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Management of the Implementation of the Massachusetts Institute of Technology (MIT) App Inventor in Informatics Learning at Integrated Islamic Senior High Schools

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ABSTRACT

This study aimed to analyze the barriers to implementing the Massachusetts Institute of Technology (MIT) App Inventor in Informatics learning from the students' perspective on aspects of learning management. The study used a mixed-methods design with an embedded approach, in which a descriptive qualitative approach served as the primary method, supported by quantitative data. Data were collected through a Google Forms questionnaire, observation, in-depth interviews, and documentation. The results showed that learning planning had been well prepared through appropriate learning materials and was supported by the availability of computer laboratories and internet access. However, learning supervision had not been implemented optimally because monitoring had not been conducted systematically. In addition, the student questionnaire results indicated that the main barriers were related to infrastructure, particularly limited access to devices and unstable internet connections, which affected the implementation of application development projects. It was concluded that the implementation of MIT App Inventor was relatively effective at the planning and implementation stages; however, challenges remained in learning supervision and students' access to adequate infrastructure. Therefore, strengthening the monitoring system and improving the quality and equitable availability of learning facilities are necessary to ensure more effective and sustainable implementation.

Keywords: management, MIT, Informatics learning, senior high school

INTRODUCTION

The development of information and communication technology has driven significant transformation in education, including learning management. Learning that was previously teacher-centered has gradually shifted toward more participatory, adaptive, and technology-based approaches. In this context, a Learning Management System (LMS) plays an important role in supporting the systematic and integrated planning, organization, implementation, and supervision of the learning process. In Informatics learning, one relevant technology-based platform is MIT App Inventor, developed by the Massachusetts Institute of Technology [1]. The use of MIT App Inventor enables learning to combine theoretical understanding with contextual and practical learning experiences. MIT App Inventor is a cloud-based platform for developing Android applications that is easy to use and employs puzzle-like drag-and-drop code blocks [2][3]. This approach is increasingly relevant to the implementation of the Merdeka Curriculum, which emphasizes the development of the eight dimensions of the Graduate Profile: Faith and Piety toward God Almighty, Citizenship, Critical Reasoning, Creativity, Collaboration, Independence, Health, and Communication, which students are expected to develop by the end of each educational level [4]. The visual programming features offered by platforms such as MIT App Inventor are particularly beneficial for novice learners, especially younger students who are beginning to explore programming and express their creative ideas through application development [5]. Therefore, interactive learning media that actively engage students in constructing their own knowledge are essential.

The development of digital technology has encouraged the transformation of Informatics learning toward project-based learning to develop twenty-first-century skills [6]. One widely used platform is MIT App Inventor, a block-based visual programming environment that enables students to develop Android applications without needing to master complex programming syntax [7]. This platform can foster students' creativity, computational thinking, problem-solving, and collaboration skills, thereby enabling more meaningful Informatics learning. Despite these

advantages, the implementation of MIT App Inventor in schools continues to face several challenges [8].

The main challenges identified arise from students' difficulties in understanding block-based programming concepts and from learning management factors. Some students experience difficulties in understanding block-based programming concepts and systematically integrating these concepts into the application development process [9]. In addition, limited learning experience, insufficient continuous practice, and the lack of contextual learning media have resulted in the suboptimal use of MIT App Inventor [5]. These challenges are further compounded by infrastructure limitations, including the availability of computers or laptops, unstable internet connections, limited practice time, and inadequate training and guidance in using MIT App Inventor [10]. These conditions reduce the effectiveness of project-based learning implementation in the classroom.

Infrastructure and facility constraints, including limited access to computers or laptops and stable internet connections, pose challenges for students when completing projects assigned by teachers. In practice, the implementation of MIT App Inventor also faces challenges related to efficiency, flexibility, and error handling, which can affect the learning process [11]. In addition, limited access to supporting devices, internet connectivity, and practice time restricts students' ability to fully explore MIT App Inventor's features. Furthermore, inadequate training and dissemination on the use of MIT App Inventor limit the potential of Informatics learning using this platform [12].

