College Students' Perception and Concerns regarding Online Examination amid COVID-19

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Abstract— **Growing concerns about online examinations have led to various investigations of techniques for improvement. With most higher education institutions shifting to online learning and examination amid COVID-19, these concerns, including the academic dishonesty, validity, reliability, and anxiety of online examination, are more critical than ever. This paper presents the outcomes of the survey to elicit the perceptions of undergraduate students from two universities in South Korea and Malaysia towards undertaking online exams and the associated concerns. Additionally, the study explores the potential of artificial intelligence (AI) in addressing these concerns. There are three main research questions: 1) How has AI been adopted to tackle the four main concerns in online exams? 2) What are the students' perceptions regarding these concerns? Are there any differences between South Korean and Malaysian students? 3) What is the extent of the stress level when webcam proctoring and timers are implemented during online exams? The survey results show that both South Korean and Malaysian students agree that online exams make cheating more accessible than in-person exams. They also suggest that selecting questions randomly from a question bank could discourage cheating. Moreover, the study highlights that both groups of students experience moderate stress levels when webcam proctoring is used over Zoom during online exams, and they experience a high-stress level when timers are set for each question.**

Keywords— **Artificial intelligence; higher education; academic dishonesty; online examination; online assessments.**

I. INTRODUCTION

The recent COVID-19 pandemic has amplified the need for educational institutions, from elementary schools to universities, to conduct online courses. The adoption of online practices has become crucial in mitigating the spread of the novel disease, and it continues to remain a prominent aspect of daily life even after the pandemic subsides. While conducting large-scale online teaching and learning is still an ongoing research area [1]–[4], educational institutions have no choice but to adopt it. Hence, the differences between traditional classroom learning and online learning have raised significant concerns, including the academic dishonesty, validity, reliability, and anxiety of online examinations.

Of particular interest is academic dishonesty that includes any forms of cheating (including the use of ChatGPT and other generative AI technologies) that occur during an online examination, including plagiarism, violation of institution policies, stealing of examination question papers or sensitive data, such as well as impersonation and forgery. The prevalence of e-cheating has been reported [5]–[8]. While traditional in-person examinations are invigilated, the same cannot be said for online examinations conducted remotely. Consequently, the credibility of online courses is questionable. Validity refers to the suitability of examination questions to reflect or measure the achievement of the learning outcomes (i.e., the knowledge or skills students acquire upon completing a course). Reliability refers to the accuracy of grading an online examination in the presence of human errors and biases. Anxiety refers to the emotion (e.g., stress, discomfort, and lack of concentration) that students feel while taking online examinations because the proctoring environment, either in-person or online, requires a level of monitoring that can present discomfort to students.

A. New Trend in Online Examination

There has been an evolution from the traditional paper-and-pencil examination to the adoption of AI in the online examination. For instance, using AI, cloud-based proctoring

services can learn based on real-time environment experiences to process a lot of data, predict patterns to classify inputs, and complete various tasks autonomously. More educational institutions have started to adopt AI in online examination, particularly examination automation and Internet-based monitoring. These applications can be extensively utilized with various authentication methods, including facial recognition, biometrics, and visual and audio behaviors. Assessment reports can be generated using AI-based applications, and both instructors and students receive system-generated notifications based on students' overall performance after each examination. AI is expected to continue integrating into educational frameworks, empowering the education field.

The main contribution of this paper is to: a) explore the literature on the use of artificial intelligence to address four concerns, namely, academic dishonesty, validity, reliability, and anxiety while undertaking online examination; and b) conduct surveys to elicit the perceptions of undergraduate students towards the four main concerns while undertaking online examinations.

B. Related Works

This collaborative study between universities in South Korea and Malaysia seeks to explore the perceptions of Korean and Malaysian students towards online examinations and the associated concerns. Comparative studies were conducted across various subject areas to examine the differences in perceptions between the two groups [9].

