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Transforming Learning in Primary Schools: The Role of AI and Flipped Classroom-based Apps

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ABSTRACT

In today's digital era, the flipped classroom is gaining popularity for its ability to increase student engagement and meaningful learning. In the flipped classroom, there are learning videos and assignments given to students to study at home. For this reason, a simple and adaptive application is needed for students to use. Referring to this, it is known that in several regions in Indonesia there are still schools and communities that are not adaptive to technological developments and are still considered complicated and confusing. For this reason, this article aims to test the effectiveness of flipped classroom-based learning applications by applying joyfull learning for elementary school students. This research uses a quasiexperimental version of the control group design, the factorial analysis technique of 2x2 nonequivalent design used Analysis of Variance (ANOVA). The results showed that there was a very significant difference in learning outcomes for Aqidah akhlak subjects in the experimental class and control class. And there is an interaction between Joyfull learning and Flipped classroom application based on Flipped classroom on student learning outcomes. The findings of this study are that the Kelasbalik.id application as a tool that supports the flipped classroom model is very adaptive for teachers, parents and student who are not teach-savvy so that it can improve the student's learning experience

1. Introduction

Today's learning environment revolution is an intelligent learning environment that offers a new future for technological solutions. Flipped classroom has the potential to be the future alternative for smart learning environment [1]. Flipped classrooms are both a challenge and an opportunity for teachers to continue to upgrade and innovate in learning [2]. The role of teachers is to help students become independent in learning and self-organizing in learning. It is essential for teachers to develop and implement effective educational strategies by creating an environment that supports independence [3]. Since 2019 researchers have conducted research ranging from the identification of flipped classroom learning environments [4], asynchronous synchronous [5], to the development of learning applications that are easy to use by teachers, students and parental involvement to build student learning experiences [6].

Based on the literature study conducted by researchers on the flipped classroom as a whole examines the implementation of flipped classrooms, frameworks, learning instructions using

flipped classrooms, and how teachers change traditional learning by making learning videos [7], [8], [9]. Available platforms such as google form, telegram, a number of LMS, WhatsApp (WA) and others are used by teachers to send videos [10]. And all of the current applications are actually not only specific to the flipped classroom model, but can also be used by any learning model. In line with this research conducted by Heiss & Oxley [8], strategies to overcome obstacles in the flipped classroom need to use tools that are easy to use so that teachers are not burdened with the operation of a platform system. Nouri's research on flipped classroom shows that students focus on learning through the use of video materials, opportunities to learn at their own pace, and increased flexibility and activeness of learning that students can access easily and effectively [11]. In the flipped classroom research, it was found that the main difficulty is to directly transfer material from physical objects into a virtual environment so that teacher strategies and platforms that can facilitate learning using the flipped classroom model are needed [12].

In the growing digital era, the integration of technology in education has become very important, especially at the elementary school level. An interesting trend is that the use of AI can be utilized to increase engagement and introduce the concept of digital literacy [13] to build students' learning experience. The application of this technology is expected to build students' digital knowledge and skills early on [14], although keep in mind that there are challenges related to dependence on technology and the need for guidance from parents and teachers. Joyful learning contributes to the learning process or strategy by making students feel happy. Based on learning theories and methodologies, some researchers created various contemporary educational games with elements of joyful learning [15], [16], [17]. Integrating AI as part of Joyfull learning with flipped classroom-based applications presents a promising approach to improving educational experiences and outcomes. The flipped classroom model, which reconfigures the traditional learning paradigm by shifting direct teaching outside the classroom and utilizing in-class time for active learning, has been shown to promote greater student engagement and autonomy [18], [19]. This is in line with the finding that the use of chatbots in a flipped learning context can improve student engagement and their learning outcomes [20].

There has been no research on the utilization of AI and flipped classroom-based applications that facilitate easy features for teachers and students in schools located in the suburbs. AI as a digital assistant can be utilized by teachers in completing administration, learning design and technology integration in their teaching [21], [22]. In addition, the next challenge is that students have not been able to utilize the learning environment by managing learning speed, selecting information, choosing learning activities, and regulating learning awareness [23]. The learning environment is one of the factors that meet the diverse needs of students. Teachers play a role in synchronous, asynchronous and project learning by following the latest advances in educational technology [24]. For this reason, learning applications with appropriate learning models such as flipped classrooms and the use of AI are needed as teacher and student solutions in adapting to technological advances.