Effective learning management is an important strategy for optimizing MIT App Inventor implementation in the classroom. Systematic learning planning, effective organization of learning activities, implementation aligned with student characteristics, and continuous supervision can help minimize various challenges that arise during the learning process [13]. Studies on MIT App Inventor learning have generally focused on its effectiveness or on the development of learning media using the platform, whereas studies examining implementation barriers from students' perspectives within a learning management framework remain relatively limited. Therefore, this study offers novelty by integrating a quantitative analysis of the barriers experienced by students with an in-depth qualitative analysis through interviews based on the learning management functions of planning, organization, implementation, and supervision. This approach is expected to provide a more comprehensive understanding of the factors affecting the successful implementation of MIT App Inventor in Informatics learning.

The challenges arising from the implementation of MIT App Inventor affect not only students but also teachers and other school stakeholders. These challenges reflect problems in learning management, including the stages of planning, organization, implementation, and supervision [14]. Therefore, each stage of learning management needs to be implemented more optimally to ensure that the design and implementation of classroom learning are effective and efficient [7]. Optimizing learning management is expected to minimize various technical and non-technical challenges while supporting the effective use of MIT App Inventor in Informatics learning.

Based on the description above, this study aimed to analyze the barriers to implementing MIT App Inventor in Informatics learning from a learning management perspective at SMA Islam Terpadu Ulil Albab Batam (Ulil Albab Integrated Islamic Senior High School, Batam). The analysis was conducted to identify the dominant barriers based on students' perceptions and was further supported by observations, documentation, and interviews with school stakeholders. The findings are expected to provide a basis for formulating recommendations to improve the effectiveness of MIT App Inventor implementation so that Informatics learning can be conducted more effectively, support the development of twenty-first-century skills, and enhance students' problem-solving abilities and creativity.

RESEARCH METHODS

This study used a mixed-methods approach with an embedded design, in which a descriptive qualitative approach served as the primary method, while quantitative data supported the interview findings. According to Sugiyono (2019), a research method is a scientific procedure used to obtain data in accordance with the research objectives and intended purposes [15]. Data were collected through a Google Forms questionnaire, observation, in-depth interviews, and documentation. The integration of qualitative and quantitative methods enabled the collection of more objective and comprehensive data [16]. The quantitative data were not used for hypothesis testing but served to strengthen and confirm the qualitative findings regarding the implementation of MIT App Inventor in Informatics learning in the field. Qualitative and quantitative methods can be combined and applied within the same study according to the research design [15].

This study was conducted at SMA Islam Terpadu Ulil Albab Batam, located on Diponegoro Street, Bukit Tempayan Subdistrict, Batu Aji District, Batam City, Riau Islands Province. The research participants were identified based on recommendations from the Informatics teacher at SMA Islam Terpadu Ulil Albab Batam. The school has educational and administrative personnel, including one principal, 44 teachers, 2 administrative staff members, and 441 students. The research participants included the Informatics teacher, the Vice Principal for Curriculum, and selected students. The Informatics teacher provided information on the learning process, including learning preparation and classroom implementation. The Vice Principal for Curriculum provided information on learning management, including the planning, organization, implementation, and supervision of Informatics learning integrating MIT App Inventor. The student participants

consisted of 43 Grade XI and XII students who took Informatics at SMA Islam Terpadu Ulil Albab Batam. The student sample was selected using simple random sampling, which provides each student in the population with an equal opportunity to be selected as a respondent [17]. This technique was used to minimize selection bias and improve the representativeness and accuracy of the research data. Data were collected through questionnaires, observation, documentation, and in-depth interviews.

The data analysis method used in this study was quantitative descriptive analysis, integrated with qualitative analysis in accordance with the mixed-methods approach. Quantitative data were obtained from questionnaires administered to students to identify the challenges encountered during Informatics learning, including technical issues, teachers' learning management, and the availability of supporting infrastructure and facilities. Questionnaire data were analyzed using descriptive statistics, including frequencies, percentages, and category interpretations, to describe the conditions experienced by students during the learning process [18].

Meanwhile, qualitative data were obtained through in-depth interviews with the Vice Principal for Curriculum and the Informatics teacher, documentation review of learning materials, and direct observation of classroom learning. Qualitative data were analyzed through data reduction, data presentation, and conclusion drawing to identify patterns related to Informatics learning management. The qualitative analysis results were then used to strengthen and explain the quantitative findings, providing a more comprehensive understanding of the managerial barriers to implementing MIT App Inventor in Informatics learning [19].