According to the UNESCO Educational Disruption and Response to the COVID-19 pandemic, most countries worldwide have closed educational institutions and moved lectures and examinations online, impacting over 89% of the world's student population [10]. Investigation is a critical part of the learning process that allows instructors to evaluate the knowledge acquired in courses. However, academic dishonesty, particularly e-cheating during online examinations, poses a significant issue that undermines the credibility of educational credentials in accurately representing student achievements. According to Corrigan-Gibbs et al. [11], academic dishonesty has worked its way into online learning. Around 26% to 34% of students have cheated in their courses, particularly while looking for answers through Internet resources. Hence, e-cheating must be addressed with the right technologies for detection and prevention.

Strict and continuous invigilation is necessary without physical invigilators to eliminate unethical activities and e-cheating during online examinations. One of the main questions that arise in online examinations is how to ensure that a review is taken by the right candidate enrolled for the course. Unlike an in-person assessment, there are limited ways to reliably verify the identity of an examinee during an online examination. For example, candidates may give oral presentations or explanations via live online sessions; however, this can be complex to implement, mainly when the number of candidates is large. Over the years, researchers have shared various methods to proctor online examinations; however, automated proctoring has not been widely used.

AI techniques have been widely used to enhance computer vision and educational applications. While deep

convolutional neural network (CNN) architecture has been designed for natural image classification, recent advancement in deep learning research has led to progress in computer vision and educational applications [12]. To counter e-cheating, various e-proctoring systems have been proposed in the literature. Incorporated with artificial intelligence, biometric verification using digital technology has been submitted to identify individuals based on their unique features [13]–[15]. González-González and Infante-Moro [10] suggested various factors (e.g., usefulness and trust) affecting the use of e-proctoring tools in remote supervision of groups of students are presented. Ghizlane et al.[16] developed a continuous online authentication system based on the face recognition algorithm and is proposed to authenticate candidates using a smart card and facial recognition. The solution uses several modules (e.g., registration, verification, monitoring, and logging) to detect any fraud behaviors candidates commit while using the examination management system throughout an online examination session. The authorized candidates are monitored throughout the session by detecting suspicious behaviors and cheating attempts. The system stores a log of all images taken for each candidate, which administrators can later view. Asep and Bandung [17] explored various approaches, including exam design with constraints, remote proctoring via webcam, machine-based proctoring, and automated online proctoring. Face verification is crucial for online exams, but robustness to pose and lighting variations remains a challenge. The study also proposed a method to enhance this robustness through incremental training using training data from m-learning online lecture sessions. The design of the proposed method is outlined in this paper. Gard et al. [18] proposed a system to identify, tag, and track a candidate's facial features to monitor any malicious practices during an online examination. In the proposed system, a combination of the Haar Cascade Classifier and Convolutional Neural Network (CNN) was utilized to detect faces and associate them with the respective candidate's name. Subsequently, it tracks the candidate's face appearing on the screen (or frame), and applies constraints (e.g., face detection from multiple angles) to prevent any malicious practices. The examination automatically ends when the candidate changes pose, or when multiple candidates appear in a frame or move out of the frame.

For continuous verification, various user verification methods based on keystroke dynamics have been proposed [19], [20]. Keystroke dynamics capture multiple aspects of a user's typing style, such as rhythm, typing speed, and critical depression time. Singh et al. [21] proposed a system based on keystroke dynamics that does not necessitate pre-registration. Instead, it collects user data during the online examination to verify the candidate. The effectiveness of the suggested system is assessed by considering two metrics: Stroke to False Reject (SFR) and Stroke to False Accept (SFA). SFR represents the average number of keystrokes needed to reject a verified user, while SFA represents the average number required to reject an imposter. These metrics provide insights into the system's effectiveness in distinguishing between genuine users and imposters.

Similarly, AI-integrated keystroke dynamics of students are analyzed during an online examination based on typing rhythms for identification [22]. Furthermore, in recent years,

various voice and whispering activity detection algorithms useful for academic settings have been proposed [23]. In their work, Naini et al. [24] proposed an algorithm based on Long Short-Term Memory (LSTM) for whisper activity detection. This algorithm differentiates whispering from audio signals by separating speech and noise. Voice activity detection (VAD) can distinguish human speech from other sounds. The algorithm considers characteristic features such as pitch from human speech and background noise to detect voice activity accurately.

