization (McCulloch and Indrarathne, 2023). This further highlights the need to investigate the transition to online systems in higher education from an emerging country lens while addressing the dark side of online examinations in such transitions. To explore the dark side of online examinations, the study takes the context of Sri Lankan university students.

Sri Lankan universities, like many other global contexts, experienced a sudden and abrupt transition to online learning, not allowing both educators and learners time to adjust to the transformation (Hayashi *et al.*, 2020; Hettiarachchi *et al.*, 2021). Prior to COVID-19, Sri Lankan education mainly relied on face-to-face teaching, with limited attention being paid to e-learning as an emerging nation (Selwyn and Leyden, 2022). The sudden shift to online systems also meant that there was a lack of time to implement newer processes. In areas such as quality assurance, where the majority of work was conducted using manual methods, concerns have been expressed regarding the general standard of work completed at the university level (Gamage *et al.*, 2020b). Research and prior knowledge of exploring the shift towards mass-scale online education and its potential impacts on the pandemic in the Sri Lankan context are lacking (Khashunika *et al.*, 2021; Subashini *et al.*, 2022).

Based on the above understanding, this study aims to address the following research question:

RQ1. What are the student concerns about online exams during the pandemic period?

2. Literature review

2.1 Digital transformation of university education

We live in a fast-changing environment, which means that what we teach as well as how teaching happens changes at a rapid pace. The impact of technology transforming livelihoods and the business climate is visible in many industries, although in the higher education sector, the pace of change has been relatively slow as traditional education has been favoured by many senior academics (Rodríguez-Abitia and Bribiesca-Correa, 2021). Digital transformation goes beyond the simple terminology of using new technology but constitutes the ability to develop processes and provide goods and services to benefit a mass audience (Maltese, 2018). Such systems in the education field enhance the learning process as well as open opportunities for flexible, distributed learning (Xiao, 2019). Digital transformation encompasses many dimensions, but at a basic level, it is the ability to revamp an entity through a combination of information, computing and communication technologies (Vial, 2021).

The use of technology in higher education goes beyond the use of new learning methods and also focuses on project- and problem-based learning. This means that as much as the learner is changing with the technological transformation, the teachers are expected to adapt and update their knowledge on the state-of-the-art technological developments in education (Sjöberg and Lilja, 2019). Students have become technologically savvy with their mobile devices as well as autonomous because of the information accessibility, which also presents the teachers with greater room to reimagine the teaching techniques and methods adopted. Moreover, universities are institutions that gather individuals from diverse backgrounds and expertise, which also means that they have a significant difference in their ability to use

technology, which further shows the need to learn technology to reach a seamless experience (Wilms *et al.*, 2017).

However, the COVID-19 pandemic impacted many aspects of business, including the education field, where the online transition was accelerated forcefully. Many HEIs, which had a long-standing history and tradition, had to shift their entire operation to the online process and keep changing constantly to accommodate the challenging pandemic environment (Rospigliosi, 2020). Moreover, the shift to online platforms by universities was an answer in certain fields; there were concerning limitations in subject content requiring practical laboratory skills, for example (Gamage *et al.*, 2020c).

Digital transformation at HEIs goes beyond one party; it is a collective effort from multiple stakeholders such as teachers, students, government, etc. to rethink and reinvent the entire process, which is ultimately not going to benefit one individual but has an impact on the entire society (Benavides *et al.*, 2020). The pandemic situation was a clear example of how digital transformation was not voluntary but an indispensable choice for any organization. However, one critical issue that needs addressing in this regard is the inherent difficulties and challenges such change presents to emerging and developing nations (Hai *et al.*, 2021).

In spite of the transition to online platforms, there are significant challenges surrounding the lack of basic internet accessibility, continuous power supplies and institutional support for many of the developing nations that are making the online transition in higher education (Akhter *et al.*, 2022; Rafiq *et al.*, 2021). There have been certain activities in the past which have allowed neighbouring countries to share technologies such as in the case of the USA and China. The key understanding of this is not only to increase the use of online learning on a global scale but also to recognize a one-size-fits-all concept is not feasible and that the right mix of localization and adjustment to cultural concerns needs consideration (Palvia *et al.*, 2018).

