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Development of Mobile Exam Application to Prevent Student Exam Cheating on High School Computational Thinking Informatics Materials

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Abstract

This study aims to develop a mobile-exam application to prevent cheating during online exams in high school computational thinking. The research follows the 4D development model (Define, Design, Develop, Disseminate) and collects data through questionnaires, observations, pre-test and post-test in control and experimental classes. Sample included 72 respondents divided into control and experimental classes. The analysis involves descriptive and statistical methods to compare test result and cheating frequencies. Result indicate that the use of the mobile exam app significantly decreases cheating occurrences compared to traditional methods. The number of cheating incidents decreased from 20 in the control classes to 5 in the experimental classes, demonstrating the application's effectiveness in promoting academic integrity. Furthermore, the experimental class using the app shows improvement in post-test by 13 points compared to a 5-point increase in the control classes, demonstrating that the app not only prevents cheating but also enhances student learning outcomes. This app contributes to promoting academic integrity in online education settings, offering an innovative solution for improving exam security and student performance.

Keywords: Accademic integrity, application, cheating, computational thingking, mobile exam

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INTRODUCTION

Academic dishonesty in online assessments is a critical issue that undermines the credibility of educational assessments and the reliability of learning outcomes. As education increasingly relies on digital platforms, the challenge of ensuring academic integrity has become more pronounced. Despite the widespread adoption of tools such as Google Classroom, Microsoft Teams, and Moodle, these platforms have proven insufficient to address dishonest practices, leaving educators struggling to maintain fairness and authenticity in assessments.

The rapid adaptation to technological changes and the application of new innovations have significantly supported the sustainability of human life. The increasing use of mobile devices has driven technological advancements. The integration of the Internet with mobile devices has further accelerated technological growth, leading to the advent of the Internet of Things (IoT), which integrates all aspects of life into a single digital framework. These technological advancements have extended their impact to the education sector, facilitating independent learning for students and providing flexible learning models.

During the COVID-19 pandemic, schools used technology for a variety of purposes, including virtual classrooms via Google Classroom, Microsoft Teams, and self-administered e-learning platforms such as Moodle. However, each of these platforms has limitations when it comes to preventing academic fraud. Google Classroom is designed as a basic classroom management platform with no specific exam proctoring features. Teachers can only set assignments and quizzes, but have no tools to prevent students from opening other browser tabs or using additional devices while working. As a result, direct proctoring is difficult in an online environment. While Microsoft Teams has video conferencing capabilities that can be used for supervision, it often faces technical limitations, such as unstable Internet connections or limitations in monitoring many learners at once. Learners can still find ways to avoid supervision. Meanwhile, Moodle, as a more complex platform often used for self-paced e-learning, has some features for online exams, such as question randomization and timed assignments. However, without integration with additional proctoring tools, such as AI-based proctoring tools, Moodle cannot prevent learners from collaborating or using external devices. In addition, complex system configuration is often a bottleneck for schools with limited IT staff. Although these three platforms provide convenience in managing distance learning, weaknesses in exam monitoring and security features make them not fully effective in addressing academic cheating.

Assessment has become a critical element of the learning process in the digital era. It is considered a central part of the learning cycle, defined as "a fundamental element capable of influencing changes in the learning process" (Conrad & Openo, 2018: 18). During the pandemic, the Indonesian government implemented policies to reduce paper usage through the Refocussing and Budget Reallocation policies under Ministry of Finance Regulation No. 39/PMK.02/2020. These policies impacted the procurement and use of paper, shifting towards a paperless system, including online assessments.

The need to develop evaluation methods in the digital era has become increasingly urgent and complex. Technological transformation has influenced how students learn and interact with online learning. However, online learning poses challenges such as learning loss, decreased motivation, and degradation of student character. Teachers must navigate these challenges by designing meaningful online learning experiences and assessments (Hodges et al., 2020). Issues like learning loss can also occur in traditional learning models and significantly affect assessment quality.

In traditional classroom settings, teachers directly supervise students, facilitating both knowledge transfer and character education. However, during online learning through platforms like Moodle, the lack of direct supervision allows students to resort to shortcuts to achieve satisfactory results, such as cheating by copying from peers, seeking answers from others, or browsing the internet for answers. Ensuring academic honesty in online assessments is challenging due to the difficulty in monitoring student behavior (Munoz & Mackay, 2019: 2). Academic dishonesty is defined as "any action taken before, during, or after the administration of a test or assignment intended to gain an unfair advantage or produce inaccurate results" (Cizek, 2012: 16).

