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Innovation in learning with EBS apps: Enhancing elementary school students' critical thinking and problem-solving skills

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Abstract: The rapid technological advancement in the Era of Society 5.0 demands innovative learning methods to enhance elementary students' critical thinking and problem-solving skills. This study aims to determine the design of the EBS Apps, the responses of elementary school students to the extent of students' interest in the app, the difficulties and challenges students encounter when using the apps, how the apps train and improve their critical thinking skills , and how the apps train and improve their problem-solving skills. The population of this study consists of all lower-grade elementary school students in Sumedang Regency, West Java, Indonesia. A randomly selected sample includes 35 lower-grade students (20 boys and 15 girls). This study employs experimental method with a one-group pretest-posttest design by using questionnaires and interviews as the instruments. The results of the study indicate that, first, the EBS Apps design features with elements such as a home screen, material and practice questions, settings, and user instructions, and offers three difficulty levels of material, each presenting four situations. Second, students responded to the EBS Apps as a user-friendly application. Third, students were interested in the features of the EBS Apps, such as practice to answer questions. Fourth, students faced various difficulties and challenges while using the EBS Apps. Fifth, there was an increase in critical thinking skills among elementary school students after using the EBS Apps. Sixth, there was an increase in problem-solving skills among elementary school students after using the EBS Apps.

Keywords: *Critical thinking, EBS Apps, Elementary school students, Learning innovation, Problem-solving.*

1. Introduction

Nowadays, the mandate to keep pace with change emphasizes innovation in various sectors, including education. The emergence of the Industrial Revolution 4.0 and its accompanying technologies, leading towards the Society 5.0 Era, requires a reevaluation of educational processes to stimulate creativity and equip students with knowledge about new technologies [1]. Indonesia is currently in the preparation stage from the Industrial Revolution 4.0 towards Society 5.0, a condition where society interacts and lives alongside technology. This era positions humans as the central focus of innovation, technological transformation, and industrial automation [2], [3]. Ideally, in the Society 5.0 era, various learning innovations will emerge, involving both teachers as educational practitioners and students as learning targets. In other words, there is a need for education that can prepare students for a rapidly changing world in terms of technology, products, and values [4]. The Industrial Revolution 4.0 demands the readiness of human resources. At least ten skills are needed, including complex problem-solving, critical thinking, creative thinking, human resource management, collaborating with others, managing emotions, drawing conclusions and making decisions, service orientation, negotiation, and flexibility [5]. Therefore, the demands of the 21st century in the educational context are connected to several types of skills, such as critical thinking and problem-solving, contextual learning, communication, information and media literacy, creativity and innovation, and collaboration [6], [7].

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Two of these skills, critical thinking and problem-solving, are fundamental and must be considered. It is undeniable that it is important for students to possess the skills mentioned to equip themselves for long-term learning processes, innovation, technology use, and life and career skills [8], [9]. However, sadly students' critical thinking still needs to be improved [10], [11], [12], [13], [14], [15]. Similarly, students' problem-solving skills also require specific enhancement [16]. Both variables need solutions, either partially or integratively. The problem of still low student skills indicates a need for learning innovation [10], [17]. In general, elementary school students tend to think slowly and critically because they are not yet accustomed to or trained in it. As a result, most fall into the category of low-order thinking skills, with only a few reaching the level of high-order thinking skills [18]. Corresponding to this problem, the most common teaching method in Indonesia is direct instruction, which is one-way, where students acting merely as recipients [19]. Therefore, Indonesian education needs a new touch in its learning components. The components of education involved influence the improvement of education quality, such as the teaching and learning process, students and learning materials, educational foundations and goals, teaching methods, learning evaluation, learning tools and infrastructure, and a supportive learning environment [20]. The most fundamental improvement in this regard is the emergence of learning innovations that align with the times. Innovative learning can enhance students' skills in the learning process more effectively than lecture methods only [21]. The use of interesting and innovative learning media can improve students' academic achievement [22].

Elementary school students today are no longer unfamiliar with the use of technology; in other words, they have integrated technology into their lives, such as using gadgets and software applications like social media or games. The development of technology in the field of education and its utilization in the learning process significantly impacts students' learning outcomes [23]. This renewal process should be able to keep pace with the Era of the Industrial Revolution 4.0. The development of information and communication technology as a flexible product according to the demands of the times can offer innovative aspects for education [24]. This technology is expected to benefit the educational world [25]. Therefore, to bridge the gap between the demands of 21st-century skills and learning innovation, this study presents Ethnopedagogy-Based Situation Apps (EBS Apps) as a learning means.

