

An Exploration into Improving Examinees' Acceptance of Participation in an Online Exam

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ABSTRACT

With the rapid development of the Internet and information technology, the issues related to online exams have become the concern of an increasing number of researchers. At present, the biggest challenges for the integration of web communication technology into online exams are the ability to detect cheating behaviors during the exam, and the verification of students' real identification. These problems can have an impact on the students' perceived trust of an online exam, and further influence their participation acceptance. This study proposes a research model with notarization process (technical level) and online exam policy (institutional level) in order to improve examinees' participation in online exams. There are 301 college students participating in this study. The results indicate that all the hypotheses in the model are supported, which implies that the monitoring and managing mechanisms proposed in this model can significantly raise examinees' participation acceptance for online exams. Finally, we further discuss the implications of the research findings and provide some suggestions for future developments for online exams.

Keywords

Perceived fairness of notarisation process, Perceived soundness of online exam policy, Perceived trust, Participation acceptance

Introduction

Due the capacity of the Internet to transcend time and space, traditional paper and pencil exams have gradually been transformed from physical space to cyberspace. Online exams have been widely used in many institutions as a convenient alternative assessment tool for evaluating students' learning outcome. However, in current educational systems, there is a considerable gap in the trust of online exams compared to traditional ones. It is difficult for examiners to monitor and credibly assess online exam systems as a result of the difficulties relating to the identification process of the students. The system should be capable of confirming whether the examinees are in fact the students specified by their identification. It is generally acknowledged that cheating in exams is not uncommon among students on college campuses (Bolin, 2004). Even though the use of technology can mitigate these unfavourable phenomena but cheating cannot be completely eradicated (Pain & Le Heron, 2003). Studies have uncovered increasingly diversified trends in cheating behaviours, and the fairness of exams is increasingly being called into question (Crown & Spiller, 1998). According to a study of online exams, 45% of students self-reported negative behaviours, such as lying, cheating, and defiance, during online exams (Russell & James, 2008), and 73.6% of the students in the sample believed that it is easier to cheat in an online exam than in a traditional exam (King, Guyette, & Piotrowski, 2009). Of these, one of the main reasons that the fairness of online exams is being called into question is the user authentication problem (Apampa, Wills, & Argles, 2010). For example, if a student with poor grades were to find a student with good grades to take an exam on his behalf, this could lead to benefits beyond the exam itself, such as higher a chance of success when applying to a more reputable graduate school. Once the fairness of exams has been violated, the trust in the system from the examinees decreases. Therefore, trust has been recognised as the most important factor in a successful participation of online exam website (Chang, Tseng, Chou, & Chen, 2011). Given the convenience of the Internet, governments and educators are thus challenged with the task of establishing fair environment and policy for online exam. As the need for online exams continues to grow, more complete user identification, including a face recording system for examinees, has been suggested for online exam websites (Chen, Hsieh, & Tsai, 2008). Furthermore, school administrations should also develop a sound policy to prevent cheating behaviours in online exams. In order to minimize cheating behaviours on online exams, we approached the issue from the perspective of two mechanisms: one at the technical level and the other at the

institutional level. Therefore, this study proposes a notarisation process (technical level) combined with the setting of an online exam policy (institutional level) to develop a more reliable and fairer exam environment. Moreover, we also propose a hypothetical model as our research framework to explore other factors whether affect examinees' participation acceptance of online exams.

Existing approaches to verify a user's identity

In the context of online exams, user authentication refers to the security procedure examinees use to establish a trust relationship with the system. It is similar to the checks on examinees' identity (ID) cards that examiners perform before allowing them into a traditional exam room. Currently there are several approaches used to verify examinees' real identities, such as face recognition, which is a method that can successfully and safely confirm personal identification (Chen et al., 2008). Other common approaches are listed below with brief descriptions:

Username and password

For this method, there is no need to purchase additional expensive equipment, and all that is required is a computer equipped with a mouse and keyboard. This is the most well-known and widely used authentication method. The main drawback of this method is that the password may be leaked and the true examinee may be impersonated by someone else.

Smart cards

Smart cards have been developed as the means of identifying users to replace the use of accounts and passwords. However, this method is impractical and limited as the hardware owned by examinees needs to identify the smart card, and it is still possible that the students may give their identity cards to others. For example, student A uses student B's smart card to login in the system to take exam, a condition leading to the inability of the system to detect the real identity and resulting in the problem of cheating.

