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Development of digital-based assessment instruments as an effort to minimise cheating in exam implementation

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ABSTRACT

This research aims to design and develop digital-based assessment instruments to minimise cheating in the implementation of exams and wants to know the effectiveness of the development of digital-based assessment instruments in minimising cheating. The method used in this research is the Research and Development method with the ADDIE development model, namely analysis, design, develop, implement, and evaluate. The subjects in this study were material experts, media experts, and students of PAI study programme class C-D in the second semester of academic year 2024/2025. The object of development in this study is a digital-based assessment instrument with a descriptive quantitative approach. The data collection instrument uses a questionnaire which is used to collect quantitative data. The results of this study explain that the validity of the development of digital-based assessment instruments as an effort to minimise cheating in the implementation of exams has been tested valid and feasible to use. At the validation stage, media or IT experts gave an average score percentage of 78% (good) and at the material expert validation stage obtained an average score of 88% (very good) with the conclusion that this assessment instrument was feasible to use. The results of the effectiveness test stated that the score on the implementation of the post-test was smaller than the pre-test with a score difference of 25.96, which means that the development of digital-based assessment instruments is proven to prevent and minimise the level of cheating.

Introduction

School examinations are an integral part of the education system. Students' understanding and achievement of learning materials can be measured through examinations. Examinations are also used to identify which parts of the material require further support, to evaluate students' comprehension of the subject matter, and to provide feedback on learning progress for both teachers and students (Yudhistira, 2024, p. 88). School examinations can be conducted in written, oral, practical forms, or a combination of these types. In addition to

serving as an assessment tool, school examinations also function as a medium to prepare students for larger standardized tests, such as national examinations or university entrance examinations. Therefore, it is important for schools and educators to plan and implement examinations carefully in order to provide an accurate picture of students' learning progress.

Traditionally, examinations have been conducted using conventional methods known as Paper-Based Tests (PBT), which utilize paper and pens as assessment instruments (Ratna Widya Wijayanti et al., 2023, p. 128). In this system, students answer questions by writing their responses on answer sheets. The assessment process does not end there; to determine the results of the learning evaluation, educators must examine each answer sheet individually. This process is undoubtedly time-consuming and requires considerable effort. Along with the development of the times, examination practices have continued to evolve. Some educators have begun to move away from conventional assessment methods and shift toward utilizing digital technology.

Currently, education has entered the era of Society 5.0, which demands innovation in traditional educational models and methods toward digitalization (Palaloi et al., 2023, p. 1383). In this era, learning concepts are implemented by maximizing the use of technology. Assessment processes supported by digital technology are considered more optimal. The advantages of digital technology include more varied and interactive forms of assessment, as well as the ability to provide faster and more accurate feedback to students. In addition, the use of digital technology can help minimize educators' administrative burdens in the evaluation process, allowing them to focus more on developing effective learning strategies.

One digital platform that has become familiar among educators is Google Forms. In addition to being practical to use, this platform provides a quiz feature that can automatically assign scores to each answer, making it easier for educators to assess students' performance. However, despite its advantages and the rapid development of technology, digital-based assessment instruments using this platform also have limitations. One major drawback is the potential for academic dishonesty, such as online cheating. Students may access applications such as Google Chrome, artificial intelligence tools, WhatsApp, ChatGPT, and other applications that can assist them in finding answers during online examinations.

A study conducted by Philip M. Newton and Keioni Essex involving 4,600 examination participants found that the level of academic misconduct increased during online examinations. Of the students who participated in the examinations, 54.7% admitted to cheating in online exams during the pandemic, compared to 29.9% before the pandemic or during offline examinations (Newton & Essex, 2024, p. 334). Another study conducted by Zayyinul Musthofa et al. examined cheating behavior during online examinations. This study involved 260 students

 ISSN 2747-089X

from four different schools. The results indicated that 93.5% of examination participants admitted to having engaged in cheating during online examinations (Musthofa et al., 2021, p. 448). Academic dishonesty has also been directly experienced by the researcher as an educator. Examination results obtained through offline oral examinations and online examinations showed significant differences. Online examination scores were considerably higher, even though students' actual abilities were considered average.