2.2 Dark side of digital transformation

The change to online education by HEIs is substantial, and it requires an adjustment of services and technology as well as human resources to accommodate such a strategy. Under such circumstances, the institution must ensure at every level that the quality and integrity of such practices are maintained to avoid any shortcomings (García-Peñalvo, 2021). Moreover, such compulsory adaptations could lead to a variety of stressors as well as strains through the overload of technology as well as the challenges surrounding anxiety and social isolation (Lee *et al.*, 2022). Students who enter an academic line of work at a younger age are exposed to stress because of the high expectations of parents, teachers, etc. to score better grades than their peers, and to overcome such challenges, certain emotional intelligence techniques are developed. However, this situation is much more complex with the online education systems that took over with the pandemic, which not only require students to experience stress as before but also challenge their emotional intelligence with social distancing and not being able to interact with peers of the same age (Chandra, 2020). In offline exams, no internet connection is required; exams are taken in person, on paper or on a computer. In contrast, online exams are those taken over the internet and require an active internet connection (Abeywickrama and Dissanayake, 2022; Dayananda *et al.*, 2021). When considering the Sri Lankan context, the lack of better network coverage, and the fact that some students connect to the internet from places at home such as the kitchen or the workshop of their parents, is a major issue currently faced under digital examination coverage (Abeywickrama and Dissanayake, 2022; Dayananda *et al.*, 2021).

Another key concern with the digital transformation of higher education has been the ability to ensure assessments meet the standards and procedures seen with physical examinations. Ensuring the online examinations take technology and human assistance when required to avoid any misconduct and malpractice is integral (García-Peñalvo, 2021). However, a challenge that has existed pre-pandemic with online adoption and assessments is the lack of direct control of both students and educators (Noorbehbahani *et al.*, 2022). Particularly, the expanded dependence on Web-based tests has lighted discussions on whether this strategy for execution evaluation accompanies higher dangers for scholastic honesty than on onsite tests, as students probably have more chances to swindle. "Online exam security" is implementing academic integrity to mitigate malpractices done by students during online exams. Given the frequency of online exams, existing work has highlighted the susceptibility of students to cheating and avenues for such misconduct compared to traditional proctored examinations (Fask *et al.*, 2014). Previous work shows that with the limited knowledge gathered in the short period of transition to online systems, exam cheating is one of the biggest concerns in the education field (Mata, 2021).

From a student's perspective, the literature highlights the concern of exam cheating surrounding the ability of individuals to have access to external resources, collusion and impersonation to gain an unfair advantage (Reedy *et al.*, 2021). Such levels of misconduct are evident across many disciplines, including the fields of business, STEM subjects as well as law fields, for example (Gamage *et al.*, 2020a; Gilmore *et al.*, 2016). This also means that academic staff are under tremendous pressure and are concerned about maintaining the expected standards of the given qualifications as well as communicating ethics and good practices to students (Schultz and Callahan, 2022). Previous studies have highlighted that in terms of subject fields, business students are prone to greater levels of online exam cheating as opposed to STEM students (Lancaster and Cotarlan, 2021). However, in the work of Walsh *et al.* (2021), it is demonstrated that during the pandemic, STEM subjects were the ones most badly impacted, as a lack of time to change assessments meant that in-class activities were simply conducted in an online space, leading to a lack of academic integrity and more room for cheating.

2.3 Online examination process in emerging economies

With the closure of HEIs worldwide, universities were tasked with the daunting task of ensuring education continued as lockdowns and other travel restriction processes were extended (Basuony *et al.*, 2020). Many emerging nations have pointed out that out of the sectors that were severely impacted, education is one of the worst affected sectors, with many examination cancellations and assessment processes being disrupted (Jena, 2020; Noor *et al.*, 2020). One of the most challenging scenarios for academic organizations was that they had no prior knowledge and experience of an online teaching scenario, which meant that there was a need to first revamp and remodel the pedagogy and material before it was assessed to be ready to be used in a classroom scenario (Singh *et al.*, 2022). Moreover, creating newer pedagogical material to suit an online learning space is extra time-consuming and significantly increases the overall workload for the instructors (Zarei and Mohammadi, 2022). This is of crucial importance, as the success of new educational methods would primarily depend on the teaching knowledge as well as the ability of the educators to encourage students to be comfortable with using newer technology (Basuony *et al.*, 2020).