Biometric authentications

Biometric methods can be divided into active and passive types depending on how the user interacts with the system during the authentication process. Such as fingerprinting and face recognition, consist of the use of biometrics to identify users in order to not only resolve the user authentication problems but also offer a higher level of information safety and ensure users' identities (Xiao & Yang, 2009). Generally speaking, fingerprinting is an active authentication style, which requires users to actively provide biometrics such as fingerprint information before they use the system. If a re-authentication request is needed during the exam, students have to use their fingers again for identification, a condition which may distract students' attention from the exam. Face recognition, in contrast, is a passive authentication style. Users only need to use a webcam in front of their monitors, and the system will keep recording, identifying, and eliminating interferences to examinees during the exam. Fingerprints and face recognition provide much safer authentication processes than passwords. However, these types of biometric methods require continuous deliveries of re-authentication requests to users, which can interfere with the online exam process of the examinees. Also, a series of re-authentication processes requires large amounts of computation which can cause an additional load on the system (Stallkamp, Ekenel, & Stiefelhagen, 2007).

The notarisation process of online exams

In the domain of information security, a public key is subject to encryption and decryption technology that not only makes it harder to tamper with the original data but also ensures their authentication (Rivest et al., 1978). After this, a third party such as a certificate authority is needed to notarise the user name and create a connection between the public key in a process known as a concept of notarisation (Ansper, Buldas, Roos, & Willemson, 2001; Lekkas & Gritzalis, 2004). To verify the real identity of the examinees and at the same time avoid interference to examinees

and additional system load from continuous re-authentication, this study offers a mechanism that combines face notarisation and face recording in online exams. The purpose is to create a fair online exam environment through the notarisation process.

This study provides a brief sketch of the notarisation process in an online exam (see Figure 1). During course registration, the exam system captures one face picture randomly from a webcam and saves it in the student's basic record. In the procedure 1, after a student registers in the online exam system and uploads a photograph of his or her face, the student arrives at the exam and is confirmed by the proctor or TA (as shown in Figure 2). In procedure 2, during the exam, the system randomly takes three photographs of the student's face and records these photographs with the student's image test report. In procedure 3, a teacher, staff member, student or TA can review the report following the online exam. In a normal situation, the recorded photographs will represent the registered student. This study implements a notarisation process and proposes a mechanism for cumulative face notarisation to explore whether the findings indicate that examinees will have a greater trust in modern online exams.

