A Comparison Between Offline and Multimodal Online Platforms at English Standardization Tests for College Students

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Abstract. English standardization is needed by a college to ensure the quality of knowledge and skills of their students before they join the international learning and research culture there. As a campus that has an international vision, Institut Teknologi PLN (ITPLN) created two English tests in for the students which are implemented at the beginning and at the end of their study time. The standardization test is meant to know the English knowledge of the students and map their weakness in English so that the lecturers can organize a more precise English learning system. The research based on the English standardization test, which was already done in two different forms, the offline paper-based and the multimodal-online-based. The article is aimed to present the comparison between those forms, the arrangement of the online test, the methods to overcome the proctoring problems, and the results. The result shows that the online test decreases the usage of time, human and other resources by 70% and with a multimodal system, increase the questions variations and types by 50%, thus they increase the effectivity of the test by 75%.

Keywords: English Standardization · multimodal online test · proctoring · cheating problems

1 Introduction

English is considered a foreign language in Indonesia since the government stated the 1974 curriculum. Now that English was erased as a subject in elementary schools and reduced in junior and senior high school in the 2013 national curriculum, shows that the government is not really serious in preparing the youth in order to compete in this globalization era [1]. This also added by the fact that although it is studied from the entry level, college students are still struggling with even some basic daily English. The reasons may vary, but it can be concluded into several things, among others: the thought that English is only a subject in school, not a life skill [2, 3], the thought that English is only needed when they are going abroad, and work does not need such skill [4], and the dependency on the online/offline translation and grammar check applications [5].

Indonesia is listed number 80 from 112 countries and provinces at the 2021 EF English Proficiency Index (EF EPI) with 'low proficiency' status [6]. This is rather unpleasant for a country that has many roles in an international level for many decades and wanted to do more in the future. Crystal [7] pointed out that English has become a global language in 2003 and with the development of the internet nowadays, it becomes more and more useful as a mean of communication. Rao [8] even explains the use of English as the language of research. It means, Indonesia will be left behind in scientific and research communities around the world if it is not aware of the importance of English.

Institut Teknologi Perusahaan Listrik Negara (ITPLN) puts the word 'International' at its campus vision and it makes English skill is a must for all ITPLN civitas Academica. One of its realizations is to hold two English tests for the students, one in the first semester, and the second one in the last semester. The one that is held in the first semester is meant to map the students' English knowledge and skills and thus creates a minimum standard for all students. The result of this test (including its training and re-test) is then distributed to an English lecturers' team to be used as a starting point in making a focused English learning system.

From 4 years of this test's implementation, the number of students who passed the minimum passing grade is roughly 50%. For those who falls behind the minimum standard, the campus through its language centre—that also acts as the test organizer— would give a comprehensive training and allow them to do a re-test. The training and re-test usually improve their knowledge and skills, and approximately left another 50%. The 25% left are the designated to do an English training and workshop in the next semester.

The goals of this program are as follows: 1) to let the students know that the campus has a standard for English skill; 2) to map the English knowledge and skills of the students; 3) to create a focused English learning system that fit to the campu's requirements for the graduates; and 4) to improve the campu's reputation in both national and international levels.

English knowledge and skills standardization program was started in 2018 by giving a test for 750 students from first semester. The test was done in ITPLN auditorium that can hold around 200–250 seats (theatre style) in one session. It was a 50 questions paper-based test with 4 question types. The test itself covers listening comprehension, basic grammar, and reading comprehension and should be done within 60 min time by the participants (Fig. 1).

It was successfully done but still raises several problems, such as:

The preparation, we need to handle the advertisement, the registrations, the scheduling, the room preparation, and the administration papers.

The crowd management, since we need to handle 750 participants (which are separated into 4 group schedule), we had to to invest some time to handle the in-between schedule (the time when the first batch finished and the second batch is about to start), the seating arrangement, the test papers spreading, the rules reading, etc. We had to spare 30 min for the in-between schedule to do those things.

The proctoring, to maintain the quietness of the test, we had to put 6 proctors for each 2 rows (there were 12 rows) and equipped them with stationaries to be lent to the participants should they needed them.

Fig. 1. Paper-based English Standardization test

The scoring, certificate printing, and distribution, although we used the creaser/perforator (paper scoring machine), we still needed to arrange the lists manually; and it consumed so many times. It took us about 2 weeks of workdays to finish that, and another month to distribute those certificates.