Tabel 1. Perbandingan Hasil Ujian Online dan Offline

No.	Initials	Oral Examination Score	Online Examination Score
1	AMD	51	98
2	EP	73	98
3	NAM	26	96
4	AA	21	84

Based on the phenomenon of academic misconduct described above, it is essential for researchers to redesign and develop existing assessment instruments to become more optimal in minimizing cheating during online examinations. The purpose of this study is to identify solutions to these problems by developing assessment instruments through the integration of commonly used examination platforms with security applications such as Exambro. Through the development of this assessment instrument, it is expected that cheating during online examinations can be minimized, thereby enabling examinations to be conducted in a fairer and more objective manner.

Digital-Based Assessment Instruments

Definition of Assessment Instruments

According to the *Great Dictionary of the Indonesian Language* (KBBI), the term *instrument* refers to a tool or means that functions to collect information required for data processing. Meanwhile, *assessment* is defined as the evaluation of students' learning processes, progress, and outcomes (Mata et al., 2018, p. 17). In the educational evaluation system, assessment plays a crucial role in revealing the quality of both the learning process and learning outcomes. If educators wish to determine students' learning development or progress, they can conduct classroom assessments to measure students' achievement of the learning materials presented (Muri as cited in Dheana, 2023). Therefore, an assessment instrument can be defined as a tool used to collect data related to the evaluation of the learning process experienced by

students.

Types of Assessment Instruments

1. Tests

   Tests are media used to collect information or data regarding an individual's abilities. The data obtained from tests are generally in the form of numerical scores. There are three types of tests:
   a) Oral tests, in which educators ask questions directly to students;
   b) Written tests, in which educators provide questions that must be answered by students in written form. Examples of written tests include multiple-choice, true–false, matching, essay, and short-answer questions;
   c) Practical tests, which require students to perform certain activities intended to measure their skills.

2. Non-Test Instruments

   Non-test assessments are conducted without directly testing students but through intensive and systematic observation. There are three types of non-test assessments: questionnaires, observations, and interviews (Elisa Mayasari et al., 2018, p. 23).

Digital Assessment

Digital assessment is a process of evaluating students' abilities by utilizing technology such as smartphones, laptops, and other digital devices to optimize assessment activities so that they are engaging, appropriate, valid, and efficient (Nova Nur Azizah, 2024, p. 197).

1. In developing assessment instruments, digital technology can assist educators in creating test items and quizzes more easily and efficiently through various software available on the internet. Several applications that can be used by educators include: Google Forms, a free application that allows educators to create test items or quizzes easily anytime and anywhere using an internet connection via computers, laptops, or smartphones;
2. Kahoot, a platform that enables educators to create a lively and enjoyable quiz atmosphere in the classroom. Kahoot serves as a collaborative learning medium by utilizing laptops, gadgets, and projectors. It can only be used online and accessed through an internet connection at www.kahoot.com. Using Kahoot makes learning more enjoyable, reducing students' boredom even when engaging with difficult subject matter;

3. Quizizz, an application that is easy to use and equipped with various features that facilitate and manage the creation of test items in educational settings. Therefore, no special technical skills are required to access tests and examinations. This application is ideal for learning activities compatible with the Learning Revolution 4.0. Educators can use Quizizz to conduct various forms of formal learning assessments, including quizzes, daily evaluations, surveys, and others (Ariza, 2024, p. 38).

Berdasarkan beberapa aplikasi yang telah dijelaskan di atas, maka pendidik dapat membuat kuis atau soal menggunakan aplikasi seperti *google form, Kahoot, Quizizz* atau aplikasi sejenisnya yang dapat memudahkan pendidik dalam menilai peserta didik baik dalam penerapan pembelajaran.

Cheating in Examination Implementation

According to the KBBI, the term *cheating* originates from the word *curang*, which means dishonest, insincere, or unfair. The focus of this study is academic dishonesty, which refers to actions carried out by students using prohibited methods to gain advantages or achieve high academic scores, practices that are not justified (Musthofa et al., 2021, p. 447). Meanwhile, Aini Maqfiroh et al. argue that academic dishonesty is dishonest, unfair, and fraudulent behavior that violates established rules and is consciously carried out by students during the completion of assignments or examinations in order to obtain high scores and gain recognition as high-achieving students (Aini Maqfiroh et al., 2023, p. 148).