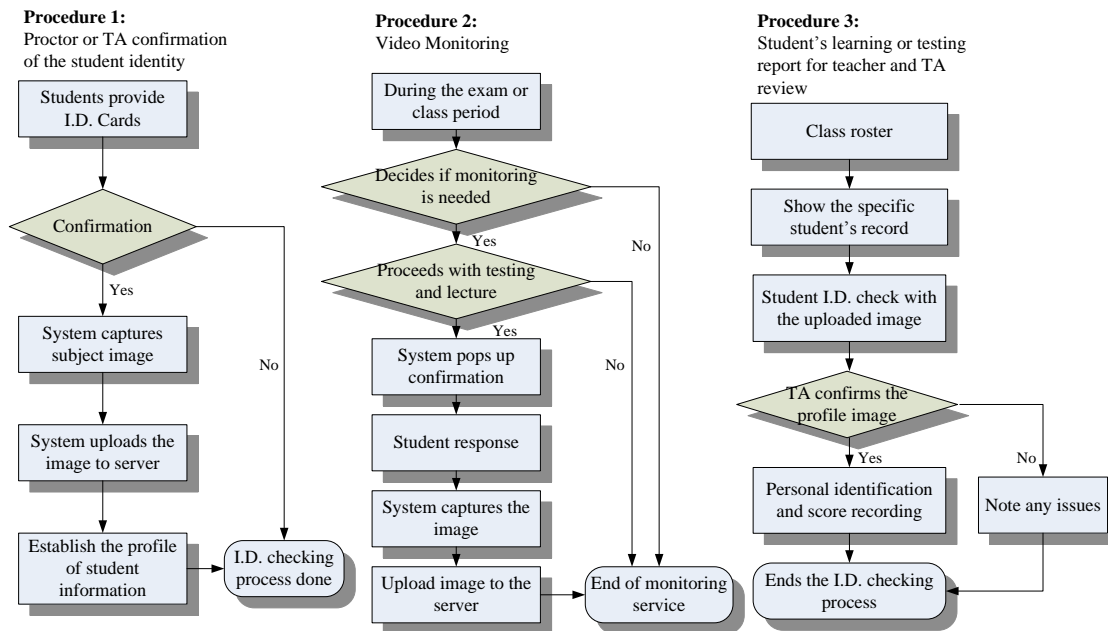


Figure 1. The notarisation process



Figure 2. The taking and recording of the student's face portrait

Research model

Theoretical development

The technology acceptance model (TAM) suggested by Davis (1986) explores the acceptance of new information technology by users. In their model, two determinants have been found to have a significant impact on the intention to use new technology: perceived usefulness and perceived ease of use. Both of these two variables are affected by external variables (Davis & Venkatesh, 1996). Both of the above variables impact on users' acceptance of information technology. In the causal relationship of the entire learning process, learning is the cause, and assessment is the result. Regarding learning, when students feel that their online learning experience can be

improved by virtue of the usefulness and ease of use brought by learning materials offered by information technology, they are more willing to use the system in the future (Pituch & Lee, 2006). Several studies have found that, in addition to the learning content, information quality and network quality also influence learners' satisfaction of using the system (Piccoli, Ahmad, & Ives, 2001; Webster & Hackley, 1997). Other research findings also indicate that the higher the quality and reliability of information technology, the better the learning outcomes (Piccoli et al., 2001; Webster & Hackley, 1997). This further suggests that learners' acceptance of the integration of IT into learning is high.

However, in terms of assessment, it is participation acceptance, rather than technology acceptance, that is the key concern of our study. Factors such as perceived fairness of notarisation process, perceived soundness of online exam policy and perceived trust are related to students' participation acceptance in online exams. Hence, in the following subsection of literature review, we will describe how these factors impact on participation.

Perceived fairness of notarisation process

Not only is online assessment not limited to time and place, as is also the case with online learning systems, but it can also improve the process of traditional assessment method insofar as online exams can save time, offer immediate feedback, reduce resources, keep detailed records and be conveniently used (McCormack & Jones, 1997). However, the fairness of the exam is a very important issue because of the typical notarisation issues that plague online exams. For example, if an online exam cannot identify users, cheating will happen more often (Apampa, Wills, & Argles, 2009). Similar online learning systems, online assessment offers practice and positive learning outcomes (Buzzetto-More & Alade, 2006), although fairness of exam outcomes should be ensured to raise examinees' belief in the trust of as well as their participation acceptance of online exams (Asha, 2008; Doukas & Andreatos, 2006). On the other hand, some studies have noticed that the fairness of online testing has an impact on examinees' participation and have proposed solutions. One such general solution is the use of users' accounts and passwords for identification. Although this is an easy and general method, it is frequently questioned, such as when leaked passwords immediately jeopardize the fairness of the online exam (Apampa et al., 2009). The outcomes of the exam will naturally be questioned if fairness and justice cannot be assured, leading to the loss of meaning of the exam and its impact on learners' participation acceptance for online testing in the future.

In this study, the purpose of the face notarisation coupled with recording system was to verify the identity of each student and prevent cheating behaviours (e.g., impersonation) in online exams in order to achieve notarised fairness. Online exams will only be fair if the system can effectively identify the real identity of examinees. The construct Perceived Fairness of Notarisation Process mainly measures how examinees perceive the fairness of the notarisation process of online exams. And we also explore its impact on perceived trust and participation acceptance. We make the following two hypotheses.

H_{1.1}. The Perceived Fairness of Notarisation Process will positively influence the examinee's Perceived Trust of online exams.

H_{1.2}. The Perceived Fairness of Notarisation Process will positively influence the examinee's Participation Acceptance.