The pandemic pushed us to do some changes on the arrangements of the test. We were required to shift our test methods into something that was less crowd gathering model. Thus, we created an online-based test system.

The plan was simple, the system should be done online but with enhanced testing questions and types and quite similar proctoring system. We realized that the online system is full of gap, including chances of cheating for the participants. After 6 months of creating and pre-testing the system, the first online standardization test was held in January 2020.

2   Methods

The methods used to structure and develop the test is done by giving a multimodal test with more various types of questions, and since we are using the online system, the wider test questions media. It is necessary for both students and lecturers. The students will have a larger chance to express their knowledge and skills while also review their attainment from the result and the feedback and the lecturers will gain a better mapping from the result [9, 10, 11].

The process of properly constructing and selecting questions is important for the transfer and evaluation of knowledge in a testing environment [12, 13]. It was done to achieve two objectives: 1) develop a wider array of the knowledge and skills mapping; and 2) ensuring the participants engagement throughout the test.

As for the research flow, we started by designing the framework of thinking (Fig. 2) and followed by structuring the research flow diagram (Fig. 3). In the framework of thinking, we configured the problems and starting to work our solution through the process by determining the language programming, the pre-test, and the test up until we find the result. It was then continued by making the flow diagram on how we had to make the system.
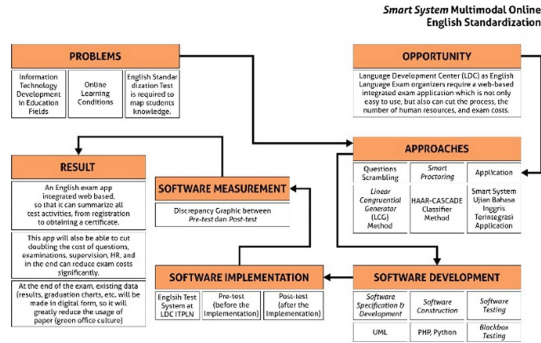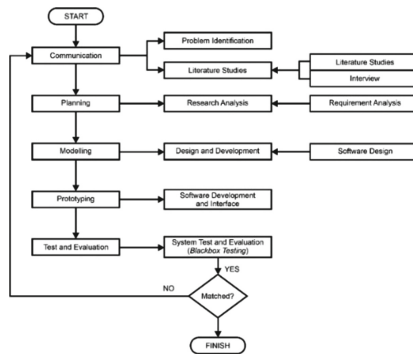
Fig. 2. Framework of Thinking

Fig. 3. Research Flow Diagram

After finished with the phases of making the system, i.e., data collection, modelling, prototyping, application testing, and evaluation testing, we started to regulate our test implementation as described in Fig. 4.

In Fig. 4, it can be seen a model of the examination process that is integrated in one website. The committee admin determines the time of the exam that is adjusted to the campus academic calendar, then releases it on social media. Prospective participants visit the LDC website, press the exam menu, select the type of exam, and then register. After the registration is activated by the administrator, prospective participants then receive an email containing their usernames, passwords, and WA (WhatsApp) group link as a means of initial communication. On the day of the exam, participants enter the website and log in. After that, participants can take the exam according to the allotted time. After completion, participants get a score according to their exam results and get the option to download the certificate.

To overcome the cheating problems, we employed two methods, namely the Linear Congruential Generator (LCG) to scramble the questions, and the Haar-Cascade Classifier (HCC) method for live-view proctoring. Linear Congruential Generator is one type of pseudo-random number, which uses a linear model in generating large random numbers effectively [14]. The LCG mathematical model can be calculated using the
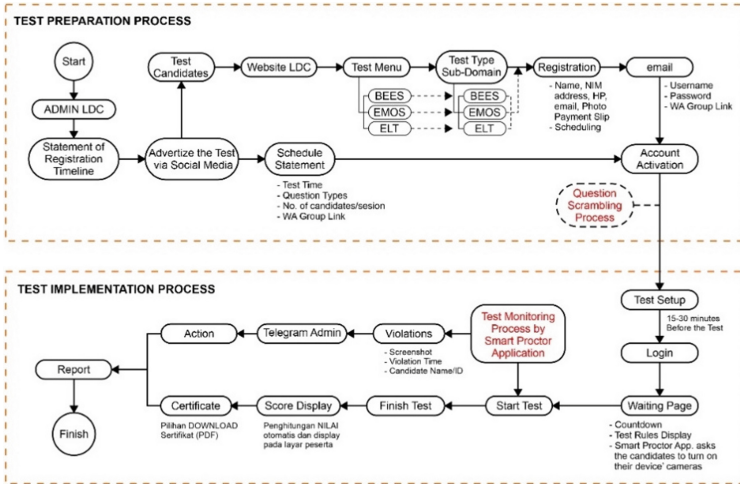
Fig. 4. Integrated Process Flow in a Test Activity