Based on these definitions, it can be concluded that academic dishonesty falls into the category of unethical behavior that contradicts academic regulations, in which students resort to instant and improper means to obtain answers during examinations or to complete academic assignments.

Method

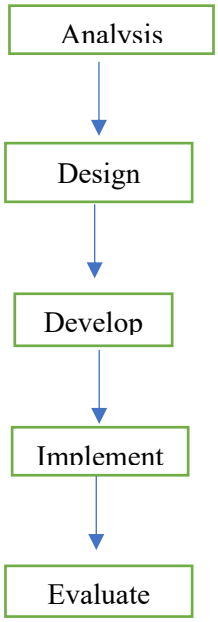
In this study, the researcher employed the Research and Development (R&D) method. This method is used to produce a particular product and to test the effectiveness of the developed product (Studi et al., 2019, p. 322).

This study adopted both qualitative and quantitative approaches. The qualitative approach was used to develop the assessment instrument, while the quantitative approach was employed to calculate the average scores of the product's quality and effectiveness.

 ISSN 2747-089X

The researcher applied the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation (Sezer et al., 2013, p. 136.

Figure 1. ADDIE Research and Development Model



The subjects of this study included **content experts, media experts, and students of the Islamic Education Study Program (PAI), Class C–D, second semester of the 2024/2025 academic year**. The object of development in this study was a **digital-based assessment instrument using Google Forms**.

The data collection instrument used in this study was a **questionnaire**, which was designed to collect quantitative data. The data obtained were then tested to determine the feasibility of the developed product. Subsequently, the data were analyzed by converting qualitative assessments into quantitative scores based on the following classification criteria:

Table 2. Product Feasibility Score Classification Guidelines

Classification	Score
Very Good (VG)	4
Good (G)	3
Fair (F)	2
Poor (P)	1

Source: Sugiyono, 2013

The data analysis technique employed in this study was descriptive quantitative analysis. The data obtained from questionnaires completed by content experts, media experts,

and students regarding the developed assessment instrument were analyzed. The questionnaire data were processed using percentage analysis techniques.

$$\text{Percentage Score} = \frac{\text{Total score obtained}}{\text{Maximum possible score}} \times 100\%$$

Quantitative data derived from expert validation questionnaires (content experts and media experts) and student responses in the form of percentage scores were then converted into qualitative scales. For quantitative data using a four-point Likert scale, the conversion followed the reference table below:

Table 3. Guidelines for Converting Quantitative Data into Qualitative Data

No.	Percentage Score	Qualification	Description
1	81% – 100%	Very Good	Very Feasible
2	61% – 80%	Good	Feasible
3	40% – 60%	Fair	Less Feasible
4	≤ 40%	Poor	Not Feasible

Sumber: Sutrisno Hadi, 1991

Result

A. Procedure for Developing Digital-Based Assessment Instruments as an Effort to Minimize Cheating in Examination Implementation

The procedure for developing digital-based assessment instruments as an effort to minimize cheating in examination implementation was carried out through five stages, namely analysis, design, development, implementation, and evaluation.

1. Stage I: Analysis

The initial stage of this study was a needs analysis to determine why the research needed to be conducted, specifically why the development of digital-based assessment instruments was necessary. At this stage, the researcher conducted preliminary observations and found instances of cheating during examinations. Several students were observed engaging in online cheating by opening other applications to find answers to examination questions. As an instructor, the researcher also found significant differences between students' scores obtained through offline and online examinations. Online examination scores were considerably higher, even though students' actual abilities were regarded as average. Based on these issues, it was necessary to redesign and develop existing assessment instruments so that they would be more optimal and enable examinations to be conducted in a fairer and more

 ISSN 2747-089X

objective manner. At this stage, the researcher also gathered information regarding relevant applications to support the development process.