Initial observations through an online survey using Google Forms in the WhatsApp group of the TIK-Informatika MGMP of Central Java revealed that 93.5% of teachers conducted cognitive learning assessments online, with 48.4% using Google Form quizzes, 29% using school-managed LMS, and 11% using Office Form quizzes. About 69.4% of teachers reported a decline in the quality of learning outcomes, and 46.8% doubted the authenticity of students' work. Only 43.5% of TIK-Informatika teachers were able to manage and control online assessment media to prevent cheating.

The development of assessment tools is essential to address academic dishonesty and maintain academic integrity. Various technologies have been developed to monitor online assessments. However, teachers still face challenges in controlling student cheating during online assessments. Chen et al. (2020: 66) noted that there is still a perception of lower risk of being caught cheating online compared to face-to-face settings. The inability to personally monitor student performance remotely during assessments creates scenarios that incentivize inappropriate behavior.

Previous research provides valuable insights into various evaluation methods and strategies that have been tested, evaluated, and found effective in enhancing learning evaluation processes. Thomas & Jeffer (2019: 247) tested technology to detect academic cheating during exams, while Al_airaji et al. (2022: 124) developed technology to automatically detect student movements during exams. Duhaim et al. (2022: 341) researched online exam cheating detection during the COVID-19 pandemic using data collection methods. Their findings suggested that the proposed online exam system effectively reduced cheating and ensured honest exam results.

Honesty is a fundamental value in education that must be instilled in students from an early age. While previous research has focused on detecting cheating during exams, this study takes a different approach by proactively minimizing opportunities for dishonest behavior. The mobile exam application developed in this research is designed not merely to detect but to limit the possibility of cheating through integrated preventive mechanisms. Using statistical analysis methods to monitor and analyze exam responses in real-time, the application emphasizes creating a controlled environment where students have limited room for dishonest actions. This innovation aims to ensure academic integrity while fostering a culture of honesty, particularly in the context of online assessments for high school computational thinking informatics courses.

METHODS

This research employs a development methodology using the 4D model (Define, Design, Develop, Disseminate), which aims to produce a mobile exam application to prevent student cheating during online exams. The 4D model was chosen for its relatively straightforward stages and efficiency in time management. The model encompasses the creation of the product (implementation), evaluation, and revisions, ensuring the developed product is suitable for online assessment purposes.

The population in this research comprises 10th-grade high school students in

Surakarta during the odd semester of the 2022/2023 academic year. The sample includes control and experimental classes, each consisting of 36 respondents. Random cluster sampling was used to select students from SMA Negeri 7 Surakarta and SMA Negeri 5 Surakarta. For the preliminary research phase, the sample comprised teachers of TIK or Informatics subjects.

Data collection instruments included questionnaires to gather feedback from teachers and students, pre-tests and post-tests to measure student performance and detect any cheating incidents, and observations during the use of the application to identify any issues or improvements needed.

Data analysis techniques involved descriptive analysis to summarize the feedback and performance data, identifying trends and patterns, and statistical analysis using tests (e.g., t-tests) to compare pre-test and post-test results and determine the effectiveness of the application in reducing cheating.

RESULTS & DISCUSSION

The preliminary study outlines the needs analysis results according to the stages in the 4D development model, specifically the analyze stage. Data collection methods used in this analysis included: 1) a questionnaire to identify cheating behaviors and the need for cheating prevention measures; and 2) observation of cheating behaviors during exams. The preliminary study results are discussed as follows.

Results of the Needs Analysis Questionnaire

A survey using a questionnaire was conducted among 20 teachers from two different high schools, SMA Negeri 7 Surakarta and SMA Negeri 5 Surakarta, with each school providing responses from 10 teachers. The questionnaire was designed to gather information on teachers' experiences with exam cheating, types of cheating commonly encountered, methods teachers use to detect cheating, school policies on cheating, and important features for a mobile exam application. The detailed results of the questionnaire can be seen in Table 1.

Table 1. Need Analysis Results

Question	SMA N 7 Surakarta	SMA N 5 Surakarta	Total
Percentage of teachers witnessing cheating	100%	100%	100%
Most common type of cheating	Use of technology	Use of technology	Use of technology
Method of detecting cheating	Direct observation	Direct observation	Direct observation
Need for lockdown browser feature	High	High	High
Need for real-time monitoring feature	High	High	High

From the questionnaire results, it was found that all teachers from both schools had witnessed cheating during exams. The most frequently encountered type of cheating was the use of technology, with students opening other applications during mobile-based exams. These findings highlight the need for prevention technologies such as a mobile exam application. The primary method teachers used to detect cheating was direct observation and analysis of exam patterns, indicating the importance of features that support teachers in observing and analyzing student behavior during exams. The top priority feature for teachers in a mobile exam application was a lockdown browser,

followed by real-time monitoring to help reduce opportunities for students to cheat.