To ensure that the instruments were appropriate and measurable, content validity was assessed through expert judgment. This validation was conducted before the instruments were used for data collection [20]. The research instruments were reviewed by a lecturer specializing in management and an education practitioner who served on the management team at SMA Islam Terpadu Ulil Albab Batam. The results of the expert judgment are presented below. The data collection techniques and instruments, including observation, in-depth interviews, documentation, and questionnaires, are described as follows.

1. Observation. The researcher observed the Informatics teacher to document the learning materials, the implementation of Informatics learning using MIT App Inventor, and the teacher's activities during the learning process.
2. In-depth interviews. The researcher conducted in-depth interviews with the Informatics teacher and the Vice Principal for Curriculum to obtain information on the implementation of Informatics learning using MIT App Inventor.
3. Documentation. Documentation was used to collect data related to the implementation of Informatics learning using MIT App Inventor. The documents analyzed included learning materials, curriculum documents, and other supporting records.
4. Student questionnaire. The questionnaire was developed based on several key aspects: planning, implementation, classroom management, facilities and infrastructure, learning interactions, and support and challenges. Each aspect was further developed into operational indicators for assessing MIT App Inventor-based Informatics learning from students' perspectives.

RESULTS AND DISCUSSION

This study was conducted in October 2025 to analyze managerial barriers to implementing MIT App Inventor in Informatics learning at SMA Islam Terpadu Ulil Albab Batam. The research participants included the Vice Principal for Curriculum, the Informatics teacher, and students from classes recommended by the Informatics teacher, as they were considered familiar with implementing MIT App Inventor. Research data were collected through observation, in-depth interviews, documentation, and a Likert-scale questionnaire administered to 43 Grade XI and XII students enrolled in Informatics. Thus, the findings describe the implementation of Informatics learning and identify the factors contributing to managerial barriers in technology-based learning.

Table 1. Teacher Observation Results

Variable	Observable Aspects	Indicator	Keterangan
Informatics Learning Using MIT App Inventor	Planning	The teacher has an Informatics teaching module for learning using MIT App Inventor.	The teacher has prepared an Informatics teaching module.
	Organize	Classroom learning management by the teacher.	The teacher organized students into several groups to complete the assigned projects.
	Implementation	Managerial barriers affecting classroom instruction.	During the learning process, the teacher encountered several difficulties related to students' understanding and managing multiple students who asked questions simultaneously.

Based on Table 1, the implementation of Informatics learning using MIT App Inventor from a managerial perspective involved three main stages: planning, organizing, and implementation. At the planning stage, the teacher prepared an learning module to guide the implementation of MIT App Inventor learning. The availability of the learning module indicates that the planning process had been properly conducted, with the learning objectives, materials, activities, and assessments designed before the learning activities began. Thorough planning provides an essential foundation for managing project-based learning because MIT App Inventor requires systematic stages in the application development process [21].

Next, in the organizing aspect, the teacher divided students into several groups to complete application development projects. This grouping aimed to improve students' collaboration, communication, and problem-solving skills. Project-based learning with MIT App Inventor can be more effective when conducted in groups, as students can exchange ideas and share tasks based on their respective abilities. In addition, this strategy helps the teacher manage classes with a relatively large number of students.

However, based on Table 1, managerial challenges were still identified during the implementation stage of the learning process. The teacher experienced difficulties when many students asked questions simultaneously, requiring attention to be divided among several groups at the same time. This condition limited the teacher's ability to provide optimal guidance to all students. These challenges indicate that project-based learning with MIT App Inventor requires more effective classroom management than conventional learning, as each group encounters varying levels of difficulty in completing the project. The main findings of this study show that Informatics learning using MIT App Inventor was implemented effectively at the planning and organizing stages, although challenges remained during implementation. The teacher had adequate learning materials and applied collaborative learning strategies through group formation [22]. However, guiding students during visual programming practice remained a major challenge in learning management.