equation:

$$Xn = ((a(Xn − 1) + c)) \bmod m \tag{1}$$

where:
   Xn = nth random number from the series.
   $Xn\text{-}1$ = Previous random number.
   a = Multiplier Factor (switch).
   c = Increment.
   m = Modulus (maximum limit of random numbers).
   a, c, m are all constants of Linear Congruent Method (LCM).
   The conditions for selecting each parameter in Eq. (1) are as follows:

1. m = modulus, $0 < m$
2. a = multiplier (multiplier), $0 < a < m$
3. c = Increment, $0 < c < m$
4. $X0$ = initial value, $0 < X0 < m$
5. c and m are relative prime numbers.
6. $(a−1)$ is divisible by the prime factor of m
7. $(a−1)$ is a multiple of 4 if m is also a multiple of 4
8. For the constant c, it must be an odd number if m is a power of 2 and cannot be a multiple of m.

The hallmark of the Linear Congruent Method is that it repeats itself over a certain period of time, or it can be said after several times of generation. This is one of the characteristics of the LCG method and pseudo-random number generator in general. Determination of constants in the LCG method, namely a, c, and m, greatly determines on whether a random number is generated in the sense that there is no repetition.

LCG has advantages in speed because it requires little bit operations but the order in which random numbers appear, is easy to predict so it is not cryptographically secure. In addition, LCG can be applied to other simulation applications because this algorithm is very efficient in processing time and saves memory usage [15]. Haar-Like feature is often used in the process of detecting objects in digital images. Haar refers to a mathematical function (Haar Wavelet) in the form of a box, which has the same principle as the Fourier function. At the beginning, the algorithm used for image processing was seen from the RGB value at every pixel but is considered less effective.

The Haar-Like feature processes the image in the form of a box, where there are several pixels in it. From each box, it is processed to get values for dark and light areas which will later be used as the basis for image processing. For the type of media via video, the calculation and summation are carried out as a whole so that the time used is longer. To get around this, an integral formula is used which can calculate faster. One of the Haar-Like feature processing that can be organized is in the cascade classification [16].

Cascade classifier is a classification that has many examples of objects consisting of positive and negative objects. Viola-Jones then created an algorithm that is in line with the combination of the cascade classifier so that the detection speed can be increased by only focusing the search on potential areas in the image [17]. This algorithm consists of several levels where each level produces a sub-image that is believed to be negative. This is because it is easier to recognize a negative sub-image than to recognize a sub-image which is a positive object [16]. The research on this English Standardization Test at the research site is based on the identification of problems that have been studied previously.

We compared the results of both offline and online standardization test based on their time consuming, human resources needed, questions varieties and types, also the other resources needed on them as it was done before by Ashby et al. [18] and based on the articles by Boitshwarelo et al. [19] and Alruwais et al. [20]. This comparison is needed to determine whether the online test is better than the offline or just the other way around.

3   Results and Discussions

The comparison covers all the main preparation, implementation, reporting stages of the test and involved the test questions, human resources, and other resources arrangements as it can be seen at Table 1.

From the Table 1 above we can determine that the human resources power reduced by 72,7%, the time usages reduced by 75.5%, the operational cost reduced by 39%, and thus, the effectivity is increased by ~75%. The requirements during the tests, both offline (paper-based) and online (multimodal online-based) was also done to display the automation presented by the online test. The comparison is shown on Table 2.

The questions spreading and variations is also compared due to the development using multimodal media on the online side. The result is shown on Table 3.

The variation of test questions and types are increased by 50% by adding another 3 variations, namely: the life/social skills, photo-audio comprehension, video questions that still presented scrambled and will appear on different number for each participant.

By the system, the types of question packages is also increased by 50% from the ease of question management feature in the system (Fig. 5).