Observation of Cheating During Exams

Observations of cheating during Informatics exams, focusing on computational thinking material, were conducted. The observations revealed that students often used their devices to access unauthorized resources during exams. The frequency of cheating incidents was documented and analyzed to understand the effectiveness of current monitoring methods and the need for advanced cheating prevention technologies.

Table 2. Observation Results of Cheating During Exams

Observation Criteria	SMA N 7 Surakarta	SMA N 5 Surakarta	Total Incidents
Number of students observed	36	36	72
Number of cheating incidents	15	18	33
Types of cheating observed	Use of unauthorized apps	Use of unauthorized apps	Use of unauthorized apps
Frequency of re-login attempts	5	7	12
Use of external help (e.g., friends/Internet)	8	9	17
Copying from other students	2	2	4

Product Development

The development of the mobile exam application involved several stages, from initial design to prototyping and refinement based on feedback. The process included the following steps:

1) Prototype Development: A preliminary version of the mobile exam application was created to test its functionality and usability. The prototype featured a user-friendly interface, secure login mechanisms, and real-time monitoring capabilities.

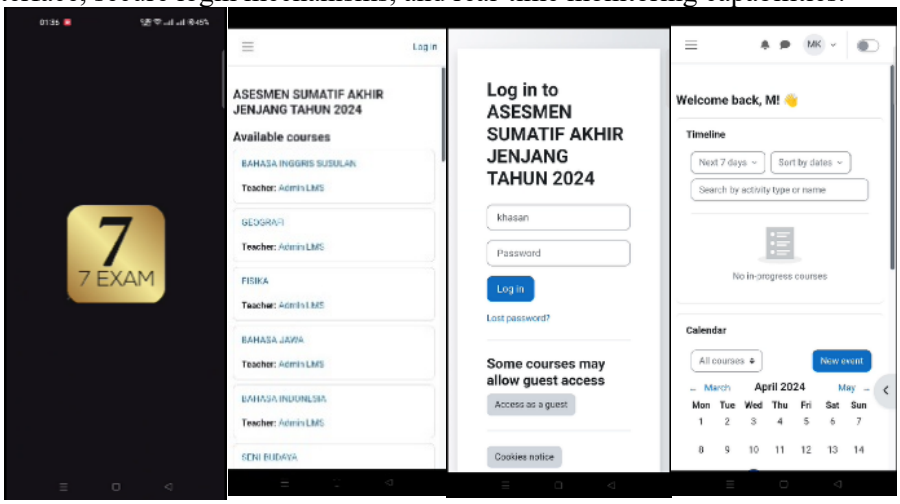

Figure 1. Mobile exam product development

2) Expert Validation: The prototype was reviewed by experts in educational technology and information technology to ensure it met educational and technical standards. Feedback from these experts was used to refine the application's features and design.

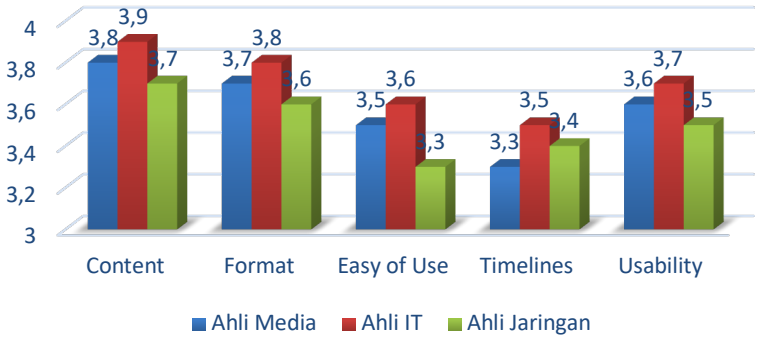

Figure 2. Expert validation results

3) Practical Testing: The application was tested in real classroom settings with students to gather feedback on its effectiveness and usability. Adjustments were made based on this feedback to improve the application's performance and user experience.

Product Testing

1) Outcomes and Cheating Frequency: The product testing phase involved using the mobile exam application in real classroom settings to evaluate its effectiveness in preventing cheating and improving learning outcomes. The testing included both control and experimental classes from SMA Negeri 7 Surakarta and SMA Negeri 5 Surakarta. The cognitive learning outcomes were measured using pre-tests and post-tests.