At the documentation stage, data were collected from the Informatics teacher by gathering learning documents used in MIT App Inventor-based learning. The documents obtained included learning modules, teaching materials, and references that supported the teacher in explaining and guiding Informatics learning in the classroom [10]. The learning documents used by the teacher in the classroom included:

Table 2. Informatics Teacher Learning Documents

Document Type	Quantity
Learning modules for Grades XI and XII	2 files
Printed teaching materials for Grades XI and XII	2 items
Video tutorials	3 videos

Based on Table 2, the learning documents prepared by the Informatics teacher consisted of two learning module files for Grades XI and XII, two printed teaching materials for Grades XI and XII, and three video tutorials used as supporting media in MIT App Inventor learning. The completeness of these documents indicates that the teacher systematically prepared the learning materials before the learning process was implemented. This finding suggests that the implementation of learning focused on classroom content delivery and was supported by learning documents designed to facilitate students' learning needs.

The learning modules served as the main guide for the teacher in directing the learning process according to the established learning outcomes [23]. Meanwhile, printed teaching materials served as learning resources students could review independently, helping strengthen their understanding of basic concepts before developing applications with MIT App Inventor. In addition, video tutorials provided a more interactive learning medium because students could independently review the application development steps when they encountered difficulties. Thus, the combination of learning modules, printed teaching materials, and video tutorials reflects the teacher's efforts to accommodate students' diverse characteristics and learning preferences.

However, the available learning documents were still limited to the core materials taught in Grades XI and XII. This condition indicates that MIT App Inventor-based learning documents still require further development in terms of material variety and more innovative learning media [6]. The addition of advanced modules, more diverse video tutorials, and project-based exercise banks is expected to increase students' independence in learning and reduce their reliance on teacher guidance throughout the learning process. This thorough preparation is one factor supporting the effective implementation of MIT App Inventor in the classroom. Teachers with comprehensive learning documents can guide students more effectively through the application development process because the learning objectives, activity procedures, and evaluation mechanisms have been systematically designed. However, well-prepared learning documentation alone cannot ensure successful learning without continuous supervision and evaluation [20].

In-depth interviews were conducted with the Vice Principal for Curriculum and the Informatics teacher. The aspects addressed in the interview with the Vice Principal for Curriculum included Planning, Organizing, Implementation, Supervision and Evaluation, and School Support. The results of the in-depth interviews are presented in Tables 3 and 4.

Table 3. In-Depth Interview Results with the Vice Principal for Curriculum

Aspect	Response
Planning	Students need basic coding knowledge before using MIT App Inventor. Information about MIT App Inventor has not yet been formally communicated to the curriculum division.
Organizing	The number of instructors or teachers needs to be increased, or peer tutors should be involved.
Implementation	Appreciation should be provided for the products developed by students.
Supervision and Evaluation	Monitoring and evaluation of MIT App Inventor implementation have not yet been conducted.
School Support	The school provides computer laboratory facilities, a Wi-Fi network, and LAN connections.

Based on Table 3, the interview with the Vice Principal for Curriculum showed that Informatics learning using MIT App Inventor had been implemented in accordance with learning management functions, including planning, organizing, implementation, and supervision, supported by the provision of school facilities and infrastructure. Planning was carried out by preparing learning documents aligned with the curriculum, while organizing was implemented by dividing teachers' responsibilities and providing a computer laboratory as a supporting facility. In terms of supervision, the school also monitored the implementation of learning activities to ensure they aligned with the established objectives. These findings indicate that, from a managerial perspective, the school had made efforts to create a learning environment that supports the implementation of MIT App Inventor.

Table 4. In-Depth Interview Results with the Informatics Teacher

Aspect	Response
Planning	Project-Based Learning (PjBL) was implemented by assigning challenges to students.
Organizing	Students were given opportunities to search for references online.
Implementation	Explanations were provided during class hours, while project activities were conducted both during and outside class hours.
Supervision and Evaluation	Monitoring was conducted through progress reports submitted by each small group at every meeting.