The main reason for conducting this research is that many teachers do not have sufficient knowledge about information technology and how to effectively utilize digital tools in learning. In addition, many students have difficulty in managing independent learning outside the classroom, especially when they do not have direct supervision from the teacher. This can lead to a lack of engagement and understanding of material delivered through videos or other online resources [25], [26]. Previous research suggests that the use of AI can help address these issues by providing rapid feedback and personalized learning support, thereby increasing teacher and student engagement in the learning process [27], [28]. This research aims to explore the role of flipped classroom-based learning applications supported by artificial intelligence (AI) in enhancing an enjoyable learning experience [29]. Using a flipped classroom-based learning application, this research will examine how technology can create a more personalized and adaptive learning experience, thus meeting the needs of diverse students. The application of AI-based technology in the flipped classroom model has great potential to improve student motivation and performance, as well as provide a more personalized learning experience [27]. Thus, this research focuses not only on the effectiveness of

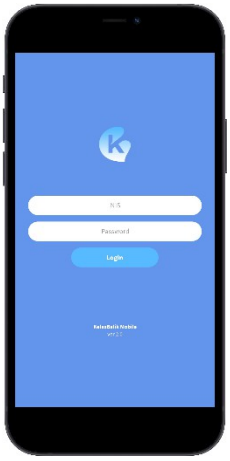
learning applications but also on how technology can be used to build students' knowledge more broadly and deeply.

2. Method

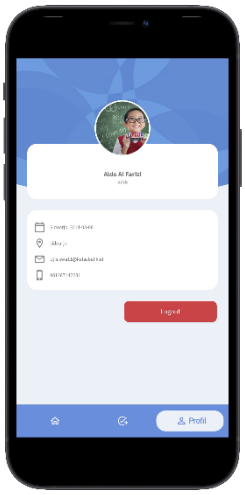
This research is a mix method starting with implementing an application that has been feasible to test before followed by quantitative research to find out its effectiveness [30], [31].[32] Researchers conducted a trial to 3rd grade students in Islamic elementary schools in Sidoarjo district, and N = 50. Researchers conducted a reverse class apk experimental class and a control class using WhatsApp (WA) with Aqidah Akhlak class III semester 2 subjects. It also supports literacy and student character learning. In the control class, researchers also distributed learning videos and homework instructions via WA. Meanwhile, the balik.id Class Apk presents 3 types of material presentation.

The Research Team piloted a flipped classroom learning application (Apk Kelasbalik.id) with the introduction of flippclassroom learning to teachers, parents and students. Learning requires learner engagement as the center of learning. Teachers transform the traditional face to face classroom into a flipped classroom. Teachers composing materials can also utilize AI to be displayed in the form of videos. The initial step taken by the research team was to provide training to teachers by socializing how the application works and the use of AI. Researchers provide workshops to teachers on flipped classroom, compiling materials and designing interesting learning videos.

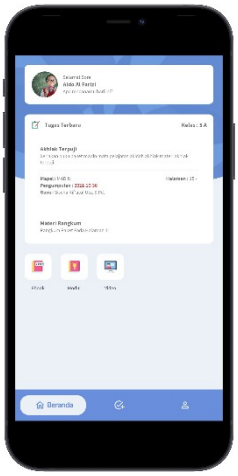
This Kelasbalik.id application is designed to be very simple, easy and useful for students. This application has gone through feasibility testing and limited trials, and has even been IPRed. Before using the application, students have first received a notification from WhatsApp about the user and password that can be used to log in to the Kelasbalik.id application.



Students log in using NIS and an easy password and given by the teacher



Students fill in biodata



Students choose to study the material provided by the teacher with

1. Read Select eBook
2. Move/practice select e module
3. View, hear select video

The teacher has embedded the materials of Aqidah Akhlak semester 2 per chapter.