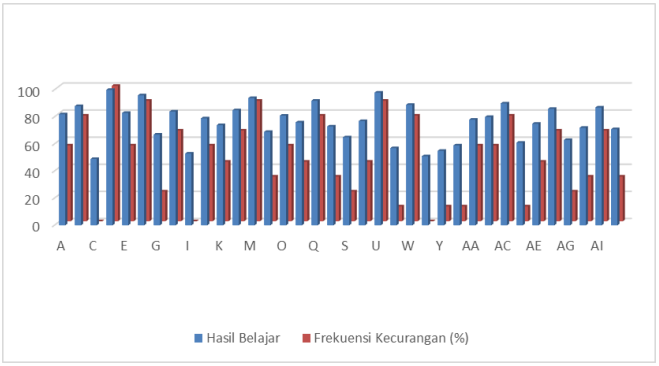

Figure 3. Control class result

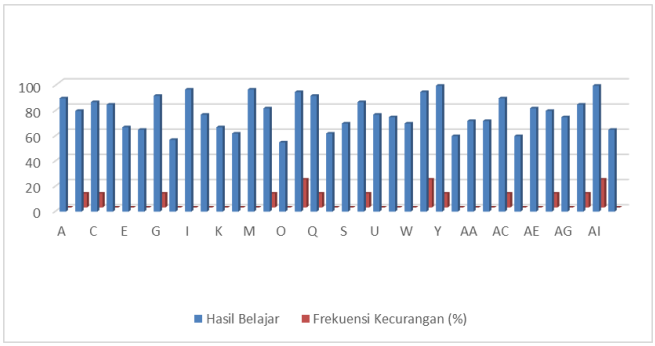

Figure 4. Experimental class result

The experimental classes, which used the mobile exam application, showed significant improvement in their post-test scores compared to the control classes. The frequency of cheating incidents was monitored using both the mobile exam application's re-login detection feature and the Autoproctor application. The data indicated a substantial reduction in cheating incidents in the experimental classes compared to the control classes.

2) Effectiveness of the Mobile Exam Application: The effectiveness of the mobile exam application was evaluated based on its ability to reduce cheating and improve learning outcomes. The results are summarized in Table 3.

Table 3. Effectiveness of the mobile application

Criteria	Control Classes	Experimental Classes	Improvement
Average pre-test score	60	62	+2
Average post-test score	65	78	+13
Number of cheating incidents	20	5	-15
Frequency of re-login attempts	10	2	-8
Use of unauthorized applications	12	3	-9
Overall effectiveness score (out of 10)	6	9	+3

The findings from this study align with previous research, indicating that technology can play a critical role in preventing academic dishonesty and improving the quality of learning. Smith et al. (2023) found that the use of technology in academic evaluations can reduce cheating and enhance academic honesty. Bierstaker et al. (2024) also stated that technology designed to detect and prevent cheating is effective in improving academic integrity.

The results from the product testing phase indicate that the mobile exam application significantly reduced the frequency of cheating incidents and improved students' learning outcomes. The average post-test scores in the experimental classes increased by 13 points compared to a 5-point increase in the control classes. The number of cheating incidents decreased from 20 in the control classes to 5 in the experimental classes, demonstrating the application's effectiveness in promoting academic integrity.

The re-login detection feature was particularly effective in identifying and preventing cheating attempts, reducing re-login attempts from 10 in the control classes to 2 in the experimental classes. Additionally, the use of unauthorized applications during exams dropped from 12 incidents in the control classes to 3 in the experimental classes.

However, this study introduces an innovation with the use of the mobile exam application that features re-login detection to identify cheating, a method not previously applied in other research. This innovation demonstrates that advanced, focused technology can provide more effective solutions than traditional methods.

The success of the mobile exam application in reducing academic cheating and improving learning outcomes offers new contributions to the field of education, particularly in the use of technology to enhance academic integrity. Overall, the mobile exam application received a high effectiveness score of 9 out of 10 from the experimental classes, compared to a score of 6 from the control classes.

These findings suggest that appropriate integration of technology in the evaluation process can significantly reduce dishonest behaviors and improve students' learning outcomes. In the context of evolving educational practices, this study provides new insights into how technology can be utilized to enhance academic honesty and the quality of learning. Therefore, the mobile exam application not only reinforces previous findings but also introduces innovative solutions that can be adopted by other educational institutions to address academic cheating. This study also paves the way for further development of

similar applications that can be tailored to various educational contexts.

Integrating advanced technological solutions like the mobile exam application can create a more honest and effective assessment environment, enhancing the overall quality of education.

CONCLUSION

The mobile exam application developed to prevent academic cheating and improve learning outcomes in high school Informatics courses in Surakarta has proven effective. The preliminary study identified a clear need for advanced cheating prevention technologies, with teachers reporting frequent unauthorized application use by students during online exams.

The product development and testing phases, including expert validation and practical classroom use, demonstrated the application's effectiveness. The innovative re-login detection feature significantly reduced cheating incidents and improved learning outcomes.

This study supports existing research on technology's role in enhancing academic integrity and introduces a novel approach to cheating prevention. The mobile exam application provides a practical solution for educators, creating a fair and effective assessment environment.

Overall, the application's success in reducing cheating and enhancing student performance highlights its potential as a valuable educational tool. Future research should explore further enhancements and broader applications of this technology to ensure its widespread adoption in various educational contexts.

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