Various tools have recently been proposed to identify machine-generated text or generated Chatbot responses. Krishna et al. [25] demonstrated that paraphrasing text can successfully evade several detectors. The authors introduced a defense mechanism based on retrieving semantically similar generations. Empirical verification shows this defense can detect many paraphrased generations while accurately classifying human-written sequences. Kirchenbauer et al. [26] proposed a watermarking framework to mitigate the potential harms of large language models. The framework embeds a watermark into generated text, which is detectable using an open-source algorithm. The watermark can detect machine-generated text based on the number of "green" tokens.

The main contributions of this paper are to i) explore the literature on the use of artificial intelligence to address four concerns, namely, academic dishonesty, validity, reliability, and anxiety while undertaking online examination; and ii) conduct surveys to elicit the perceptions of undergraduate students towards the four main concerns while undertaking online examinations.

II. MATERIALS AND METHODS

This section presents AI methods for improving online examinations and the proposed method.

A. AI Methods

AI-based online examination has gained interest from education institutions, government, industry, and funding agencies. AI addresses the challenges rooted in the traditional inadequacy and the modern complexity of online examination. AI can harness a large amount of data readily available in the online teaching and assessment system to address these challenges and provide more imaginative online examination solutions.

Different stakeholders, including education institutions, industries, and researchers, have used different approaches in handling online examination problems through AI. The AI communities tend to develop distinct approaches as they have had different research experiences through some overlapping fields. For example, data mining and knowledge discovery researchers address research problems using the big data concept, which includes extracting the right information, discovering patterns, and providing pre-generated feedback. On the other hand, AI addresses research problems using various algorithms, including machine learning and deep learning approaches, by learning from data (e.g., based on data science and statistical learning), creating machine intelligence, identifying the pattern, and inferring the perception of e-cheating (e.g., based on expert systems and probabilistic models). Overall, the applications of AI in the online examination can help to improve the efficiency of teaching and learning practices in the virtual learning environment.

B. Application of AI to Address Online Examination Concerns

There are five most common artificial intelligence (AI) tools for automated proctoring. Firstly, facial recognition compares a student's photo (e.g., digital photos read from the student identity card) with facial features (e.g., iris and skeleton shapes) of the candidate sitting in front of a screen. It verifies the identity of the candidate regularly throughout the examination. Secondly, eye tracking tracks eye movement to detect a candidate who reads notes placed next to the screen in a closed-book online examination. Similarly, skeleton tracking tracks suspicious behaviors or movements of a candidate during the examination. Thirdly, speech and type recognition analyze the keystroke and voice dynamics parallel for identity verification to verify whether the right person is providing answers without anyone whispering in the background. Fourthly, browser and app restrictions prevent using unauthorized materials (e.g., Wikipedia websites) during the examination. Fifthly, plagiarism validation software verifies the authenticity of a candidate's answer by matching its similarity with online sources and other submitted answers.

Furthermore, we explore using artificial intelligence to address the four main concerns of online examination.

1) Academic Dishonesty

Academic integrity is a constant matter of importance in higher education, mainly when conducting online examinations. Addressing academic dishonesty in online examinations helps to secure academic integrity. Academic dishonesty is defined as the behavior of students who gain undue benefits in assessment tasks without abiding by university policies [4]. Research has demonstrated that academics are in a prime position to impart the necessary education to establish and maintain an ethical environment. Being "ethically aware" is crucial in fostering academic competence for all individuals involved, including students, teachers, and universities. An investigation shows that the tendency to conduct academic dishonesty has no significant difference among students of different academic standings (e.g., freshmen, sophomore, junior, and senior students) [27]. Another research conducted by Kiekkas et al. discussed reasons (e.g., academic overload, no educational value, time scarcity, unfair treatment of students by academic personnel, and the lack of significant consequences for cheating) [28].