A previous study by [23] focused on developing Android-based mathematics learning applications. Their departs from the need for an interesting learning model and provides increased achievement, especially in problem solving skills, while also aiming to optimize the learning model assisted by Android-based mathematics learning devices. The findings demonstrate that experimental class using using Android application had better problem solving abilities than in the conventional class. Another previous study is by Rasyid et al. (2019) [26] who developed learning media assisted by Android games to improve students' critical thinking skills by utilizing the ADDIE model research and development (RnD) approach. Their research aims to determine the development results of learning media assisted by Android games and determine the increase in critical thinking skills and student responses to learning media assisted by Android games. In addition, the media produced was very valid and practical, therefore, it could improve students' critical thinking skills. Positive responses came from students regarding the application of learning media assisted by Android games. The development of nearpod e-media through the Discovery Model to improve students' critical thinking skills in elementary schools was carried out by Susanto (2021) [27]. This study employed research and development (RnD) approach and collected data through test instruments, observations, interviews and questionnaires. The findings showed that the product effectiveness test was in the medium category, in meaning that the product use was effective in improving students' critical thinking skills. In line with that, its use in learning is very feasible and effective in improving students' critical thinking abilities. Furthermore, another development research was carried out by [28] who used the Dick, Carey and Carey model of research and development (RnD) approach. This study aims to analyze the feasibility and practicality of multimedia-based products by involving 156 students as respondents. The research results found that the multimedia developed was effective in thematic learning. Students responses showed an average indicator of 79.5% indicating that multimedia-based applications were feasible to implement. Lastly, [29] conducting research related to the development of the Kopi D'Lima application for Independent Learning by employing research and development (RnD) with the ADDIE model. The analysis stage

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showed that the needs of teachers and students for effective and efficient application-based learning media resulted in the independent learning process being implemented optimally, especially in elementary schools. In connection with previous research, this study generally aims to explore the implementation results of using EBS Apps taking the perspective of elementary school students. Based on this explanation, the research questions were formulated as follows.

(1) How is the design of EBS Apps?
(2) What are the responses of elementary school students regarding the use of EBS Apps application?
(3) Do elementary school students have an interest in the EBS Apps application?
(4) Do elementary school students face difficulties related to using the EBS Apps application?
(5) How can the EBS Apps application train and improve elementary school students' critical thinking skills?

How can the EBS Apps application train and improve elementary school students' problem-solving skills?

2. Literature Review

2.1. EBS Apps as Learning Innovation

One of the teacher's efforts to train critical thinking and problem solving skills is to use innovative learning models and media [30]. Ethnopedagogy-Based Situation Apps (EBS Apps) is an actualization of a learning model developed through three stages. The learning model used in this application is ethnopedagogy-based situation, where the users begin the activity by observing various cultures presented at each level and is offered a choice of appropriate information according to that culture. The second stage is asking questions based on culture (problem posing) and the third stage is evaluation. This application makes it possible to train students' analytical skills, problem posing and problem solving through an interesting and innovative learning menu. EBS Apps contains three levels which have various cultures at each level. The features available in EBS Apps include the use of sound, dark and light displays, and the available language versions, namely Indonesian and English. EBS Apps application is available on Google Playstore and offers three levels of ability, namely easy, medium and difficult. Each level has four learning situations which contain several test questions. If the previous level has not been completed, the next level is still locked. Students need to complete the first situation before moving on to the third situation. The questions in the application are related to local Indonesian wisdom according to the student's context. Teachers can try to facilitate students regarding environmental problems that they usually face and experience. This acts as an effort to train students' problem solving abilities [31].