From the perspective of HEIs, existing work has suggested more investment and resources need to be provided to support the drive towards online education, especially in emerging contexts, and provide support services such as online training, workshops and technical support to drive change and consistent adaptation (El Said, 2021). This is also

connected to the idea of maintaining a strong external resource system, which combines fundamental steps such as the availability of a fast, affordable and uninterrupted internet connection, as it plays a crucial role in ensuring online education and assessment processes could be run in an effective manner (Cahyadi and Widyastuti, 2022).

In spite of the drive and interest of respective HEIs, there is a strong reluctance among educators from emerging country contexts to adopt newer technologies for digital transformation (Aldowah *et al.*, 2019; Iqbal and Bhatti, 2020; Ismail *et al.*, 2020). Evidence has suggested one of the key barriers and lack of motivation for staff members to adopt newer technology into the learning space is their lack of knowledge and understanding of the piece of technology (Iqbal and Bhatti, 2020). Certain evidence from emerging nations such as Pakistan has shown the limited exposure and experience of virtual learning has put severe stress and pressure on educators as the future of students is left to their decisions and they lack confidence in using technologies about which they do not have sound knowledge in the first place (Noor *et al.*, 2020). Furthermore, in some cases, even though lecturers might have the subject knowledge, how to transform it into virtual content seems to be lacking, which could act as another barrier to making progress (Zarei and Mohammadi, 2022).

The instability and uncertainty surrounding such fundamentals have not only raised doubts among academics, but students have raised concerns about online exams in many emerging contexts because of the interruptions and connectivity challenges in the digitalization process (Majola and Mudau, 2022). At a deeper level, the issue is even more serious, not because of a new problem but because of the growing opportunity to cheat and engage in academic malpractice. Online assessment is inherently recognized to be more susceptible to academic malpractice and cheating, and the forced changes in online platforms during the pandemic have given even more room for such irregularities to take place (Bhattacharya *et al.*, 2022; Sattar *et al.*, 2023). In the context of emerging nations, one of the key challenges to countering the threat of the growing amount of academic malpractice in the online examination process has been the significant cost involved in adding tools and techniques to ensure such issues are under control (Bhatia and Joseph, 2023).

2.4 Theoretical background

Kolb's theory of experiential learning (Kolb, 1984; Kolb *et al.*, 1974), which emphasizes two continuums of learning, is also associated with online teaching/learning. The perception continuum extends between two forms of learning (feeling vs thinking), and the processing continuum extends between two other forms of learning (watching vs doing) (Kelly, 1997). Two settings are considered in online learning: by listening to and watching video tutorials, students engage in lower-order thinking skills, such as knowing and comprehending, while at home (Kelly, 1997) (i.e. the perception continuum), and use of the online platform to facilitate learning activities that facilitate higher order thinking skills, including the ability to analyse information through discussions with faculty members and other colleagues while reflecting and synthesizing information (i.e. the processing continuum) (Kelly, 1997). It is important to note that not all writers agree with Kolb's theory. In his 1996 book, Rogers points out that learning includes goals, purposes, intentions, choices and decision-making, and it is unclear how these elements fit into the learning cycle (Marshall *et al.*, 1996). Habermas has also proposed that there are three types of learning and that each one has a different learning style (Marshall *et al.*, 1996). The greatest limitation of the Inventory is pointed out by Kolb himself. The results are based solely on how learners rate themselves. Hence, we adopted the theoretical constructs of Kolb's theory of experiential learning (Kelly, 1997) with two continuums of learning, namely, the differentiation of learning and online learning.

3. Methodology

3.1 Survey design

The study uses a survey consisting of university students studying in Sri Lanka who are from the study streams of business and STEM fields. As previously identified from the literature, the importance of identifying the dark side of online examinations and other issues such as teaching during the COVID-19 period has predominantly been studied from a STEM and Business perspective (Gilmore *et al.*, 2016; Lancaster and Cotarlan, 2021; Walsh *et al.*, 2021). Given the inconclusive evidence, the work has highlighted the importance of future research examining the area, and the present study aims to build on this idea in the context of Sri Lanka.

The questionnaire was developed based on previous research scales and distributed online via Google Forms. The questionnaire included demographics and discussed the reliability, practicality, pedagogy, attitude and security factors of online exams and the digital transformation process in higher education. The survey consisted of 22 questions on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Items related were adopted from the work of Hillier *et al.* (2018), Khalaf *et al.* (2020) and Khan *et al.* (2021). The online question was made available in English. Initially, a pilot study was carried out with 12 members related to the education field and students. Once the pilot testing procedure was completed, the survey was carried out in July and August of 2022. Participation in the survey was voluntary.