2. Stage II: Design

At this stage, the researcher began designing the development of digital-based assessment instruments. The design or product planning process was closely aligned with the results of the needs analysis and the problems identified in the field. The design stages included compiling test assessments, inputting test items, and designing the digital assessment instruments using relevant applications.

3. Stage III: Development

The development stage consisted of three steps: instrument development, expert validation, and product revision.

a. Instrument and Assessment Development

At this stage, the researcher developed a digital-based assessment instrument. The development process referred to the blueprint of the Final Semester Examination (UAS) for two Arabic language courses, consisting of 50 multiple-choice questions. The questions were divided into three sections: *fahmu al-maqrū'* (reading comprehension), *fahmu al-kitābah* (writing comprehension), and *fahmu at-tarākīb* (grammatical comprehension).

The assessment instrument commonly used previously was the Google Forms digital platform. In this development, the researcher integrated this platform with the Exambro application.

b. Expert Validation

After the digital-based assessment instrument was completed, it was validated or tested for feasibility by experts with competencies in media/IT and Arabic language learning materials. The media (IT) expert or validator in this study was Faridul Anshor, M.Pd (Lecturer in Digital Technology, Bakti Negara Institute of Islamic Studies, Tegal), while the content expert was Dr. Muhammad Jafar Shodiq (Lecturer in Arabic Language Education, Sunan Kalijaga State Islamic University, Yogyakarta).

Several aspects were assessed in the feasibility evaluation of the developed assessment instrument. The feasibility aspects evaluated by the media expert included content, format, ease of use, timeline, and usability.

The feasibility evaluation by the content expert covered aspects of content appropriateness, item construction, and language use. Content appropriateness included alignment with Basic Competencies (KD), item indicators, cognitive level, conceptual or factual accuracy, and content currency. Item construction included clarity of question formulation, functionality of distractors, absence of clues leading to the correct answer, even distribution of

 ISSN 2747-089X

answer options, completeness of answer choices, and suitability of the multiple-choice format. Language aspects included conformity with Arabic language rules, appropriateness of diction, clarity of question wording, and accuracy in word and sentence construction.

Based on feedback from the media or IT expert, it was suggested that ad-free features should be utilized to prevent advertisements from appearing unexpectedly during test access, as such interruptions could disrupt students' concentration during examinations. Feedback from the content expert emphasized the need to recheck items involving sentence construction to avoid questions with very similar sentence structures.

c. Product Revision

After the assessment instrument was evaluated and reviewed by media and content experts, the next development stage was product revision. At this stage, the researcher revised the developed product based on suggestions and feedback from the validators. After revision, the assessment instrument was ready for field testing with students.

4. Stage IV: Implementation

The next stage of development was implementation. The validated and revised assessment instrument was then tested in a field trial. The field trial was conducted with 26 second-semester students from the Islamic Education Study Program (PAI), Class C–D. Students used the developed assessment instrument, while the researcher conducted observations by monitoring students' behavior during the examination.

The observed aspects included individualistic-opportunistic, independent-planned, social-active, and social-passive behaviors. Individualistic-opportunistic behaviors included whether examinees attempted to exit the application, took advantage of supervisory lapses, or appeared rushed when the supervisor's attention was diverted. Independent-planned behaviors included whether examinees brought backup laptops or smartphones. Social-active behaviors assessed whether examinees verbally or non-verbally requested answers from peers (through hand gestures, eye contact, etc.) or frequently glanced at peers' smartphones. Social-passive behaviors referred to examinees deliberately showing their answers to peers and signaling approval for others to copy their responses.

The observation results were analyzed to determine the effectiveness of the digital-based assessment instrument development as an effort to minimize cheating during examinations.

5. Stage V: Evaluation

This stage constituted the final revision phase. Revisions were made based on the results of observations conducted during the examination. The observation results indicated minimal signs of cheating that required extra attention from supervisors. However, regarding

 ISSN 2747-089X

the individualistic-opportunistic aspect, several students attempted to exit the application but failed. This indicated that students had no opportunity to engage in online cheating by accessing other applications to find answers. Based on the obtained observation scores, it can be concluded that the development of digital-based assessment instruments as an effort to minimize cheating in examination implementation was effective.