2.2. Critical Thinking Skills

Critical thinking is a skill needed in everyday life, hence, individuals can make decisions and solve problems [32]. The stages of critical thinking skills include analysis, assessment, building ideas, and rational and logical thinking [33]. Critical thinking is a reason-giving and reflective skill that emphasizes making decisions about what to believe or do [34]. This can be interpreted as the activity of analyzing ideas in a more focused manner, sharply distinguishing, selecting, identifying, studying, and developing them towards a more refined direction. [35]. For example, the emergence of this skill in students is reflected in the form of (1) comparing or contrasting, (2) making categories, (3) examining small parts of the whole, (4) explaining causes, (5) making sequences, and (6) make predictions [30]. This is seen as an intellectual process in conceptualizing, applying, analyzing, synthesSizing, or evaluating various information obtained from observations, experiences, reflections, and the results are used as a basis for taking action [36]. The development of students' thinking skills is reviewed through broader indicators, including formulating problems, collecting data and compiling information, analyzing data to build arguments, asking questions and answering questions, ensuring the credibility of information, conducting evaluations, and making conclusions [37].

Teaching critical thinking to students is crucial, as Marzano et al. (1993) [38] revealed that this skill allows students to utilize their potential, is a universal skill and is needed by all professions, trains

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adaptability in responding to rapid changes in information technology, improves verbal and analytical skills, increases creativity, and is crucial for self-reflection. Several indicators related to critical thinking skills include: (1) the ability to provide simple explanations by focusing on a question, analyzing arguments or asking and answering clarifying and challenging questions, (2) the ability to build basic skills by considering the credibility of sources and observation results, (3) the ability to make good and precise conclusions, (4) the ability to make further explanations, and (5) the ability to organize strategies and tactics by deciding on a course of action when interacting with other people [39]. A similar standpoint from Ennis (2011) [40] that there are five aspects of critical thinking skills, including (1) providing simple explanations by focusing on questions, analyzing questions, asking and answering questions about an explanation, (2) building basic skills that contain indicators by considering whether the source is trustworthy or not, observing and considering an observation report, (3) concluding by deducing and considering the induction of the results of the deduction, inducing and considering the induction, and making or determining the results of the consideration, (4) providing further explanations which include defining terms and considering a definition in dimensions and identifying assumptions, and (5) organizing strategies and tactics to determine an action when interacting with other people. Some of these complex indicators include problem formulation, gathering facts, planning, strategic planning, and providing further explanations [10].

2.3. Problem Solving Skills

Individual success in facing the era of globalization is characterized by having problems solving skills [41], [42]. Problem-solving skills help individuals to adapt effectively to the living environment [9]. Simply, this skill refers to efforts to overcome difficulties to achieve goals. Solving problems focuses on the ability to apply pre-existing knowledge and experience to find answers [43]. These skills are necessary, especially for students to compete globally, make appropriate, logical and systematic decisions and consider decisions from various points of view [44], [45], [46]. The manifestation of problem solving is the ability to understand problems, find solutions, and be able to predict results [47]. Problem solving skill has four characteristics, such as being cognitive, involving processes, guided by the goal of the problem, and being personal, namely whether the problem is difficult or easy depending on personal preferences [48]. Students can achieve this skill if they are able to go through the stages, including defining the problem, looking for alternative solutions, determining the most appropriate solution among many alternative choices, applying the solution to the problem, and predicting the results of solving the problem [49]. These steps expand to understanding the problem, developing a plan, implementing the plan, and reviewing or evaluating the problem [50], [51]. In details, Polya (2004) [51] describes four indicators of problem solving skills and each sub-indicator, including (1) understanding the problem, marked by the student's ability to show the principle part of the problem being asked, what is known, and the prerequisites, (2) planning a solution, marked by the ability to connect something with a given problem and restating the problem, hence, a brilliant idea emerges that comes from previous experience or knowledge, (3) carrying out the plan is marked by the students' belief in the correctness of each previously determined solution step, and (4) evaluating the problem or checking the results obtained are characterized by the ability to critically re-examine answers, provide supporting or challenging arguments, and find different solutions creatively, through four processes. Initially, it begins with students understanding the problem, developing a plan to solve the problem, creating a solution, and seeing the results of the solution and reviewing its implementation [52]. The development of problem-solving skills provides the basis for the acquisition of decision-making skills[53]. Students hypothesize a solution to a problem, but still need sufficient information to test the validity and feasibility of the hypothesis [53].

3. Methodology

3.1. Research Model

The study employed a one-group pretest-posttest design, which is a type of quasi-experimental design. The one-group pretest-posttest design involves one group of students being measured using certain instruments [54], [55]. The population of this study was all lower-grade elementary school

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students in Sumedang Regency, West Java, Indonesia. A sample of 35 third grader at SDN Sukaraja 1 was randomly selected. The students involved were given an explanation of how to use the EBS Apps application. Once the explanation is complete and they feel they have understood the instructions well, they are asked to operate and explore the application. The following is the one group pretest posttest design used in this study.