In 2011, the United Nations Economic Commission for Europe (UNECE) approved the Strategy in Education for Sustainable Development (ESD) that encourages regional monitoring as a practical management approach used by educators, including school teachers, as well as the heads and specialists of municipal educational departments [29]. Implementing proctored online examinations has been suggested to analyze and discourage academic dishonesty by identifying and addressing malicious activities among participants [30], [31]. A pool of questions can be uploaded, and AI is used to detect any suspicious behaviors and cheating attempts during an online examination so that the questions can be randomized or chosen from different pools of

questions. Detection is performed by predicting students' behaviors, clustering students depending on their knowledge levels based on quiz and assignment marks and associating and discovering the relationship among the categories and difficulty levels of questions. Both free and paid plagiarism detection software tools can be regularly utilized for routine plagiarism checks to compute similarity scores of submitted answer scripts and programming codes. Examples of plagiarism detection tools for checking submitted answer scripts are Turnitin (http://turnitin.com), DupliChecker (http://duplichecker.com), and WriteCheck.com (http://writecheck.com), and for checking programming codes is MOSS (Measure of Software Similarity).

2) Validity

Validity concerns whether online assessments, which form an integral part of a course fully delivered online, can measure students' performance with validity and reliability comparable to offline assessments (e.g., the traditional take-home essays). The validity of online assessment methods is undermined when factors unrelated to students' achievement of course-based learning outcomes, such as gender, socioeconomic status, or ethnic background, interfere with student performance. In addition, the difference between computer-based and paper-based assessments can affect validity because some characteristics (e.g., digitized text display) have been shown to hinder reading comprehension. Different media have influential roles to readers or under certain texts and tasks, such as reading proficiency and adaptability [32].

Hence, adaptive algorithms are proposed to develop personalized learning and assessment systems for students using online learning and taking an online assessment to enhance the quality of the assessment and the system's validity [33]. Adaptive models enable a tailored learning experience and assessment for each student. AI plays crucial roles in the examination design, operations, and feedback, including analytics that offer insights about time management and students' commitment.

The system employs AI to customize lecture content for individual students, such as learning resources, reference materials, and learning paths. This personalization enables personalized assessment feedback, ensuring all students receive equal monitoring and assessment. An example of an AI approach is Reinforcement Learning (RL), which generates reward signals to suggest suitable actions for solving specific problems. RL is useful for generating feedback for students, modeling students' personalized learning styles, modeling adaptive tutorials, and enhancing students' problem-solving capabilities to improve their achievement in an online examination.

3) Reliability

The reliability of online examinations pertains to the consistency and fairness of the evaluation process [34]. Assessments must be conducted equitably, meaning that if similar questions are repeated for the same group of students, the examination results should be relatively consistent and comparable. The real challenge is the generation of examination questions on the fly, which should be reliable.

AI-based test generator tools generate a huge set of questions for a topic, and a variant set of questions is allocated to each student based on their knowledge and skill set. Using AI, selected examination questions can have varied difficulty levels based on students' average response time, average idle time, and the average number of keystrokes. AI models can also be trained based on student performance in previous semesters to understand student performance in a new semester.

4) Anxiety

Research has shown that anxiety is at a record high among this generation of students in higher education, including those enrolled in online education. Beginning in early education, students have been taught that excellent grades can lead to success and low grades can reflect failure. Many students experience anxiety during examination situations due to various factors, including the inability to ask questions to invigilators and the occurrence of Internet connection issues. These circumstances contribute to heightened anxiety levels among students. In addition to stressing the importance of examination, anxiety can hinder a student's ability to concentrate and remember potential answers, especially when there is a time limit. To help with such anxiety, an online examination has become popular and has offered new opportunities to students (e.g., students can receive more detailed feedback, which online examination systems offer). However, Surveys have revealed that while certain students find online examination opportunities advantageous, such as easier participation, other students who harbor concerns about technology and proctoring exhibit higher anxiety levels [3]. Being able to recognize better, respond to, and support students with anxiety concerns can affect a faculty member's ability to increase students' engagement in the class and, as a result, the student's overall success [35].