The English Standardization Test is included in a website managed by the ITPLN Language Development Center (LDC) and holds 3 different test and many other services. This system is implemented on a web-based exam system according to the system design, database, and interface. The implementation is the stage that is carried out after the system

Table 1. Comparison between offline and online English Standardization Test

No	Elements		Personnel (max. Pax)		Time Taken (work days)		Info
			offln	onln	offln	onln	
1.	Preparation						
	a.	Notification	2	1	2	1	Printing, spreading
	b.	Registration	6	1	10	1	Setup, service
	c.	Scheduling	2	1	5	0	Setup, service
	d.	Administrations	2	1	5	1	Lists Printing
	e.	Test Questions	8	4	3	2	– Multiplying papers
	f.	Test types					– Test Variations
	g.	Question variations					– Test Types
		Subtotal	**20**	**8**	**25**	**5**	
2.	Implementation (Test Days/schedule)						
	a.	Schedule flow	20	5	5	4	Crowd management Seating/schedule Test policies
	b.	Test Sheet spreading					
	c.	Proctoring					
		Subtotal	**20**	**5**	**5**	**4**	
3.	Reporting/Administration						
	a.	Test Scoring	10	0	5	0	Manual vs Automatic
	b.	Certificate Printing	3	0	5	0	
	c.	Data Management	2	1	5	2	
	d.	Data Summary					
	e.	Maintenance	-	1	-	4	
		Subtotal	**15**	**2**	**15**	**6**	
		Total	**55**	**15**	**45**	**15**	*rough numbers*

(continued)

Table 1. (*continued*)

No	Elements		Personnel (max. Pax)		Time Taken (work days)		Info
			offln	onln	offln	onln	
		Decreased %		↓73%		↓75%	

creation has been completed. The result of this implementation is a system that is ready for testing.

a. Question Arrangement and Randomization System (Administrator/Test Officer)

Administrator Login Page, Administrator(s) can access the web page that has been created and login by entering the email address and password (Fig. 6).

Manage Question Types Page, the question types are the available question file spaces. Administrator can add question types to increase the level of randomization of questions to participants (Fig. 7).

Add Questions Page, on this page, the administrator can add questions to the selected question type file. The questions will be randomized by themselves based on the participant registration and verification process. On this page the question must be accompanied by the answer at once. Questions can be in the form of audio, text, or images (Fig. 8).

Exam Schedule Settings Page, administrator can add or reduce the exam schedule in accordance with the results of the agreement/order from the head of the laboratory and has been distributed to prospective participants (Fig. 9).

Exam Results Page, after the exam session is done, the administrator can display and download the general exam results (the entire schedule) to be able to find out the statistics of the test participants (Fig. 10).

Exam Results According to Schedule Page, administrator can also view and download exam results according to a pre-set schedule. This is intended to make it easier for admins to make reports (Fig. 11).

b. Smart Proctoring

Login Page, this page is the page that participants use to access the exam portal. On this page, participants need to enter their username and password that have been sent to their respective emails (Fig. 12).

Setting Up the Camera Display, as soon as the participant presses the "Start" button, the exam will start along with the start of Smart Proctoring application. Before the camera starts to turn on the system will give an alert that the camera is being set up (Fig. 13).

Exams Page Display, after the camera is turned on successfully, the examinee's face will be displayed on the right side of the screen. The green square box marks the detection edge of the participant's face (Fig. 14).

Display When Participants Cheat, when the system does not detect the presence of a participant's face perfectly (the green box does not appear), an alert will be displayed to the participant that cheating has been detected and the participant's exam screen will freeze. The participant screen will reactivate after the participant returns to his normal position (a green box is visible) and presses the "OK" button (Fig. 15).

Table 2. The Requirement Comparison

No	Element		Bees Test Activities	
			Offline (2017–2019)	Online (2020-NOW)
1.	*Preparation*			
	a.	Notification	Design, Printing, spreading	Design, uploading
	b.	Registration	Setup, list, direct service	Automatic on the website
	c.	Scheduling	Setup, list, direct service	Automatic during registration
	d.	Administrations	Schedule, presence Printing	Automatic by the app. System
	e.	Test Questions	Multiplying test papers Multiplying answer sheets Same questions arrangements	Automatic by the app. System Automatic Scrambled questions
	f.	Test types		
	g.	Question variations		
2.	*Implementation (Test Days/schedule)*			
	a.	Schedule flow	Crowd management Seating arrangement Schedule administration Test policies	Online group control Online proctoring (1 proctor/group) using multi-screen live feed Automatic proctoring (device camera) Auto-screen freeze on visible violation
	b.	Test Sheet spreading		
	c.	Proctoring		
3.	*Reporting/Administration*			
	a.	Test Scoring	Manual scoring	Automatically appear after the test
	b.	Certificate Printing	Manual printing	Automatically sent after the test
	c.	Data Management	Manual composing and summarizing	Automatically composed and summarized
	d.	Data Summary		