Table 1.

	Treatment	Questionnaire measurement
Experiment class	X	O

3.2. Participants

This study involved a population of lower-grade students in Sumedang Regency, West Java, Indonesia. The research sample was taken randomly, namely 35 lower-grade students from one of the elementary schools in Sumedang, consisting of 20 boys and 15 girls. Before the experiment was carried out, students were given a detailed explanation of how to use the EBS Apps application. Next, they were asked to operate the application independently.

3.3. Data Collection Tools

The instruments used in this study are questionnaires, interviews and observations. The questionnaire and interviews have been validated by two experts who are lecturers with doctoral degrees from the Education University of Indonesia and have experience in research. Questionnaires were used to collect data regarding student responses to the EBS Apps application as well as improving critical thinking and problem solving skills. Students fill out a questionnaire based on statements with closed answer options: strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). Interviews were conducted to obtain additional data and clarify student responses recorded in the questionnaire [56]. Observations were carried out by the research team to ensure students' understanding of the explanation of using the EBS Apps application, therefore, they could optimize its use.

3.4. Data Collection Process

The data collection process was divided into 4 stages.

3.4.1. Preliminary Stage

In this stage, the research team requested permission from elementary schools in Sumedang Regency, West Java, Indonesia by submitting an application letter to the School Principal. The letter contained a request for permission to conduct data collection involving third grader. Once approved, the research team began the data collection process. We came to the classroom and carried out research procedures. This study process includes planned activitues, such as observation, interviews, and filling out questionnaires by students. All activities were carried out by paying attention to research ethics and permission given by the school.

3.4.2. Pre-Treatment Stage

Students were given detailed directions and explanations on how to use the EBS Apps application.

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Figure 1.
Teacher explaining the use of EBS Apps application.

To make things easier, the research team was assisted by several university students in providing instructions and accompanying students. With the help of students, it will be easier to provide explanations contained in the EBS Apps guidebook (Isrokatun et al., 2022), hence, students can follow each step well. This activity aimed to ensure that there were no technical obstacles faced by students when they operate the EBS Apps application. Thus, it was hoped that students can use this application smoothly and effectively, and support their learning process optimally. The explanations provided also include solutions to some technical problems that may arise, therefore, students feel more confident and ready to use the application.

3.4.3. Treatment Stage

After ensuring that students had a good understanding of using the app, they were asked to start operating it. This process was carefully monitored by the research team to ensure that the application runs optimally without any technical problems. During operation, all students were ensured to have explored and interacted with various digital activities available in the EBS Apps application. This observation aims to ensure that each student can use the application effectively and get maximum benefit from the activities provided. Apart from that, supervision was also carried out to provide direct assistance should there be students experiencing trouble or needing additional explanations. In this way, the entire process of using the EBS Apps application can run smoothly and meet research objectives.

3.4.4. Post-Treatment Stage

Once they had finished exploring the EBS application, students were asked to fill out a questionnaire. The answers were followed up by interviews with students to obtain more in-depth data.

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Figure 2.
Students filling questionnaire.

Figure 3.
Student interview.

3.5. Data Analysis

After collecting data, the next activity was to carry out analysis using qualitative and quantitative approaches. The qualitative data was done by analyzing the interview results with students by reducing data, simplifying, grouping, drawing conclusions, verifying, and presenting data in narrative form that is easy to understand [56].

Meanwhile, the quantitative data were obtained from questionnaires filled out by students. The responses to the questionnaire were assessed using a Likert scale, and the mean value of their responses were calculated. Next, we conducted a one-sample t test to evaluate improvements in critical thinking skills and overall problem-solving ability. Quantitative data processing uses software such as Microsoft Excel and IBM SPSS Statistics 24 [56], hence, the results of the analysis can be valid and used as a basis for generalization in the context of this study.

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4. Results

4.1. Operational Design of EBS Apps

4.1.1. EBS Apps: Feature and Supports

Ethnopedagogy-Based Situation Apps (EBS Apps) have features such as a home page, materials and practice questions, settings, and instructions for using the application. In particular, the homepage offers three difficulty levels of questions, namely easy, medium and difficult. The three levels each contain four different situations. Each level and situation is in a locked condition, to open the locked ones, students must answer the questions correctly. The following is a visualization of the EBS Apps homepage.