C. Research Methodology

This research was carried out in four primary stages as follows: (1) research design stage; (2) online exam case-study stage; (3) questionnaire design stage; and (4) research validation stage. The proposed methodology is illustrated in Fig. 1. Each stage has been described in the following subsections.
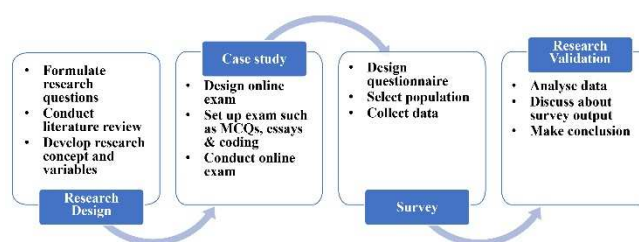

Fig. 1 Proposed methodology

1) Research design

There are three main research questions as follows:
- RQ1. How has AI been adopted to address the four concerns (academic dishonesty, validity, reliability, and anxiety) plaguing online examinations in higher education institutions in the literature?
- RQ2. What are students' perceptions of online examinations about the concerns mentioned above? Is there any difference in perceptions towards the

concerns between the South Korean and the Malaysian students?

- RQ3. What is the extent of the stress level when a webcam proctor and timer are implemented during the online examination?

To address RQ1, we have explored literature related to the use of artificial intelligence in addressing four main concerns, namely academic dishonesty, validity, reliability, and anxiety, while undertaking online examinations. To address RQ2, we conducted surveys to capture undergraduate students' perceptions regarding the four primary concerns associated with online examinations. The survey results are presented in Section 3. To address RQ3, two questions (AN3 and AN4) were included in the survey to assess the stress levels experienced by participants during online examinations. The responses to the questions are based on the range of $1 - 5$, from 1 (i.e., strongly disagree and stress-free) to 5 (i.e., strongly agree and the highest stress level). Survey results show that both groups of students experience moderate stress when a webcam proctor measure is used over Zoom during online examinations. They also experience a high stress level when a timer is set for each question.

Based on the research questions, we focus on the main independent variable: the student's nationality. Note that the survey was conducted without gathering personal information such as name, age, and gender. Ethical approval was not required since it was about the subject matter, namely the online examination. In addition, we briefed the students about their participation in the survey and asked for their consent before their participation.

2) Case study

At this stage, case studies were conducted to provide and conduct online exams. We used MCQ, essays, and coding questions. We set a timer for each question during the online examination, and a webcam proctor measure is used over Zoom. The case study was designed for the students to begin with a suggested issue or face the possibility of issues occurring during the online exam.

3) Survey

The survey was conducted to provide empirical findings. Two principal features of the survey are: a) to acquire data from targeted samples, namely university students, and b) to generalize results. In the questionnaire collection activity, an online questionnaire in the web-based system was chosen as the primary data collection tool. This paper provides some measures to overcome the growing concerns about the academic dishonesty, validity, reliability, and anxiety of online examinations. To achieve this, we elicited the perceptions of first-year undergraduates towards undertaking online examinations regarding the above concerns.

We conducted an online survey when remote teaching and learning were made compulsory due to the COVID-19 pandemic. Researchers discussed that each study's minimum sample size requirements do not depend on a single factor but rather on multiple factors, such as the amount of missing data and the population size [36]. 92 and 106 first-year undergraduate students from South Korean and Malaysian universities, respectively; the sample size of 92 and 106 was the entire population taught by authors in two countries. Samples were collected purposively from a specific target population: first-year undergraduate students studying IT subjects from two universities in South Korea and Malaysia, respectively, with a 100% response rate without any missing data. Although this sample size might not be generalized to other contexts, it can be sufficient to draw minimal conclusions as there is no strict rule to explain the adequacy of the number of samples for survey evaluation. The participants took part in the survey immediately after they had taken online examinations. The participants took the online examinations using a webcam proctor over Zoom (http://zoom.us) at their convenience places (e.g., at home). The structure of the online examination questions was similar to those given in traditional in-person examinations, which consist of multiple-choice and short-answer or scenario-based. The main differences between online and traditional examinations are generally: a) the location of the examinations (i.e., a remote location in the online examination and an examination hall in the in-person examination); and b) the presence or absence of examination invigilators at the location of the examinations.