Perceived soundness of online exam policy

In a typical exam setting, classroom regulations focus primarily on limiting students' behaviour: students may not talk or help to each other during the test process. Bugbee (1996) argues that under the exam principles of development, usage, and explanation, computer-based exams have the same efficacy as paper-based ones. Some studies, however, indicate that students tend to violate exam rules in computer-based exam (Buzzetto-More & Alade, 2006). For example, although students comply with exam regulations and act appropriately when taking a traditional exam monitored by instructors, students may use uncharacteristic strategies to obtain better grades on a web-based exam, such as whispering to others in the exam (Apampa et al., 2009). This situation may give rise to feelings of guilt and a sense of violating one's integrity. Aside from putting forward a notarisation process to prevent cheating behaviours in online exams, this study also stresses the need to establish a complete online exam policy (Schroeder, 2013; Wilson, 2004) that increase examinees' trust and participation acceptance in online exams. Online exam policy is defined here as all strategies and regulations used to manage online exams, including punishments for cheating,

credit acknowledgement, question type design, and so on. For example, computerised adaptive testing gives examinees different question items according to their abilities (van der Linden & Glas, 2000), and other studies have proposed methods like randomised items in order to prevent cheating behaviours (Marks & Cronje, 2008; Pain & Le Heron, 2003). These policies above are related to acceptance of participation and the trust of online exams. The construct Perceived Soundness of Online Exam Policy mainly measures how examinees perceive the policy soundness of online exam. In this way, the perceived trust of online exam and examinees' acceptance to participate it are examined through the following hypotheses related to perceived soundness of online exam policy.

H₂₋₁. The Perceived Soundness of Online Exam Policy will positively influence the examinee's Perceived Trust of online exams.

H₂₋₂. The Perceived Soundness of Online Exam Policy will positively influence examinee's Participation Acceptance.

Perceived trust and participation acceptance

A reliable system will make an impact on learners' intention to participate in e-learning (Ong, Lai, & Wang, 2004). Many studies have suggested that the security of information systems (such as systems of e-commerce, e-learning, and e-assessment) has an influence on users' participation (Chen et al., 2008; Ong et al., 2004). That is, when information system quality is reliable, stable, and creditable, users will have higher intention to participate.

Students' learning performance is usually based on the score from the assessment. The evaluations of students' performance are influenced by traditional principles of assessment, such as fairness, trust, efficacy and comparability (Messick, 1994). During the process of a traditional test, examiners are able to monitor examinees' behaviours to detect cheating. Perceived trust offered by computer-based or web-based exam will make an impact on students' participation for these types of exams (Chang, et al., 2011; Newhouse, 2011). Regarding to the Participation, it can be an indicator of students' acceptance of online exams. If the system cannot provide a teacher-assessment environment, the fairness of the online exam will be questioned and challenged by examinees. If students do not trust the exam system, their acceptance to participate in exams will be affected even though teachers have the right to decide the exam format (Chang et al., 2012; Jaillet, 2009; Smith, 2007).

Web innovativeness affects participation intentions (Fang, Shao, & Lan, 2009). In this study, the notarisation process with face recording (technical level) and online exam policy (institutional level) is an innovative implementation that may act as an incentive to attract students to use the online exam system and may influence the acceptance to participate. The construct Perceived Trust measures overall how much perceive trustworthy the examinees have in the online exams, including the perception from technical and institutional levels. The construct Participation Acceptance is used to measure the overall acceptance of participation examinees feel towards online exams. To examine Perceived Trust and Participation Acceptance, the following hypotheses are proposed. Based on the above literature, this study explores whether examinees' participation of an online exam in our research model to discuss and illustrate the relationships between all factors that influence the examinees' participation in online exams (see Figure 3).

H₃. The Perceived Trust of examinee will positively influence the examinee's Participation Acceptance.