3.2 Data collection

The online survey was responded to by 127 students. The survey was conducted during the time of exam results via their student groups and peers to increase participation and minimize recall bias. Out of the 127 who completed the survey, the majority, 64 (50.4%) students, are in their third year of their degree program, followed by 29 (22.8%) students from the postgraduate program and 11 (8.7%) students were in their second year, making up the most prominent groups of the sample. A total of 64 (50.4%) students were 20–22 years of age, 64 were male and 63 were females in the sample. A total of 92 students (72.5%) are from the business faculty, followed by 35 students (27.5%) from the STEM subjects.

The sample was selected based on the convenience sampling approach (Perera *et al.*, 2022). However, the current study does not exclude the likely generalizability issue that may arise from non-probability sampling. To offset this, the researchers endeavoured to approach a large number of participants. In this respect, Coviello and Jones (2004) argue that in spite of the generalizability limitation of non-probability sampling, the technique still generates quality data when samples are characterized by high response rates and participation levels. Further, this sampling size can be further justified based on the precedent studies (Perera *et al.*, 2022; Zarandi *et al.*, 2022).

4. Data analysis

The data normality was first checked for skewness and kurtosis, and all variables were found to be within their suggested levels. As our data were self-reported, we used the common method bias test (Podsakoff *et al.*, 2003). Thus, we used Harman's single-factor test (Harman, 1980), which is recommended by Podsakoff *et al.* (2003), and ran the analysis using constructs with all items using an unrotated factor solution (Table 1).

Firstly, when looking at the reliability of online exams, most of the responses showed mixed feelings, as the neutral response was almost one-third of the five responses. In terms of the observations, 61 (48.1%) disagree with online exams and their applicability to any subject area. However, 60 (47.3%) agree that online exams provide authenticity with their

Profile	Frequency	%
Sex		
Male	64	50.4
Female	63	49.6
Age (years)		
Below 20	8	6.3
20–22	64	50.4
23–25	35	27.6
25–27	10	7.9
Above 27	10	7.9
Year of study		
First	4	3.2
Second	11	8.7
Third	64	50.4
Fourth	19	14.9
Postgraduate	29	22.8
Faculty of study		
Business	92	72.5
STEM	35	27.5

Table 1.
Demographic profile

Source: Developed by authors

integration of multimedia and simulations. The positive attitude continues at 58 (45.6%) when asked about the quick and accurate solutions online exams provide. In terms of its ability to withstand technical failures, a considerable number of participants (48, 37.8%) disagree with it. In spite of the efficiency of online exams, as seen previously, many are concerned (70, 55.1%) about the unknown aspects, online exams bring to the table.

Regarding the practicality of online exams, the majority of 84 (66.2%) agreed online exams are more conveniently accessible than paper-based exams. Similarly, there was a clear agreement by 105 (82.7%) participants on the fact that online exams can be accessed and operated on personal electronic devices. This pattern is followed by the question of how online exams become efficient in terms of time, effort and cost (91, 71.6%). In terms of pedagogy, almost 30% of the respondents were neutral when asked about the ability of online exams to provide a deeper understanding of a given subject as well as their adaptability as a learning approach.

Regarding student attitude, one-fourth of the respondents had mixed feelings about it. 59 (46.5%) agree that online exams can reduce stress and anxiety. This is followed by 62 (48.8%) agreeing on feeling comfortable sitting on an online exam as opposed to in a physical setting. A total of 65 (51.2%) students have a positive attitude when asked about whether online exams give a chance for them to focus more on the questions and 84 (66.1%) have shown agreement with the ease of operation of online exams. However, 77 (60.6%) agree that online exams sometimes favour certain students more than others. Out of the sample, 56 (44.1%) are happy to use online exams in the future and 55 (43.3%) will recommend online exams to others in the future.

The final section on the security aspect of online exams demonstrates that over one-third of the students have mixed feelings about it. When asked about online exams being secure against cheating and plagiarism, 49 (38.5%) disagree with it. However, 50 students (39.3%) agree test materials and results are secure online. Furthermore, 75 students (59.0%) agree

online exams could potentially give individuals the chance to use additional support material without permission to take advantage of it during exams. This belief is continued as 84 (66.1%) agree online exams give a chance to exchange ideas for possible answers and benefits during exams. Finally, 76 (59.9%) agree that online platforms could be manipulated to fake technical glitches and gain an unfair advantage during online exams (Table 2).