Table 2. (*continued*)

No	Element		Bees Test Activities	
			Offline (2017–2019)	Online (2020-NOW)
e.		Maintenance	Manual archiving Space-taking documents	Automatic digital archiving App. System maintenance

Table 3. Comparison between offline and online English Standardization Test (Test Question Variations and Types)

No	Test	Variations			
		Number of Questions	Question variations	Test types	Time
1.	Offline paper-based	50	3 (Listening, grammar, reading)	4 (A/B/C/D)	60 min
2.	Online web-based	50	6 (Listening, grammar, reading, life/social skills, photo-audio comprehension, video)	8 (A/B/C/D/E/F/G/H)	60 min
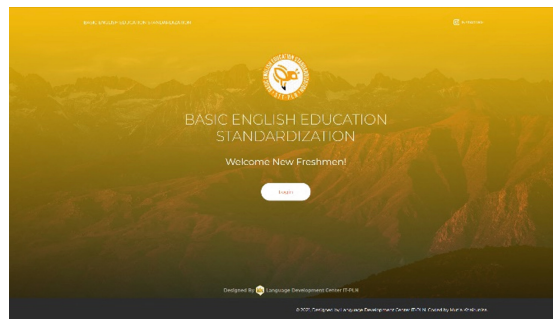
Fig. 5. English Standardization Landing Page

Cheat History Page, examinee data, both test result data and cheating history will be stored in the database and displayed on the Cheating Details page (Fig. 16).

Cheat History Validation Page, on this page the proctor can validate whether the results obtained are valid to be considered as fraud or not (Fig. 17).
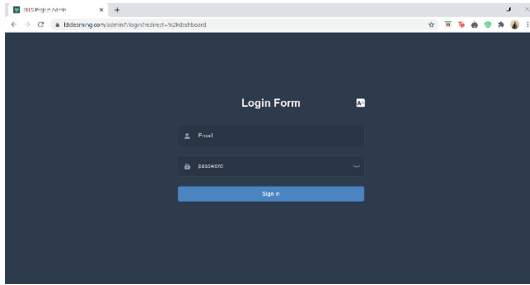
Fig. 6. Administrator Login Page
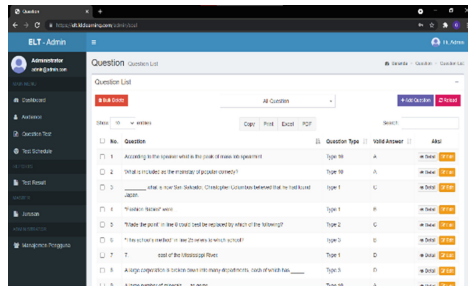
Fig. 7. Manage Question Types Page
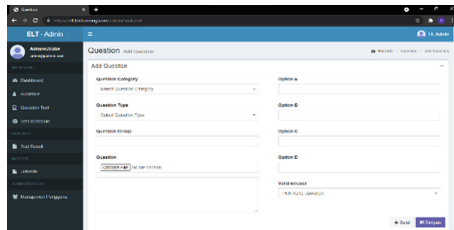
Fig. 8. Add Questions Page
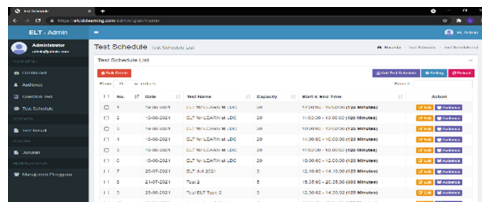
Fig. 9. Exam Schedule Settings Page
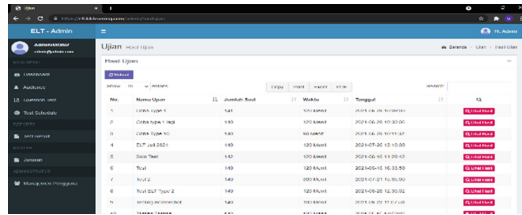
Fig. 10. Exam Results Page
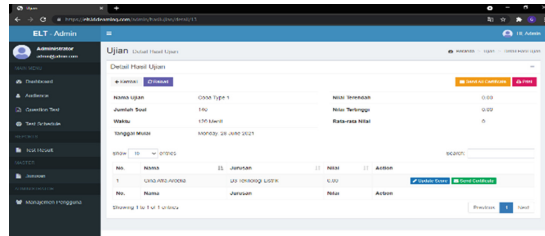
Fig. 11. Exam Results According to Schedule Page
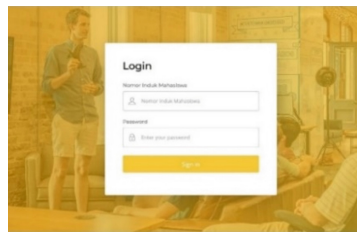
Fig. 12. Login Page
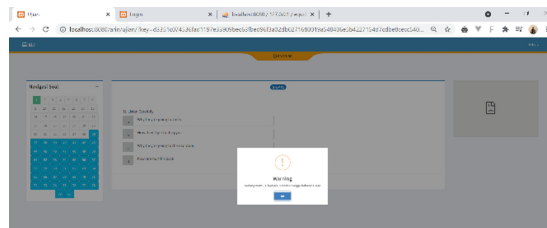
Fig. 13. Setting Up the Camera Display