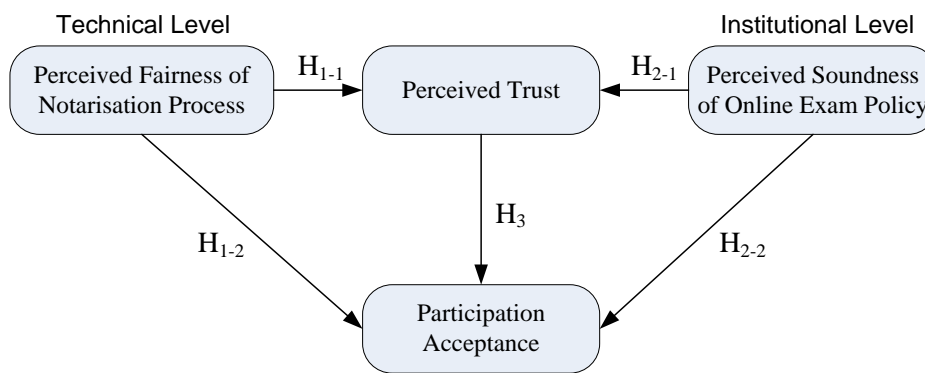


Figure 3. Research model

Methodology

Instruments

The research model proposed in this study had its question items based on four constructs. Some items of the constructs (Perceived Fairness of Notarisation Process, Perceived Soundness of Online Exam Policy) were developed in this study. The items in Perceived Trust and Participation Acceptance constructs were adapted from previously validated instruments for use in an online exam context (Chen et al., 2008; Ong, Lai, & Wang, 2004; Davis & Venkatesh, 1996). In total, 20 question items comprised the preliminary questionnaire. A five-point Likert type scale was adopted to measure the extent of examinees' feelings towards the four constructs from 1 point (strongly disagree) to 5 points (strongly agree). For each construct, sample constructs were compared to identify significant differences. It was hypothesized that significant differences in the participation Acceptance of the online exam would exist between different constructs (Perceived Fairness of Notarisation Process, Perceived Trust, and Perceived Soundness of Online Exam Policy). We collected 128 samples from the pre-test. With the Cronbach's alpha value greater than 0.8, we found the questionnaire to be reliable in the pre-test.

Online exam context and participants

A total of 325 college students from northern Taiwan attending a class of English literature reading given at a centre for General Education took part in the study. This class was split into two semesters. Before the semester ended, the students' learning outcomes were assessed through online exams. The main type of question items in this study was multiple choice questions. The instructors needed to first upload pre-set question items to a database and also to define the difficulty of each item according to the question content, with difficulty levels ranging from difficult, medium, and easy. For example, an instructor might wish to set an exam level that had 20% with difficult, 50% with medium and 30% with easy questions. The instructors only needed to adjust the difficulty settings of exams to the aforementioned proportions, and the system would then randomise the exam items for each examinee. Therefore, while examinees were examined under the same level of difficulty, they received different exam items. In addition, the exam took place in the computer centre of the school where examinee seating was determined randomly on the spot so it was impossible to know beforehand where the examinees would be sitting.

The study used a face recording system, a webcam embedded in a computer monitor (see Figure 4), at the beginning of course registration and added a notarisation process to verify the identity of each student. At the beginning of a class, a teacher or teaching assistant confirmed students' identification using the students' photos (see Figure 5). If students had registered and uploaded a photograph, the system showed a photo confirmation date and notes who confirmed the photo. Then, the registered photos were compared with the photos captured by the online exam process (see Figure 6). After the exam, the students were asked to complete a questionnaire. After the removal of invalid samples, a total of 301 valid ones remained. The response rate was 92.6%.

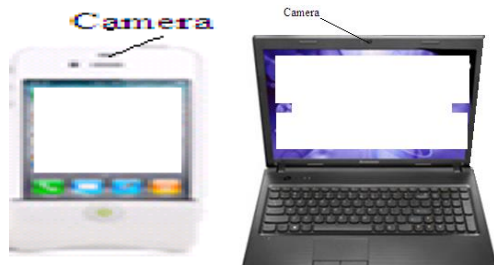


Figure 4. Webcam embedded to the monitor screen



Figure 5. Registration confirmation



Figure 6. The image capture process of an online exam

Data analysis

This study adopted the maximum likelihood method to estimate the model's parameters. According to the subject-to-variable ratio, the ratio should be no lower than 5 (Bryant & Yarnold, 1995). Structural equation modelling (SEM) is used in this study in order to estimate the measurement and structural model so as to determine whether the study's assumptions are a good model fit after analysis and modification (Ngai, Poon, & Chan, 2007).

To examine this model, the first step is to determine the construct validity, which involves the verification of the hypotheses of this study. Factor analysis and path analysis are the basic tools used to verify the construct validity of a model. Table 1 lists the findings from the exploratory factor analysis (EFA). All items are good fit into 4 factors.

Table 1. Results of exploratory factor analysis

Items	Factor			
	Factor 1	Factor 2	Factor 3	Factor 4
Perceived Trust 1	.771			
Perceived Trust 2	.744			
Perceived Trust 3	.687			
Perceived Trust 4	.598			
Perceived Trust 5	.578			
Participation Acceptance 1		.785		
Participation Acceptance 2		.697		
Participation Acceptance 3		.643		
Participation Acceptance 4		.639		
Participation Acceptance 5		.617		
Perceived Fairness of Notarisation Process 1			.750	
Perceived Fairness of Notarisation Process 2			.709	
Perceived Fairness of Notarisation Process 3			.678	
Perceived Fairness of Notarisation Process 4			.566	
Perceived Soundness of Online Exam Policy 1				.815
Perceived Soundness of Online Exam Policy 2				.793
Perceived Soundness of Online Exam Policy 3				.680
Perceived Soundness of Online Exam Policy 4				.584