Each online survey questionnaire has 14 questions (Table $1 - 4$). The first twelve questions aim to identify the extent to which the participants agree with the statements related to students' perceptions on concerns about the academic dishonesty, validity, reliability, and anxiety of online examinations. The questionnaires are on 5 points Likert scale: (1) Strongly disagree; (2) Disagree; (3) Undecided; (4) Agree; (5) Strongly agree.

The final two questions were designed to gauge the stress levels experienced by participants during the online examination. The responses to the questions are based on the range of $1 - 5$, from 1 (e.g., strongly disagree and stress-free) to 5 (e.g., strongly agree and the highest stress level).

4) Research Validation

At the research validation stage, the data from the survey were analyzed using a two-tailed statistical hypothesis test. Following on from the above discussion, we present two mutually exclusive hypotheses; the null hypothesis (H_0) is the claim to be tested and based on the South Korean **k** and Malaysian **m** sample data on the perception of particular concern are equal (i.e., H_0:**k=m**), while the alternative hypothesis (H_1) claim that the mean values are not equal (i.e., H_1:**k≠m**). The data were analyzed using a statistical approach, specifically a t-test, to determine whether there were any significant differences between the means of the two student groups. The t-test, a specialized type of ANOVA, was employed to ascertain the statistical distinction between the two groups of students. In our study, the chances of errors might not be present since we only compare two means of the populations concurrently.

5) Limitations of the study

Table 1 shows Cronbach alpha reliability. The low values are due to the small number of questionnaires for each concern, including academic dishonesty (AD), validity (VA), reliability (RE), and anxiety (AN)[37]. We wish to highlight that in our future work, the low values do not indicate poor reliability of the questionnaires[37], and they can be improved by adding more related questions explored in the most recent literature in this fast-growing area.

TABLE I
THE CRONBACH ALPHA RELIABILITY COEFFICIENT

Questionnaires	Cronbach Alpha
AD1 – AD3	0.31
VA1 – VA4	0.44
RE1 – RE4	0.76
AN1 – AN4	-0.2

III. RESULTS AND DISCUSSION

A. Academic Dishonesty

Academic dishonesty (AD) means any cheating before or during the online exam. It includes plagiarism, cheating, violation of institution policies, stealing examination questions or sensitive data, unauthorized entry, and forgery [38]. Table 2 shows the questionnaires about academic dishonesty and the results. Both groups of students are undecided on the academic dishonesty concern (AD1–3).

TABLE II
ACADEMIC DISHONESTY SURVEY QUESTIONNAIRES AND RESULTS

No	Statement
AD1	It is easier to commit academic dishonesty in online exams than in paper-based exams.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.18/1.07 3.15/1.07
AD2	Using randomized questions from a question bank may discourage academic dishonesty during online exams compared to paper-based exams.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.38/0.75 3.19/0.96
AD3	Using randomized questions from a question bank may discourage academic dishonesty during online exams compared to paper-based exams.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.11/0.77 3.08/0.83

B. Validity

Validity (VA) can be defined as the extent to which examination questions align with the expected learning outcomes, encompassing students' expected acquisition of knowledge and skills upon completing the course.