B. Results of Validation of Digital-Based Assessment Instruments in Minimizing Cheating in Examination Implementation and Observation of Examination Participants

The purpose of validation was to evaluate whether the developed product was feasible for use in the learning process. Validation was conducted in two aspects: **media/IT validation and content validation**. Media validation aimed to assess feasibility in terms of appearance and ease of use, while content validation aimed to determine the alignment of the material with the intended learning objectives.

1. Media Design or IT Expert Validation

The results of the media expert's evaluation of the developed digital-based assessment instrument are presented as follows:

Table 4. Results of Media Expert Evaluation on Content, Format, Ease of Use, Timeline, and Usability Aspects

No.	Indicator	Score	Category
Content Aspect			
1	Application usage instructions are easy to understand	3	Good
2	Application interface is attractive	3	Good
3	Information provided in the application is complete and clear	3	Good
	Total Score	9	
	Percentage Score	75%	
	Category		Good
Format Aspect			

 ISSN 2747-089X

4	Test working page layout is well-structured	3	Good
5	Text is easy to read	4	Very Good
6	Menu and text layout in the application is neatly arranged	4	Very Good
	Total Score	11	
	Percentage Score	92%	
	Category		Very Good
Ease of Use Aspect			
7	Application is easy to use	3	Good
8	Application can be accessed on various devices	2	Fair
9	Menus in the application are easy to understand and use	3	Good
	Total Score	8	
	Percentage Score	67%	
	Category		Good
Timeliness Aspect			
10	Loading time is relatively fast	3	Good
11	Navigation between menus is fast	3	Good
12	Answer submission process is fast	3	Good

13	Score printing process is fast	3	Good
	Total Score	12	
	Percentage Score	75%	
	Category		Good
Usability Aspect			
14	Application helps teachers conduct evaluations more effectively	3	Good
15	Exambro mobile application saves teachers' time in assessing students' learning outcomes	4	Very Good
16	Exambro mobile application helps detect cheating by students	3	Good
17	Exambro mobile application helps identify students who work honestly	3	Good
	Total Score	13	
	Percentage Score	81%	
	Category		Very Good

The results of the media expert's evaluation of the developed product showed that the content aspect achieved a score of 75% and was categorized as Good, the format aspect achieved 92% and was categorized as Very Good, the ease of use aspect achieved 67% and was categorized as Good, the timeliness aspect achieved 75% and was categorized as Good, and the usability aspect achieved 81% and was categorized as Very Good. When calculating the average

percentage score across all aspects, the product obtained an overall score of 78%, which falls into the Good category. This indicates that the developed assessment instrument is feasible for use.

2. Content Expert Validation

The results of the content expert's evaluation of the development of the digital-based final semester examination assessment instrument for the Arabic language course are presented as follows:

Expert Validation Results on Material Quality

Aspect of Content Validity

No.	Indicator	Score	Category
1	Alignment with Basic Competencies (BC)	4	Very Good
2	Alignment with item indicators	3	Good
3	Appropriateness to cognitive level	4	Very Good
4	Accuracy of concepts or facts	4	Very Good
5	Currency of the material	4	Very Good
	Total Score	19	
	Percentage Score	95%	Very Good
	Aspect of Item Construction		
No.	Indicator	Score	Category
6	Clarity of question formulation	3	Good
7	Functionality of distractors	4	Very Good
8	Absence of clues leading to correct answers	3	Good
9	Even distribution of answer options	4	Very Good
10	Completeness of answer options	4	Very Good

11	Suitability of multiple-choice item type	3	Good
	Total Score	21	
	Percentage Score	88%	Very Good

The results of the content expert validation of the developed product showed that the content feasibility aspect obtained a percentage score of 95% and was categorized as Very Good, the item construction aspect obtained a percentage score of 88% and was categorized as Very Good, and the language aspect obtained a percentage score of 81% and was categorized as Very Good. When calculating the average percentage score across all content-related aspects, the product achieved an overall score of 88%, which falls into the Very Good category. This indicates that the assessment material for the examination is highly feasible for use.