The score on reliability can vary from 5 to 25 as it involves 5 responses. It has an average, indicating that the majority is in the neutral category. This is further supported by the median value, which says that 50% of the respondents have a score of less than 17. Regarding the score of practicality, 50% of the study group scored more than 12. This shows students agree with the practical perspective of online exams. The respondent who has a minimum score of 3 is a postgraduate female student from the business field in the age group of 20–22 years.

As far as pedagogy is concerned, the one who scored the minimum of 2 is from the field of science, a second-year male student in the age category of 23–25 years. He does not believe that online examinations can provide learners with immediate feedback to gain in-depth subject understanding and create a more adaptive learning environment as opposed to physical examinations.

In terms of attitude, half of the study group is below 24 out of a possible maximum score of 35, indicating a moderate impression of the take of online examinations. Regarding the security of online examinations, the minimum possible score is 9 and the maximum is 25. The average is 17.33 (SD 3.003). Half of the study group has a score of less than 17. Almost all the scores demonstrate that the majority secures a score in the middle, which means they have mixed feelings about the different aspects (reliability, practicality, pedagogy, attitude and security) of online exams.

We also carried out a comparison of the respective scores between the two groups, namely, in the business and STEM fields. In the case of the reliability of online exams, STEM students show a slightly higher average (16.66 ± 1.94) compared with business students (16.59 ± 2.03). However, the difference is not statistically significant (t-statistic $= 0.176$, df $= 125$, p-value $= 0.861$). Similarly, in terms of practicality, STEM students show a slightly higher average (11.63 ± 0.30) compared with business students (11.54 ± 2.61). However, the difference is not statistically significant (t-statistic $= 0.170$, df $= 125$, p-value $= 0.866$). Regarding pedagogy, the field of business shows a slightly higher average (6.60 ± 1.80) compared with STEM students (6.34 ± 1.68). However, the difference is not statistically significant (t-statistic $= 1.315$, df $= 125$, p-value $= 0.191$). The attitude towards online exams in the field of business shows a slightly higher average (24.29 ± 5.96) compared with STEM students (22.97 ± 6.29); however, the difference is not statistically significant (t-statistic $= 1.1$, df $= 125$, p-value $= 0.273$). In terms of security, STEM students show a slightly higher average (17.91 ± 2.73) compared with business students (17.11 ± 3.09); however, the difference is not statistically significant (t-statistic$= -1.36$, df $=$ 125, p-value $= 0.178$).

Constructs	Mean	SD	Median	Minimum	Maximum
Reliability	16.61	2.001	17	12	21
Practicality	11.57	2.515	12	3	15
Pedagogy	6.68	1.772	7	2	10
Attitude	23.93	6.056	24	10	35
Security	17.33	3.003	17	9	25

Source: Authors' own

Table 2. Descriptive statistics for the scores

For all the aspects considered above, the two groups, business and STEM, are not significantly different from each other. Therefore, for further analysis, all the respondents were considered a single group, disregarding the field of study. The current study adopts a quantitative data analysis technique as well as a presentation (Pallant, 2020). The initial analysis of the data showed that there were no incomplete or missing values in the study. The data was primarily analyzed using SPSS version 21. The first step was to analyze the demographics and identify the significant correlations. The second step involved calculating individual scores for reliability, practicality, pedagogy, attitude and security. We checked the correlation structure of these five scores. Reliability is significantly correlated only with security, whereas the other three factors are highly correlated among themselves (Table 3).

Practicality is significantly correlated with security, with a negative correlation coefficient of −0.215 (p-value = 0.15). We can see from the correlation coefficients that there is a possibility to reduce dimensions using principal component analysis (PCA). PCA is identified as one of the most popular multivariate statistical data analysis techniques used in many scientific subject fields. The key objective of the PCA is to extract the key information from the data and display them as a new set of orthogonal variables known as principal components (Abdi and Williams, 2010). By using only a few components as opposed to thousands of variables, PCA allows understanding a sample cohesively and visually assessing the similarities and differences (Ringnér, 2008).