Initially, the questionnaire contained 20 items, but two poorly performing items were deleted during exploratory factor analysis (EFA) to make the model more stable. Thus, the final version of the questionnaire contained 18 items (see Appendix A). According to Nunnally and Bernstein (1994), Cronbach's alpha can be deemed reliable if its value is at least 0.7. The value of Cronbach's alpha for the four constructs in this research was greater than 0.87.

The average variance extracted, which is used to measure the discriminant validity of each construct, is only acceptable when it is greater than 0.5 (Fornell & Larcker, 1981). The average variance extracted was generally higher than 0.70. Additionally, the KMO test was 0.96, which indicates that the questionnaire was well-designed in this study. The reliability and validity of this questionnaire are both acceptable.

Model testing results

Many indices can be used to assess the fit of a model (Schumacker & Lomax, 1996). This study uses indices suggested by Hoyle and Panter (1995). In general, the closer the observed data is to the research model, the better the fit of the model, and the easier it will be to satisfy the thresholds of index values. As shown in the presentation of this research model in Figure 7, and the criteria for the evaluation of the model: (1) $\chi^2/\text{d.f.} = 2.41 (< 3.0)$; (2) the Goodness-of-fit index (GFI) = 0.95 (> 0.9); (3) the Normed fit index (NFI) = 0.97 (> 0.8); (4) the Relative fit index (RFI) = 0.96 (> 0.9); (5) the Incremental fit index (IFI) = 0.98 (> 0.9); (6) Root mean square residual (RMR) = 0.059 (which is close to the recommended value less than 0.05); (7) and the Root mean square error of approximation (RMSEA) = 0.068 (< 0.08). Most index values comply with the threshold values, and the estimates of the regression weights are significant at $p < 0.05$ (as shown in Table 2).

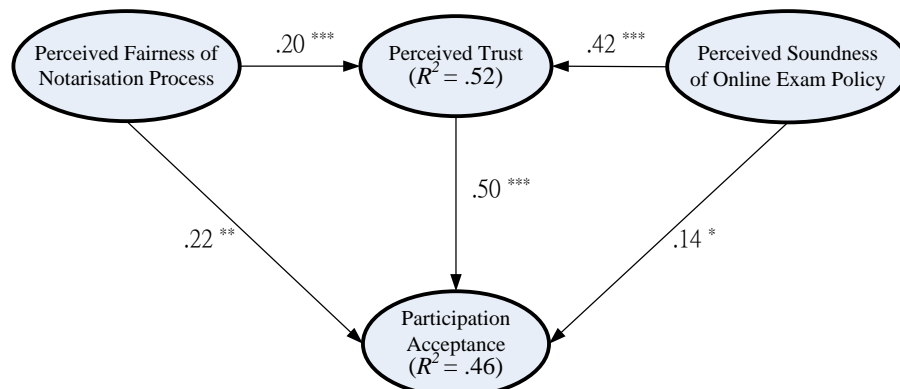


Figure 7. The results of research model

Table 2. Standardized regression weights

Hypotheses	Independent variable	Dependent variable	Estimate	P-value
H ₁₋₁	Perceived Fairness of Notarisation Process	→ Perceived Trust	0.20	***
H ₁₋₂	Perceived Fairness of Notarisation Process	→ Participation Acceptance	0.22	0.001**
H ₂₋₁	Perceived Soundness of Online Exam Policy	→ Perceived Trust	0.42	***
H ₂₋₂	Perceived Soundness of Online Exam Policy	→ Participation Acceptance	0.14	0.047*
H ₃	Perceived Trust	→ Participation Acceptance	0.50	***

Figure 7 shows the causal relationship between the constructs and the standardised path coefficients. In the results of the H₁₋₁, face notarisation and recording technology increase the fairness of the online exam. This factor of Perceived Fairness of Notarisation Process significantly ($*** p < 0.001$) affects the Perceived Trust of the online exam.

From the results of the H₁₋₂, the factor Perceived Fairness of Notarisation Process significantly ($** p = 0.001$) affects the examinees' Participation Acceptance for the online exam. The results from H₂₋₁ also reveal that the antecedent variable of Participation Acceptance, Perceived Trust, is significantly ($*** p < 0.001$) affected by the Perceived Soundness of Online Exam Policy.