Based on Table 4, the Informatics teacher explained that learning using MIT App Inventor had been implemented in accordance with the planned stages of learning management. The teacher prepared learning documents, conducted learning activities aligned with the established learning outcomes, and evaluated students' learning through application development projects. However, several challenges remained, particularly limited access to devices among some students, unstable internet connections, and differences in students' ability to understand block-based programming concepts. These findings indicate that although the learning management process had been implemented effectively, the implementation of MIT App Inventor was still affected by infrastructure limitations and students' readiness for technology-based learning.

In the planning aspect, the Vice Principal stated that teachers need a basic understanding of coding before implementing MIT App Inventor and that information about its integration into the curriculum has not yet been adequately communicated. Meanwhile, the Informatics teacher explained that planning had been implemented using Project-Based Learning (PjBL), with challenges assigned to students as part of the learning activities. These findings indicate that the teacher had operationally developed a learning strategy aligned with the characteristics of MIT App Inventor, while stronger school-level support is still needed through better communication and teacher competency development. Thus, readiness for implementation depends on the teacher's classroom planning and institutional policy support to ensure a more structured and sustainable implementation.

In the organizing aspect, the Vice Principal considered that the number of instructors still needed to be increased or supported by peer tutors to provide more optimal guidance to students. The interview with the Informatics teacher also showed that students were given opportunities to independently search for references online as part of the learning process. This finding indicates that the teacher had implemented student-centered learning, although the need for guidance remained high because project-based learning requires more intensive support. Therefore, peer tutors or additional teaching assistants may serve as alternatives to improve the effectiveness of learning management [10].

In the implementation aspect, the Vice Principal expressed appreciation for the application products successfully developed by students as an indication that the learning process had provided authentic learning experiences. This statement was supported by the Informatics teacher, who explained that learning began with in-class explanations and continued with project activities both during and outside class hours. This condition indicates that MIT App Inventor learning

extends beyond conceptual understanding by providing students with opportunities to apply their knowledge in developing application products. However, continuous project implementation also requires a substantial time commitment, guidance, and learning motivation from both students and teachers.

In the supervision and evaluation aspect, the Vice Principal stated that the implementation of MIT App Inventor did not yet have a specific monitoring and evaluation system. In contrast, the Informatics teacher explained that supervision had been conducted through project progress reports submitted by each group at every meeting. This difference in perspective indicates that the teacher had been monitoring at the classroom level but had not yet integrated it into a school-level evaluation system. As a result, the implementation outcomes had not been comprehensively documented as a basis for decision-making and future program development.

In the school support aspect, the Vice Principal stated that the school had provided a computer laboratory, Wi-Fi access, and a LAN network to support learning. The availability of these facilities indicates the school's commitment to technology-based learning. However, as reported in previous studies, the availability of facilities does not necessarily ensure smooth learning when internet connectivity and the number of available devices are insufficient to meet all students' needs.

These findings align with previous studies emphasizing that supervision and evaluation are essential components of technology-based learning management. Without structured monitoring, the implementation of technology in learning may face recurring challenges that are not systematically documented.

The data collection questionnaire was developed based on several key aspects: planning, implementation, classroom management, facilities and infrastructure, learning interaction, and support and challenges. These aspects were further developed into 16 operational indicators for assessing MIT App Inventor-based Informatics learning from students' perspectives. The questionnaire was completed by 43 students, comprising 21 Grade XI and 22 Grade XII students who selected Informatics as their elective subject. The questionnaire also included indicators of managerial barriers, including technical problems encountered by students during classroom learning.