The analysis involved the five scores. As per the process, varimax rotation identified two factors through the suitability test, with the Kaiser–Meyer–Olkin measure of sampling adequacy value of 0.648, demonstrating a good measure of factor suitability (significant = $p < 0.000$; $\chi^2 = 152.992$; df = 10). The two factors identified explained 72.25% of the total variance considered acceptable with eigenvalues not less than 1 (Factor 1 = 2.169, Factor 2 = 1.443). Further exploration of the factors led to the labelling of the factors as Factor 1: "Trustworthiness" because it involves items of reliability and security explaining online exams. The second factor, Factor 2, was named **"**Apprehensible education**"** because it comprises items explaining how students expect pedagogies to be practical in their learning experience. A more in-depth analysis of each factor revealed that Factor 1 explained 43.39% of the total variance, with Factor 2 explaining 28.86%, respectively, and the total variance explained amounts to 72.25%, which is convincingly above the acceptable variance of 60% (Hair *et al.*, 2012) (Table 4).

5. Discussion of the findings

Online education and digital transformation in HEIs have been ongoing for the past few years but were expedited by the global pandemic situation. Such dramatic changes have presented significant challenges to many of the stakeholders, such as students. The

Constructs	Reliability	Practicality	Pedagogy	Attitude	Security
Reliability	1	0.1	−0.067	−0.047	0.429**
Practicality	0.1	1	0.543**	0.631**	0.004
Pedagogy	−0.067	0.543**	1	0.524**	−0.215*
Attitude	−0.047	0.631**	0.524**	1	−0.117
Security	0.429**	0.004	−0.215*	−0.117	1

Table 3.
Pearson correlation coefficients

Notes: **Correlation is significant at the 0.01 level (two-tailed); *correlation is significant at the 0.05 level (two-tailed)
Source: Developed by authors

technological changes and adaptations to assessment and exams have been questioned by many because of the rise of malpractices and their susceptibility to failure. The study examined specific attributes related to online exams in the emerging context through students in Sri Lanka and to what extent they felt the online mechanism was robust on some key dimensions compared to a physical exam setting.

The study presents valuable insights into the research question presented in the paper. One of the first findings identified through the study was that both Business and STEM students demonstrated similar opinions about online exams, and there was no clear difference in how they perceived the different dimensions of online exams. However, this finding contradicts to a certain extent the previous work of Lancaster and Cotarlan (2021) as well as Sarkar (2022), both of whom identified a certain difference when it comes to the malpractice of cheating on online exams, where business students tend to cheat more as opposed to STEM students. However, the results of the present study do not tally completely with the previously mentioned work as it only looked at exam cheating, whereas the present work aimed to gain a holistic picture surrounding the reliability, practicality, pedagogy, attitude and security concerns of online exams from a student's point of view.

Moreover, the findings demonstrated that many students showed mixed feelings in their perception of the dimensions of online exams replacing traditional physical exams. This is consistent, especially in recent times, with studies such as Ismaili (2021) highlighting how the COVID-19 situation has resulted in mixed feelings of perplexity and uncertainty amongst students about their educational progression, such as classes and exams. It is also interesting to see that the mixed feelings of students were also relevant before COVID-19, as a study done in 2016 with Australian students by James (2016) showed students had doubts about the user-friendliness of online systems, which resonates with the practicality dimension discussed in the present study and the mixed feelings of Sri Lankan university students. The results of the present study show consistency with another study previously done in the UAE universities, which also indicated many participants were neutral in their opinion on whether online education systems had an edge over traditional examination mechanisms (Ali, 2021). On the positive side of things, the results demonstrate the convenience of online exams as a key attribute as opposed to physical exams, and this idea could be linked to a positive emotion as seen previously with the work by Almossa (2021). However, a similar sense of strong emotions could also be observed, as seen with the results on students' concern about unfair advantages for certain groups with online exams and this could also be linked to increased anxiety as well as stress levels of students who are not only concerned about their performance in an unrefined assessment system but also on a macro level based on the living conditions and uncertainty linked with lockdowns and shutdown periods during the pandemic (Almossa, 2021; Kharbat and Abu Daabes, 2021).