TABLE III
VALIDITY SURVEY QUESTIONNAIRES AND RESULTS

No	Statement
VA1	Online exams are appropriate to test students' level of learning outcomes.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.48/0.87 3.51/0.90
VA2	My subject is too complex to be dealt with by online examination.
	μ/σ (South Korean) μ/σ (Malaysian)
	2.58/1.02 3.06/1.04
VA3	Excelling in IT skills (i.e., hardware and software skills) is an added advantage in online exams.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.65/0.98 3.67/0.91
VA4	Compared to traditional in-person exams, online exams allow examiners and students to enhance questions and answers by incorporating multimedia content and demonstrations.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.52/0.82 3.42/0.91

Validity also ensures that the examination adequately addresses the subject matter's complexity. In other words, a valid examination accurately measures the attainment of learning outcomes pertinent to the specific assessment. Table 3 shows the questionnaire about the validity and the results. Both groups of students disagreed on the academic dishonesty concern (AD1–3).

C. Reliability

Compared to traditional in-person exams, online exams allow examiners and students to enhance questions and answers by incorporating multimedia content and demonstrations. However, online exams must be reliable and trustworthy, as the reliability of an examination refers to the consistency and fairness of the evaluation process [34]. Table 4 shows the questionnaires about reliability and the results.

TABLE IV
RELIABILITY SURVEY QUESTIONNAIRES AND RESULTS

No	Statement
RE1	Marking online exams is less prone to human errors.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.46/1.0 3.19/0.90
RE2	The online exam is reliable or consistent because questions are selected randomly from a large question bank.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.50/0.87 3.33/0.86
RE3	The online exam ensures that markings are not biased or in favor of certain students or groups of students.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.57/0.73 3.29/0.95

D. Anxiety

Anxiety refers to the emotions students feel while taking online exams, such as stress, discomfort, and lack of concentration, as both in-person and online proctoring environments involve a level of monitoring that can cause discomfort for students [39]. Table 5 shows the questionnaires about anxiety and the results.

TABLE II
ANXIETY SURVEY QUESTIONNAIRES AND RESULTS

No	Statement
AN1	Exams are stressful enough, and doing them on computers makes it worse.
	μ/σ (South Korean) μ/σ (Malaysian)
	2.83/1.09 3.08/1.34
AN2	Nowadays students use computers all the time, so I feel more comfortable when they are used in exams.
	μ/σ (South Korean) μ/σ (Malaysian)
	3.33/1.10 3.43/1.09

No	Statement	
AN3	What is your stress level if a webcam proctor measure is used over Zoom during the exam?	
	μ/σ (South Korean)	μ/σ (Malaysian)
	3.57/1.16	3.48/1.09
AN4	What is your stress level if a timer is set for each question to prevent academic dishonesty?	
	μ/σ (South Korean)	μ/σ (Malaysian)
	4.26/0.82	4.00/1.02

E. Difference of perceptions

We investigated the difference in perceptions towards the concerns between South Korean and Malaysian students. To do this, we used the sample data from the survey to assess whether there exists a significant difference between the means of the two groups in terms of their perceptions. We used a two-tailed statistical hypothesis test based on our sample data, which comprised two independent data sets. Our null hypothesis stated that the mean values for the South Korean k and Malaysian m sample data on the perception of particular concern are equal (i.e., $H_0:k=m$). In contrast, the alternative hypothesis stated that the mean values are unequal (i.e., $H_1:k \neq m$).

To further analyze the survey data, a statistical approach called the t-test was employed to investigate any significant differences between the means of the two student groups. This allowed us to examine whether there was a notable distinction between the means of the two groups. The independent variable refers to the nationality of the students.

A summary of the t-test results for the four main concerns is provided in Table 6. If the p-value is greater than 0.05, we accept the null hypothesis.

TABLE VI
THE T-TEST RESULT

Academic Dishonesty					
AD1		AD2		AD3	
p-value	result	p-value	result	p-value	result
0.780	equal	0.235	equal	0.966	equal

Validity							
VA1		VA2		VA3		VA4	
p-value	result	p-value	result	p-value	result	p-value	result
0.711	equal	0.001	not equal	0.841	equal	0.049	equal

Reliability					
RE1		RE2		RE3	
p-value	result	p-value	result	p-value	result
0.131	equal	0.051	equal	0.001	not equal

Anxiety							
AN1		AN2		AN3		AN4	
p-value	result	p-value	result	p-value	result	p-value	result
0.080	equal	0.245	equal	0.266	equal	0.245	equal

Both groups of students have the same perception of the academic dishonesty concern (AD1–3), validity concern (VA1, VA3, VA4), reliability concern (RE1, RE2), and anxiety concern (AN1, AN2, AN3).