3. Results of Observation on Student Behavior During the Examination Using Digital-Based Assessment Instruments

The digital-based assessment instrument was implemented with 26 second-semester students from the PAI study program, classes C–D. The student response observation instrument consisted of four assessment aspects. The data obtained from the observation are presented as follows:

Table 7. Results of Observation on Students' Examination Cheating Behavior

1. Higher Education Institution: Bakti Negara Institute of Islamic Studies (IBN) Tegal
2. Faculty/Study Program/Semester: Faculty of Tarbiyah and Teacher Training (FITK) / Islamic Education (PAI) / Semester II
3. Stage: Pre-test

No. Ujian	*Individualistic-opportunistic*	*Independent-planned*	*Social-active*	*Social-passive*	Skor
141124079		√		√	1
141124084				√	1
141124089	√		√		2
141124092	√		√	√	3
141124097	√		√		2

141124101	√		√		2
141124116					0
141124120	√	√	√		2
141124021	√		√		2
141124002	√		√	√	3
141124006	√		√		2
141124009					0
141124017	√		√		2
141124022			√		1
141124030	√		√		2
141124072	√		√	√	3
141124081					0
141124085					0
141124187					0
141124093	√		√	√	3
141124095					0
141124111	√		√		2
141124112			√		1
141124113			√		1
141124117	√		√		2
141124135	√		√		2
Jumlah	15	2	17	6	51
Rata-rata	57,69	7,69	65,38	23,08	49,04

Higher Education Institution : Bakti Negara Institute of Islamic Studies (IBN) Tegal

Faculty/Study Program/Semester : Faculty of Tarbiyah and Teacher Training (FITK) / Islamic Education (PAI) / Semester II

Stage : Post-test

No. Ujian	*Individualistic-opportunistic*	*Independent-planned*	*Social-active*	*Social-passive*	Skor
141124079				√	1
141124084				√	1
141124089					0
141124092			√	√	2
141124097			√		1
141124101					0
141124116					0
141124120	√	√			2
141124021			√		1
141124002			√	√	2
141124006					0
141124009					0
141124017	√		√		2
141124022			√		1
141124030			√		1
141124072			√	√	2
141124081				√	1
141124085					0
141124187					0
141124093	√		√		2
141124095					0
141124111	√		√		2
141124112					0
141124113					0
141124117	√				1
141124135	√		√		2

 ISSN 2747-089X

Jumlah	6	1	11	6	24
Rata-rata	23,08	3,84	42,31	23,08	23,08

Based on the results of the pre-test and post-test observations of students' cheating behavior during examinations, the average pre-test score was 49.04, while the average post-test score was 23.08. The post-test score was lower than the pre-test score, with a score difference of 25.96. This difference is considered significant, particularly in the individualistic-opportunistic and social-active aspects.

Students no longer had the opportunity to search for answers using other applications because they were unable to exit the examination application. If they attempted to forcefully exit the application, an alarm would sound and the examination would automatically be terminated. Based on these observation results, it can be concluded that the digital assessment instrument developed by integrating Google Forms with the Exambro application is effective in preventing and minimizing cheating behavior during examinations.

Conclusion

Based on the results of data analysis and processing in this study, several conclusions can be drawn.First, the development procedure of the digital-based assessment instrument as an effort to minimize cheating during examinations was conducted through several stages, namely: (I) analysis, (II) design, (III) development (instrument construction, expert validation, and product revision), (IV) implementation, and (V) evaluation.Second, the validity of the developed digital-based assessment instrument has been empirically tested and proven to be feasible for use. During the validation stage, media or IT experts provided an average score percentage of 78% (good), while material experts provided an average score of 88% (very good), indicating that the assessment instrument is suitable for implementation.Third, the post-test score was lower than the pre-test score with a difference of 25.96, which indicates that the development of the digital-based assessment instrument is proven to be effective in preventing and minimizing cheating behavior during examinations.The developed assessment instrument should be further refined, as there are still several limitations. One of the main challenges is that students experience difficulty accessing the examination application due to the requirement to log in using their email accounts and passwords. Many students do not remember their email passwords, which ultimately hinders their ability to access the examination application smoothly.

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