	Initial eigenvalues			Extraction sums of squared loadings		
Component	Total	Loadings	Cumulative %	Total	% of variance	Cumulative %
1	2.169	43.39	43.388	2.169	43.388	43.388
2	1.443	28.86	72.249	1.443	28.861	72.249
3	0.580	11.61	83.858			
4	0.462	9.24	93.096			
5	0.345	6.90	100.000			

Source: Developed by authors

Table 4. Total variance explained by the PCA

Based on the PCA, the initial attributes demonstrated certain patterns, and a new grouping emerged. This is where the two initial dimensions of online exams, reliability and security, were now identified as one dimension "Trustworthiness". Studies have also demonstrated specifically in the context of education how security and reliability are two of the most important and fundamental requirements in developing online educational systems (Wang, 2022). The term trustworthiness in the field of digital education also demonstrates that it comprises both security and reliability as core features allowing a system to function in the face of human errors and other possible hazards (Hartenstein *et al.*, 2020). This demonstrates that security and reliability are interconnected, and it is not a choice between one or the other. Some work also points to the interconnected nature of the two dimensions, where conducting reliable online exams means fundamentally addressing any security concerns inherently present with virtual learning systems (Muzaffar *et al.*, 2021). This idea further justifies the PCA narration of the combined concept of security and reliability, as both dimensions work hand in hand in the context of online education and assessment based on previous research work.

The dimension of trust could also be interpreted as a mechanism by which students who demonstrate online assessments and examinations as a challenge may be able to build trust. As previously seen in the work of Basri *et al.* (2022), one crucial way in which HEIs might be able to build interest and self-motivation in students who are not enthusiastic about the online transformation is to establish a relationship of trust and give them confidence in using such technology. This could potentially be linked back to the study's finding of a reliable and fool-proof mechanism, as inferred previously.

Similarly, the PCA identifies the dimensions of practicality, pedagogy and attitude under one common group named "Apprehensible education". It was previously identified that, in spite of no evidence of drastic performance differences in student performance between online learning and physical classes, it was important to think about the practicalities of developing pedagogies when it comes to different learning setups, such as the online environment (Rajaysur and Gadekar, 2021). This idea is further supported by previous research evidence surrounding student attitudes. In the work of Ismaili (2021), students showed quite different expectations as well as experiences with the online education system as opposed to traditional mechanisms. The development of a community and a space for both learners and educators to grow could potentially be an area to boost the growth of interest in the online space. In creating an environment encompassing apprehensible education, efforts could be made to improve the instructor's understanding, who will then be able to contribute to creating a more interesting online space to sustain the interest of the students (Muthuprasad *et al.*, 2021).

6. Theoretical and practical implications

By examining student perception towards online exams as well as how robust online exams are in the higher educational sphere, the paper has responded to the requirements of future research to examine how to build online exam robustness as well as investigate its impacts on key stakeholders such as students (Patael *et al.*, 2022; Reedy *et al.*, 2021). Previous work has provided a certain understanding of student perception of online exams (Ilgaz and Afacan Adanır, 2020; Laksana, 2021), the present study goes a step further to examine student perspectives of online examinations from an emerging country perspective, which is already facing its own set of challenges in the first place to adopt online learning technologies in the education field (Basuony *et al.*, 2020; Mumtaz *et al.*, 2022). This contributes to strengthening our understanding of the challenges and the dark side emerging from both a developed and developing country perspective, which helps to build a

broader picture, which is essential as online education is adopted as a forced measure, especially during the COVID-19 era.

Theoretically, the study adds value to the existing understanding of Kolb (1984) and Kolb *et al.* (1974) in a few ways. Firstly, as there were clear mixed feelings about the use of online examinations, this possibly guides us towards the first step of Kolb's model of experiential learning process, where the foundation for online examinations in the context of Sri Lanka was lacking because of the knowledge gap and the availability of training and other resources to cement a concrete understanding of the process at an initial stage. This draws parallels to the recent work of Kittelmann *et al.* (2023), which demonstrated that the pandemic situation and the online space of the learning room for concrete experiences and fever experiences in this regard could hinder students' competencies in the long run.