4   Conclusions

Based on the results of the discussion and research that has been carried out, the following conclusions can be drawn: 1) The multimodal online test reduced the number on time, human resources, and other resources by more that 70%, and increase the effectivity of
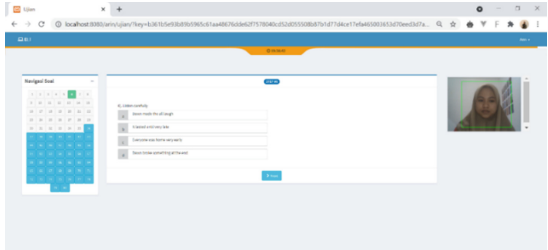
Fig. 14. Exams Page Display
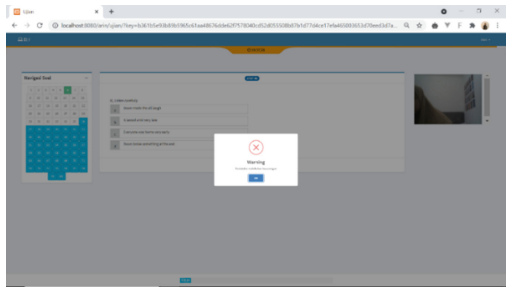
Fig. 15. Display When Participants Cheat
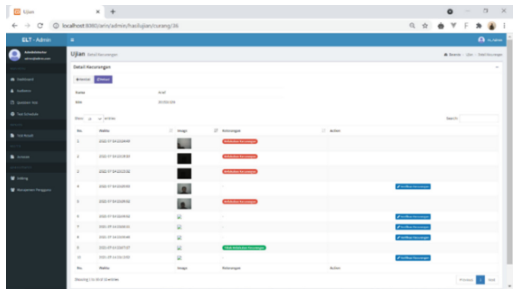
Fig. 16. Cheat History Page

the test by 75%. The questions variations and types are also increased by 50%. 2) The application of the Linear Congruential Generator (LCG) method for randomization of questions is intended to reduce as much as possible cheating actions because the system is made for a web-based online exams, both on-site online, or off-site online. 3) The Smart Proctoring system is formed by the Haar-Cascade Classifier method which focuses on fraud detection in accordance with the rules described in the proposed system analysis. This web-based exam system is an integrated system that includes a registration system, validation, schedule selection, randomization of questions, smart proctoring, display of final exam results, and certificate generator. This system is expected to make a positive contribution to the form of online exams, especially in colleges.
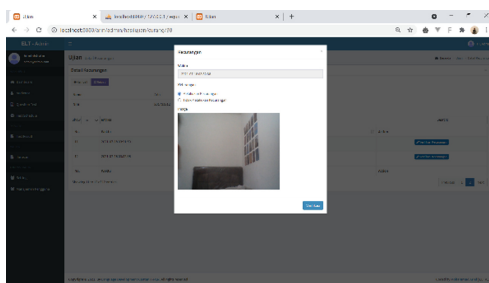
Fig. 17. Cheat History Validation Page

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