The results from H₂₋₂, it can be seen that the Perceived Soundness of Online Exam Policy significantly ($p < 0.05$) affect Participation Acceptance. Finally, the results from H₃ indicate that the antecedent variable, Perceived Trust does significantly affect ($p < 0.001$) the Participation Acceptance. Hence, H₁₋₁, H₁₋₂, H₂₋₁, H₂₋₂, and H₃ are all supported. Further, the explained variances include Perceived Trust ($R^2 = 0.52$) and Participation Acceptance ($R^2 = 0.46$).

As depicted in Figure 7, there is a strong relationship between Perceived Soundness of Online Exam Policy and Perceived Trust ($\beta = 0.42, p < 0.001$), as well as Perceived Trust and Participation Acceptance ($\beta = 0.50, p < 0.001$). This suggests that the completeness of the online exam policy has an impact both on students' perceived trust of the exam process, as well as directly and indirectly on students' participation acceptance for the online exam. In addition, although the relationship between the Perceived Fairness of Notarisation Process and Perceived Trust (H₁₋₁, $\beta = 0.20, p < 0.001$) is less strong than that between Perceived Soundness of Online Exam Policy and Perceived Trust (H₂₋₁, $\beta = 0.42, p < 0.001$), the Perceived Fairness of Notarisation Process actually has a statistically significant impact on the Perceived Trust of the exam process, and directly and indirectly on the Participation Acceptance of the online exam. This finding importantly confirms that students will more likely trust and participate in future online exams.

Discussions and conclusions

This study discovered that the most significant determinant affecting examinees' Participation acceptance for the online exam was Perceived Trust. This implies that the more reliable and credible examinees feel about the online exam, the more acceptance they will be to participate in it. This finding is consistent with prior studies (Chang et al., 2011; Newhouse, 2011). After all, an online exam via a webcam and the Internet is relatively stranger and more unfamiliar to examinees compared to a paper-based test in the traditional classroom. For most examinees, it is a whole new experience to take this type of exam. In Taiwan, during paper-based tests, one or two examiners typically monitor the exam in order to prevent cheating behaviours. Examinees can submit their examination papers after answering all the questions, and they don't have worry about possible system problems associated with online exams, such as system crashes, network disconnections, or unexpected situations due to unfamiliarity with the operation of online exam system. Even though examinees may want to cheat during an exam, they have to bear the risk of being punished with a zero score or possible expulsion, which is an effective deterrent for most. This mechanism of with monitoring and punishment is believed to be essential for fairness and test trust crucially depends on it. As such, the same mechanism should also necessarily be established for online exams.

In order to increase examinees' perceived trust of an online exam, the study aimed to develop an online exam environment from the two perspectives of technical level and institutional level. Regarding the former perspective, this study found that when examinees felt the notarisation process was fair, they perceived the exam to be more reliable. In order to prevent the problem of fake ID due to the inability to verify users' authentic identity (Apampa, 2010), we combined face notarisation with face recording to increase the system's capability of verifying real identity of each examinee to avoid fake ID or other cheating behaviours. In traditional exams, examiners have to monitor all examinees in the classroom to detect other cheating behaviours, such as using cheat sheets, peeping at others' answers, and delivering short messages. These behaviours are fleeting and are not easily identified, which can cause a heavy load on the examiners' attention. In contrast, every webcam represents each examiner's eye during online exam. The notarisation process conducted by this study can take photo of examinees randomly for authentic identity, and take video files to monitor the whole exam process and record them in database. If an examinee is suspected of cheating, examiner can check the video files to decide after the fact whether he or she was cheating or not during the online exam. The goal is to achieve the fairness of the notarisation process during an online exam. As concluded by Asha (2008), and Doukas and Andreatos (2006), once online testing can offer a fair exam environment like that of traditional exams, examinees will feel the exam is trustworthy and their participation acceptance will increase. The Notarisation process developed in this study not only replaces the simple verification process of checking accounts and passwords, but also gives up the complicated task of fingerprint recognition in order to achieve a fair notarisation process.