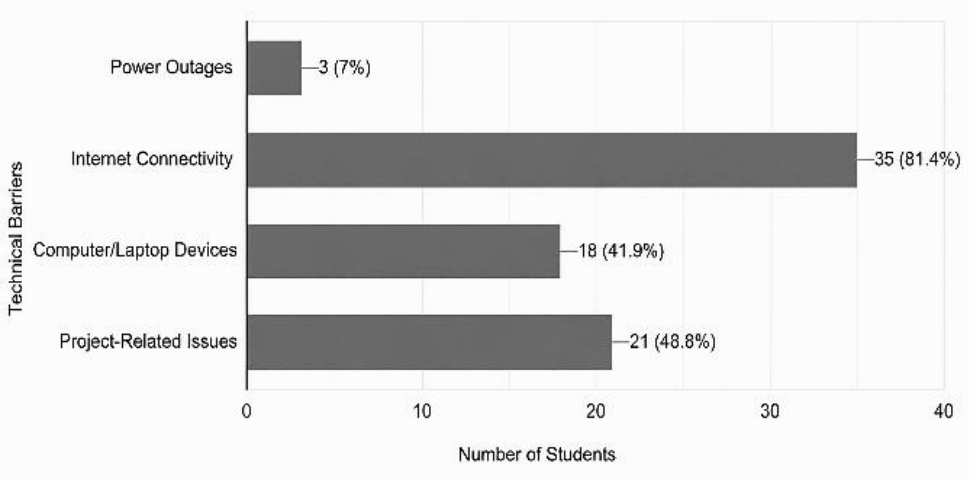

Figure 1. Students' Technical Barriers During Learning

Based on Figure 1, managerial barriers to implementing Informatics learning using MIT App Inventor were distributed across several aspects, with relatively similar proportions. Planning, implementation, and facilities each accounted for 15%, making them the most dominant aspects. Learning interaction accounted for 14.5%, followed by classroom management at 14.1%, while challenges and infrastructure accounted for 12.5% and 12.1%, respectively.

The relatively even distribution of percentages indicates that barriers to implementing MIT App Inventor were not caused by a single factor but resulted from the interaction of various aspects of learning management. The high percentage in the planning aspect indicates that programming-based learning requires more thorough preparation than conventional learning. Teachers need to prepare learning modules, practical materials, learning media, and project-based learning scenarios to ensure that the learning process aligns with the established learning objectives.

The same percentage in the implementation aspect indicates that the main challenges emerged during the learning process. Learning using MIT App Inventor requires intensive teacher guidance because each student or group may encounter different difficulties in understanding programming logic, arranging code blocks, or correcting errors (debugging). Consequently, teachers need effective time-management skills and the ability to provide appropriate guidance to all students.

In addition, the facilities aspect also showed a high percentage. This finding indicates that successful implementation of learning depends on both teacher competence and the availability of supporting facilities, such as computer laboratories, adequate computers or laptops, and stable internet access. If these facilities are inadequate, project-based learning may face various challenges that hinder the achievement of learning objectives.

In the interaction aspect, the percentage of 14.5% indicates that communication between teachers and students, as well as among students, plays an

important role in learning success. Project-based learning requires continuous discussion, collaboration, and feedback. Therefore, effective interaction supports students' understanding of concepts and their ability to complete assigned projects [24].

Meanwhile, the classroom management aspect accounted for 14.1%. This finding indicates that teachers face challenges in managing the classroom when several groups require guidance simultaneously. This condition requires teachers to distribute their attention evenly so that all students receive balanced guidance during the learning process. The findings show that managerial barriers to implementing MIT App Inventor are multidimensional, involving planning, implementation, facilities, interaction, classroom management, and infrastructure support. No single aspect was highly dominant, indicating that successful learning implementation depends on a balance among all components of learning management. Thus, although teachers have effectively designed learning activities, implementation remains influenced by the quality of instruction, the availability of facilities, interaction patterns, and supporting infrastructure. Meanwhile, the challenges and infrastructure aspects showed lower percentages than the other aspects. Nevertheless, both aspects continue to affect learning effectiveness, particularly when unstable internet connections, limited access to devices, or other technical issues disrupt the MIT App Inventor development process.

Based on Figure 1, the most common technical issue experienced by students during MIT App Inventor learning was internet connectivity (81.4%), followed by problems with the developed project outcomes (48.8%), computers or laptops (41.9%), and power outages (7%). These findings indicate that internet connection quality was the most dominant factor affecting the smooth implementation of visual programming-based learning. This condition is understandable because MIT App Inventor is a cloud-based platform that requires an internet connection for login, project storage, synchronization, and application testing [25]. When the network was unstable, students experienced delays in accessing these features, making practical activities less effective. In addition, problems with project outcomes and computer devices indicate that implementation barriers stemmed from network infrastructure, students' ability to construct programming logic, and differences in device specifications. In contrast, the low percentage of power outages indicates that this factor was not a major barrier to the implementation of learning.