It is worth mentioning that most students agreed with the difficulty of engaging in academic dishonesty, attributing this to the implementation of technologies like remote proctoring, which helps alleviate concerns related to online examinations. However, students disagreed with the notion that using randomized questions from a question bank can effectively deter academic dishonesty during online exams. Consequently, AI can be applied to address the issue of e-cheating. For instance, if AI detects two students' attempts to cheat, their examination questions can be selected from a different set of question banks or alter the randomization method of the current test bank to prevent dishonest behavior.

As for validity, both groups of students agree that online examination is appropriate to measure the students' attainment of learning outcomes and is suitable for their subjects. The groups also agreed that having strong IT skills, such as proficiency in navigating the examination system and utilizing software tools for tasks like diagram creation, provides an additional advantage. They also acknowledged that multimedia content and demonstrations could enhance online exam questions and answers. Based on these findings, we agree that online examinations are well-received by IT students and have the potential to establish a precedent for future assessment methods.

Regarding anxiety, IT students do not perceive online examinations as more stressful than traditional in-person examinations. They find it easier to adapt to the online examination format, contributing to their reduced anxiety levels. As for the stress level, both groups experience moderate stress when a webcam proctor measure is used over Zoom during the online examination (AN3), and both groups experience high stress if a timer is set for each question to prevent academic dishonesty (AN4). In our opinion, the stress level is elevated when there is an increase in restriction. Implementing a webcam proctor and a timer is more restrictive than a webcam proctor only. Hence, adopting a webcam proctor with built-in AI can be beneficial - the students experience less stress, and the lecturers can leverage AI features to detect the possibility of cheating cases.

IV. CONCLUSION

A sudden switch to online mode for teaching and assessment due to the COVID-19 pandemic has inspired us to study the perception of the participants on how well they accept online examinations, which may be the new normal trend. Hence, a study on how well these students could cope with the transition from in-person examination to online would be necessary as the online mode for teaching and assessment continues to gain popularity. Generally, our study contributes important evidence to the academic body by highlighting the four concerns (academic dishonesty, validity, reliability, and anxiety) about online examinations. The insights from our study can provide some considerations when implementing online examinations. From our findings:

We concluded that online cheating is moderately easier, so tighter control over the examination is needed. This suggests the need for universities to incorporate academic integrity in their syllabi to provide a fair assessment for all students. We recognized the usefulness of AI to be applied to online

examinations to reduce the cheating rate further. A powered AI proctor software has the potential to detect anomalies such as unusual eye movements and keystroke rates.

We noted that including a webcam proctor over Zoom during online examinations and setting a timer had caused stress amongst the participants as the webcam proctor and timer may not create a conducive online examination set-up. This has motivated us to investigate the application of AI techniques to replace the time-constraint method to alleviate stress and provide a better examination experience.

We observed that despite cultural differences, participants from both countries have the same perception of online examinations. This fundamental discovery is important for us to further our research about e-cheating. We discovered that the application and perceptions of using AI tools within the online examination experience are still limited; hence, further work can be pursued to mimic that of the traditional in-person examinations. This will then provide educational bodies with some guidance on how AI tools can be incorporated into assessments to foster integrity and provide students with a holistic experience.

This study surveyed a proportionally right sample size from two countries. However, the researcher could not contact students face-to-face from other universities due to COVID-19 restrictions. A qualitative interview method or survey among a larger number and various subject studies could have given this study a richer perspective on the research problem. As this study has been conducted among IT subject-related students of South Korea and Malaysia, the results can be extended to other subjects and other countries in the future.

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