This is also connected to the idea of Kolb *et al.* (1974) on how such rapid changes as seen with COVID-19 and online education need a clear learning cycle (Malatji *et al.*, 2021). However, the study shows that students from both STEM and business fields equally felt the lack of knowledge and clarity in the process of examinations, and hence it is viewed as a challenge to be implemented in the long run. This also means that the study findings demonstrate that the online shift from the student perspective is more connected to abstract conceptualization rather than learning through the experience dimension of the experiential model. For online assessment and examination processes to be accepted and gain trust from a student's perspective, the need for more systematic documentation and processes is viewed as a crucial element. The choice towards abstract conceptualization could also be linked to the wider issue of not having a clear overall education policy or training protocol, as many of the educational plans during the pandemic were not adapted to local contexts and cultures to fit specific requirements (Zarei and Mohammadi, 2022). Especially in the context of Sri Lanka, the identified factors and their relationships to one another inform the need to account for the vast array of subject fields in which students engage in online exams and adopt practices that improve the trust students have in the system. Given that both business and STEM students have shown similar concerns about the need for online pedagogies to have a unique approach and an application-based learning system as well as the need for robust measures to reduce the vulnerabilities of online exams, simply adapting Western practices in emerging contexts will not be as effective. This corresponds to the previous understanding of how emerging nations demonstrate a different path, and a clear distinction is required in the approach (Palvia *et al.*, 2018). Overall, it provides an interesting viewpoint on the experiential theory, as conceptualization is seen as a key driver for online examination success, and it will be interesting to see from the developed lens how this would change.

From the theoretical underpinnings, a few key practical implications related to online education can be deduced. First, students are not fully convinced by the online examination approach in spite of its technological advancements and efficiency gains. As found from the research, there is a lot of scepticism as to how well the online examination process could be carried out in Sri Lanka, given certain challenges as an emerging nation. It is evident that the digital divide, as seen in many other emerging nations, is equally present in Sri Lanka. If the online transformation of exams as well as education is taken seriously, emerging nations need to significantly invest in the internet infrastructure, as this is seen as a prerequisite before other concerns about online education are taken into consideration (Muthuprasad *et al.*, 2021).

HEIs and other stakeholders, such as the Education Ministry, must work in partnerships to first solve the fundamental concerns before working their way down to other concerns. For example, one of the solutions at this juncture would be to possibly open communication

channels with strategic stakeholders such as telecommunication partners and identify avenues for subsidizing the cost of internet subscriptions for both students and instructors as part of an effort for social welfare or CSR initiatives (Adedoyin and Soykan, 2023).

7. Conclusion, limitations and future research

In the context of COVID-19, online education has transformed at an unprecedented rate. This change means that online assessment is a key standard present in many HEIs. To understand how stakeholders react to such changes, the present study aims to understand the student perception from an emerging country's perspective on the use of online examinations and the potential downside of such initiatives by the universities. Accordingly, this study has examined some of the key factors affecting student perception. Overall student perception of online exams demonstrates mixed reactions and feelings, with certain concerns raised more strongly about the susceptibility of online exams to manipulation and other unethical practices to arrive at an unfair advantage. Our study identified five key factors affecting student perception, which were then regrouped into two key dimensions (trustworthiness and apprehensible education).

There are some key limitations of the study that are worth acknowledging. Firstly, the study was conducted with a sample of 127 students, and to gain a wider impression of the differences between both business and STEM groups, future work can expand on a larger sample. Secondly, the study was also based on Sri Lankan students, and it will also be important to look at other cultures in the region to see how those university students perceive online examinations. Finally, the study was not exploring the direct impacts of COVID-19 on online education but was looking at the situational context as well as focusing only on the assessment component and student perception, which needs greater elaboration with other stakeholders in future works in higher education research.

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About the authors

Isuru Koswatte is an Assistant Professor at the School of Business and Creative Industries, University of the West of Scotland, UK. He is part of the Social Innovation Leadership and Management (SILM) research group. He is also an Adjunct Senior Research Fellow at NSBM Green University Sri Lanka. His primary research interest is in the areas of organizational resilience, entrepreneurial leadership and educational development. His research has been published in journals such as *Educational Sciences* and *Managing Global Transitions*.

Chandrika Fernando has been a Research Associate of Curtin University attached to the research group on assistive technologies of School of Electrical Engineering Computing and Mathematical Sciences (EECMS). Her research interests include statistical pattern recognition, handwritten mathematical expression recognition, data mining and data science learning environments. She has contributed to academic organizations as a founder member of the Institute of Applied Statistics Sri Lanka.

Nirma Sadamali Jayawardena is an Assistant Professor in OP Jindal Global University, India. She completed her Graduate Diploma of Business Research and PhD in Marketing from Griffith University, Australia. She pursued BSc in Business Management (first-class honours) from NSBM Green University, Sri Lanka and MBA in International Business from University of Colombo, Sri Lanka. Her research interests include consumer psychology, consumer social cognition, digital video advertising and experimental research. Nirma Sadamali Jayawardena is the corresponding author and can be contacted at: nirmas.jayawardena@jgu.edu.in