These findings indicate that the successful implementation of MIT App Inventor-based learning depends on teacher and student readiness as well as the availability of technological infrastructure [10]. The prevalence of internet connectivity issues indicates that application-based learning requires stable network access to access learning materials, synchronize projects, and test developed applications. When internet connectivity is unstable, the learning process is disrupted because students require more time to access learning resources and complete assigned projects. This condition reduces learning effectiveness and limits students' opportunities to fully explore the features of MIT App Inventor [26].

In addition, nearly half of the respondents reported difficulties in completing application projects. This finding indicates that learning with MIT App Inventor requires proficiency with the software, an understanding of programming logic, the ability to develop algorithms, and the application of problem-solving skills. When students have not fully mastered these concepts, the application development process becomes more difficult, and the resulting projects may not meet the intended learning targets [27].

Another barrier was limited access to computers or laptops, reported by 41.9% of respondents. This condition indicates that not all students had devices with adequate specifications to support programming-based learning. Differences in device capabilities resulted in uneven project completion rates, requiring teachers to adjust the learning process so that all students could participate effectively.

In contrast, power outages were not a major barrier because only a small proportion of respondents experienced them. This finding indicates that the school's electrical infrastructure adequately supported the continuity of learning, so disruptions from this factor did not significantly affect the implementation of MIT App Inventor. These results are consistent with previous research indicating that limitations in technological infrastructure, particularly internet access and computer devices, are among the main barriers to implementing digital learning [10]. Thus, this study reinforces previous findings that the success of technology-based learning is strongly influenced by the readiness of the infrastructure directly used by students.

The use of MIT App Inventor in learning offers several advantages, as it is easy to use for users with basic programming skills. The project development process can be completed relatively quickly, from application development to producing an application ready for testing. In addition, MIT App Inventor is freely available, with extensive supporting information, including tutorials, provided on its official website [28]. MIT App Inventor is an application development platform that facilitates the creation of simple applications without requiring mastery of complex programming languages. Its available features simplify the project development process without the need for complex programming syntax [21]. These features and advantages make it easier for teachers to design more efficient learning activities. However, these advantages do not necessarily ensure the successful implementation of MIT App Inventor in learning.

Although this platform is designed with a simple and user-friendly interface, its effectiveness is strongly influenced by teachers' competence in planning, managing, guiding, and evaluating project-based learning [23]. Teachers serve as facilitators who determine how to optimize MIT App Inventor's potential to achieve learning objectives. Therefore, the successful implementation of this platform depends on both the

characteristics of the technology and teachers' professionalism, which is influenced by their educational background, teaching experience, and continuous professional development [29]. Teachers' educational background influences their professionalism because formal education provides pedagogical knowledge, subject-matter mastery, and the ability to design learning strategies aligned with students' characteristics [26]. Meanwhile, teaching experience provides teachers with opportunities to encounter various learning situations, making them more skilled in classroom management, problem-solving, and adapting instructional methods to actual classroom conditions [30]. Teachers' educational background and teaching experience are significantly related to teacher professionalism. Teachers with relevant educational qualifications and longer teaching experience tend to demonstrate stronger pedagogical, professional, social, and personal competencies than those with limited teaching experience [31]. Therefore, improving teacher competence through training, workshops, and practical experience is an important factor in supporting the successful implementation of technology-based learning.

CONCLUSION

The implementation of MIT App Inventor in Informatics learning at SMA Islam Terpadu Ulil Albab Batam was effective in the planning and organizing aspects, through the preparation of learning documents, the use of project-based learning, and support from school facilities. However, this study found that managerial barriers remained in supervision and evaluation aspects, which had not yet been addressed systematically. In addition, from the students' perspective, the main barriers affecting learning effectiveness were infrastructure limitations, particularly unstable internet connections and inadequate access to computers or laptops. These findings indicate that the successful implementation of MIT App Inventor depends on the platform's usability, the quality of learning management, and the readiness of the supporting infrastructure. Therefore, strengthening learning supervision, monitoring, and evaluation systems, improving teachers' competence in managing technology-based learning, and optimizing facilities and infrastructure are necessary to ensure the more effective, efficient, and sustainable implementation of MIT App Inventor to support Informatics learning.

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