Students will study at home and listen according to their learning style

Figure 1. Kelasbalik.id App view

Based on Figure 1, when students understand the teacher's instructions on the 'task' screen, then students choose a way of learning that suits them and the next day when they meet the teacher in class can be discussed together to find out the results of student learning at home with the application. The discussion given by the teacher in class can ask students to demonstrate / work on projects / solve problems and be evaluated. Thus in class the teacher can see the extent to which students understand the material and can find out the extent of the learning experience gained by students.

The instruments used are a questionnaire about joyfull learning through the balik.id class apk and student learning outcomes. Each of them has 10 questions given to students. Researchers analyzed the data with anova and used SPSS 24.

3. Results

Based on the questionnaire given, 86% of students agreed that the Kelasbalik.id application from appearance to operation was easy and attractive, and 81% agreed that students easily understood the teacher's instructions with a joyful learning approach both outside the classroom and in the classroom. Based on the percentage of the data, it was found that the use of the platform was good even though some students felt that the display was too simple and easy. Kelasbalik.id App is designed and integrated according to the needs of students in developing and resource- limited countries. Teachers as facilitators provide fun digital learning environment facilities so that students are enthusiastic about learning first when at home and able to discuss in class. In this

process, it is very helpful for students to self-regulated learning, stimulating learning interest so that it makes learning relevant, flexible, and meaningful.

Analysis of learning effectiveness

Table 1. Average learning outcomes in Aqidah Akhlak

Group Statistics

Group	N	Mean	Std. Deviation	Std. Error Mean
WA	25	67.40	11.402	2.280
Kelasbalik.id	25	85.44	7.506	1.501

Based on table 1, it shows that the value of Aqidah akhlak using the Kelasbalik App is higher than the material through WhatsApp. This is because students feel happy to learn according to their choice of 3 types available in Kelasbalik.id App

Table 2. Significance of the difference in the average score

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
						Significance		Mean	Std. Error	95% Confidence Interval of the Difference
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Difference	Lower	Upper
Aqidah learning results	Equal variances assumed	1.228	.273	-6.608	48	<,001	<,001	-18.040	2.730	-23.529	-12.551
	Equal variances not assumed			-6.608	41.513	<,001	<,001	-18.040	2.730	-23.552	-12.528

Based on Table 2, there is a statistically significant difference in the average scores of Aqidah Akhlak learning outcomes between the two applications, with a significance value of 0.001 < 0.05**.** This indicates that students who used the Kelasbalik.id App achieved higher learning outcomes compared to those who learned through videos or materials shared via WhatsApp**.**

Table 3. Data Variability

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.734[a]	.538	.496	5.328

a. Predictors: (Constant), Joyfull learning, Kelasbalik.id App)

This shows that R = 0.734 there is a strong positive relationship between independent variables and dependent variables. The regression can be relied upon to predict dependent variables based on the independent variables used. R Square = 0.538 which means that 53.8% of the variation in learning outcomes can be explained by independent variables. Overall, this model

shows a significant positive relationship between independent and dependent variables. Although there is a 46.2% variation that could be due to other factors that are not included in this model.

Table 4. Hypothesis Test of the Second Variable on Learning Outcomes

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	727.524	2	363.762	12.812	<,001[b]
	Residual	624.636	22	28.393		
	Total	1352.160	24			

a. Dependent Variable: Aqidah learning results

b. Predictors: (Constant), Joyfull learning, Kelasbalik.App)

Based on table 4 showing F count 12,812 > F Table 3.44, it is concluded that there is a significant difference between the two groups tested. Thus, indicating that the treatment given to the group of students who use the Kelasbalik.id App and joyful learning has a significant effect on student learning outcomes.

Table 5. Hypothesis Test of Each Variable on Learning Outcomes

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
(Constant)	44.410	8.281		5.363	<,001
Kelasbalik.id App	.425	.204	.354	2.083	.049
joyfull learning	.821	.289	.483	2.837	.010

a. Dependent Variable: C

Based on table 5, it shows that the sig for Kelasbalik.id App is 0.049 < 0.05 and the sig for Joyfull learning is 0.010 < 0.05, indicating that there is an influence on learning outcomes. Thus, H1 is accepted, which means that there is an influence of the Kelasbalik.id App and joyfull learning on student learning outcomes.