Another very significant determinant which raised examinees' Perceived Trust of online exam was the Perceived Soundness of Online Exam Policy. From the perspective of the institution level, this study found that the more sound examinees felt about online exam policy, the more reliable they felt the exam was. This also suggests that when

information and communication technology is integrated into the scenario of an exam, more and more management issues related to online exams will emerge. For this reason, administration should establish and develop a sound online exam policy in an attempt to effectively manage the operation of online testing. An example of this is examinees having to complete answers within a valid visible scope and rotational angle of the webcam with the system immediately issuing a warning ten seconds after the system cannot detect the examinee's face; when the number of warnings amounts to three, the system will log out automatically, terminating the exam session. In addition, the types of questions used on online exams should warrant closer scrutiny in future work. In Taiwan, traditional test items include yes/no, multiple-choice, and short-answer questions, but given that there are standard answers for yes/no and multiple-choice questions, cheating behaviours for these types are more widely seen in both online and traditional exams (King et al., 2009). This study used randomised items and randomised seating as part of their strategies of online exam policy to decrease the possibility of cheating. However, smart phones, for example, have become popular as a covert device that can deliver short messages to facilitate the cheating behaviour. The best way to prevent this from happening during online exams is to redesign different types of questions suitable for different disciplines, such as "open-book" questions, which do not have standard answers. In order to prevent examinees from plagiarizing articles from other websites, the screen can be locked until the end of exam, denying access to Internet websites, such as Google, Wikipedia, and Facebook. In summary, as long as administration is able to establish a sound online exam policy to effectively manage the exam operation in addition to a fair notarisation process, examinees will think that online exams are more reliable, thus encouraging their higher participation acceptance for future online exams.

According to discussion and conclusion, this study offers several suggestions from technical and institutional levels for the development of online exams in the future.

- School administration should play the role of manager of making policy, of continuously developing contemporary online exam policy, strategy, rules, rewards and penalties, and of establishing a complete process to effectively manage the operations of the online exam.
- School administration, such as that relating to the computer centre, should play the role of monitor carrying out policies, and continue to develop more advanced equipment of information technology, which are applied in the online exam environment in order to ensure the fairness and justice of the exam process. Although the notarisation process proposed in this study can achieve fairness, information technology continues to evolve and users' behaviours keep changing, such as with the use of smart phones combined with Apps to deliver instant messages. Therefore, only by continuously developing more advanced hardware and software of information technology and applying them into online exams can students be prevented from adopting next generation information technologies in cheating.
- Educators should reconsider the impact of IT on the pattern of traditional exam. They should thoroughly redesign all new exam types and processes based on the characteristics of online exams. For example, an open-book type of online exam allows examinees to surf the Internet, but should use a checking system to ascertain whether answers are copied; examinees should also be prohibited from using handheld mobile devices to communicate via text or spoken secret messages.

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Appendix A

Question items used in this research

Item statement	Reference
Perceived Fairness of Notarisation Process	
	Self-developed
1. I feel that the notarisation process can prevent cheating behaviours in online exams.	
2. I feel that face recording is an effective method for authenticating examinee identities in online exams.	
3. I think that the chances of impersonation are very low if a webcam is used to photograph and record examinees.	
4. From technical level, I think that the online exam is fair to identify examinees' real identities.	
Perceived Soundness of Online Exam Policy	
	Self-developed
1. I feel that randomizing items is a good strategy that can prevent cheating behaviours in online exams.	
2. I feel that school provides complete online exam regulations and processes.	
3. I would not dare to cheat as any violation of the exam rules might result in punishment from the school.	
4. From institutional level, I think that the online exam policy is sound to manage online exams.	
Perceived Trust	
	adapted from Chen, Hsieh, & Tsai (2008); Ong, Lai, & Wang (2004)
1. I feel that the notarisation process used to authenticate examinee identities is reliable.	
2. I feel that the strategies used to prevent cheating behaviours in online exams are trustworthy.	
3. I feel that the information security of online exam is creditable.	
4. I feel that the efficacy to manage online exams is believable.	
5. Overall, I think that the online exam is trustworthy to me.	
Participation Acceptance	
	adapted from Chen, Hsieh, & Tsai (2008); Davis & Venkatesh (1996)
1. I am satisfied with the online exam experience.	
2. I can accept that evaluations of my learning outcomes through the online exams.	
3. I can accept the inconveniences that occasionally occur due to lack of familiarity with computer operations during online exams.	
4. I can accept the eventuality that more courses will be conducting their exams online in the future.	
5. Overall, I am accepting of participation in next online exam.	