Based on a survey given to parents, 95% results were obtained, supporting children's learning with Kelasbalik.id App. Based on the appearance of the application, 90% of parents find it easy to use the application. Based on the presentation of material for students, 98% of parents strongly agree with the presentation of all materials in the form of links. Based on the analysis of the data above, the use of Kelasbalik.id application has achieved the goal of increasing the effectiveness of student learning. The emergence of the application also eases the task of teaching teachers and makes teachers more directed in preparing lessons. And students learn more flexibly and efficiently in the classroom. In short, this application has been successfully used and in demand by students, teachers and parents. Different from the traditional classroom learning mode, this platform stimulates their curiosity and thirst for knowledge, and their enthusiasm for creativity also increases. In class, each student will develop their own learning experience, the teacher facilitates learning by presenting discussion topics for problem solving/projects/demonstrations and ending with learning games as learning evaluation.

In line with other research on flipped shows the results that the flipped classroom approach helps reduce the abrupt switch in teaching methods from face-to-face and hands-on practice to online, and it restores the unfamiliarity of migration with online teaching platforms. In addition, it enhances students' teamwork, critical thinking, and learning skills through collaborative discussions in online sessions [33]. In the area of digital literacy for children, a holistic approach advocated by international organizations is research and networking projects. Research based on

the Global Kids Online survey [34]. In the area of digital literacy for children, a holistic approach advocated by international organizations is research and networking projects. Research based on the Global Kids Online survey [34] recommends a comprehensive approach to policy interventions related to children's well-being and rights in the digital age: "Access, skills, risks and opportunities are all part of the overall picture of children's well-being and rights in the digital age. In this study, digital literacy was developed in a flipped classroom app that provides an online learning environment and adapts to students' learning styles. Literacy through activities where students access learning and choose the learning environment available and record all assignments given as well as uploading and communicating completed assignments. The tasks given are not just doing homework but completing both reading, observing, experimenting and other tasks [22]. [35]. Other findings on students' engagement in joyful learning suggest that accurately measuring students' interest and engagement in activities that support early literacy competencies is a challenging task that needs to be approached from multiple perspectives. The discrepancies between measures of interest and engagement along with the different patterns of findings on gender and dimensions of interest suggest that using only one informant or approach to collect data on preschoolers' literacy interest and engagement does not fully capture these constructs. [36].

Another study found the potential of animated concept-in-context maps as an influential online multimedia learning resource. The map animation guides students to establish connections between different concepts and enhances their learning ability. Thus, allowing learners to correlate content at their own pace [37]. Similarly, in this study, the joyful learning activity with the reverse classroom application supports students to be more interested and challenged regarding the tasks given by the teacher and students adjust the task completion by selecting the available buttons either e text, video or e module available. Joyful learning is essentially student-centered, process- focused, fully supported, and can improve memory, and this has practical consequences for the development of joyful learning tactics [[17], [38]. AI plays an important role in creating an interactive learning environment that supports the development of 21st century skills [18], [19].

4. Conclusion

Kelasbalik.id App is a researcher's effort to support the flipped classroom learning model that is in demand in schools, especially in Indonesia. This application supports flipped classroom learning so that students understand what should be done at home related to the material presented by the teacher. The response of parents is very high because children become independent, and for parents who are left behind by technology no longer find it difficult with the application display. In fact, all display materials are in the form of links so that the cellphone load is not heavy because nothing is downloaded. In addition, students become independent and even improve learning outcomes. The results of surveys to parents also prove the effectiveness and convenience of Kelasbalik.id App and increased children's interest in learning. It is hoped that future research will develop more learning content, build a more perfect platform, bring more learning convenience and more benefits for students to gain learning experience. Future research is expected to specifically examine the impact of using AI and assess students' metacognition in depth.

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