Figure 4.
Home of EBS Apps.

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Figure 5.
Selecting information.

Figure 6.
Selecting questions.

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The next feature in EBS Apps is material and practice questions. There are twelve practice topics that students can play, including local wisdom about reog, Borobudur Temple, congklak, Prambanan Temple, engklek, karapan sapi, rumah gadang, angklung, wayang golek, sekaten festival, kecak dance, and dango ride. Initially, students were asked to read a short text according to the chosen topic, then answer four questions related to the text. The visualization of this feature is as follows.

Figure 7.
Materials and exercise features.

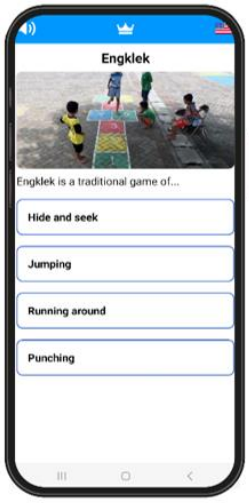

Figure 8.
Exercise.

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The next feature on the home page is the settings and instructions for using the application. The feature offers display in two modes, namely dark and light modes, language rules available in Indonesian and English, sound settings, and application copyright. Meanwhile, the instructions feature explains the procedures for using EBS Apps, as displayed in the following figures.

Figure 9.
Application instructions.

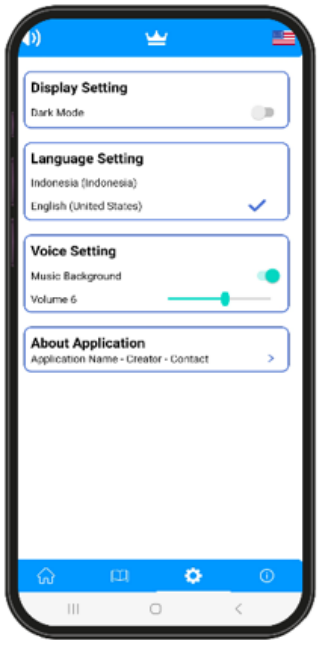

Figure 10.
Setting feature.

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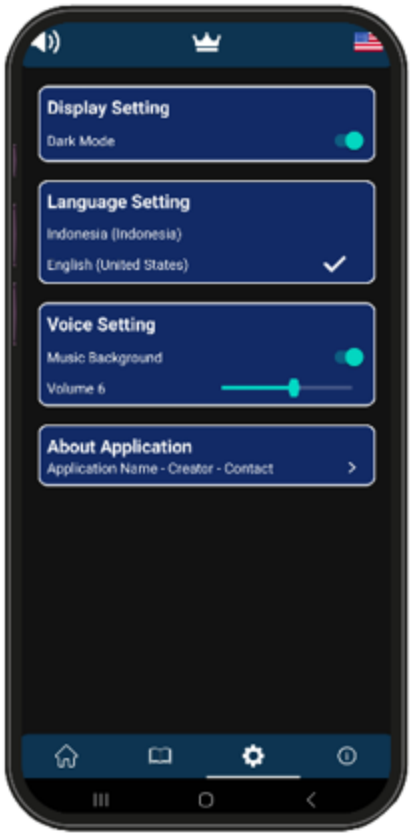

Figure 3.
Dark mode feature.

4.1.2. Students appreciating EBS Apps

This study was carried out in face-to-face learning activities in elementary schools. According to school regulations, students were not allowed to bring gadgets. Meanwhile, to support the implementation of EBS Apps uses gadgets provided by researchers. The following is a link to download EBS Apps https://play.google.com/store/*Apps*/details?id=emcorp.studio.ebs*Apps* [57].

All students were given time to explore the by ensuring that student activities were fully oriented towards using EBS Apps, such as on the homepage feature students were directed to select levels, select information, select questions, and read discussions. Meanwhile, in the material and practice features, students were directed to read a short text and continue answering five questions. Students who had completed the EBS Apps assignment, then fill out surveys and conduct interviews to explore their responses to using EBS Apps.

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Figure 4.
Students using EBS Apps.

4.2. Elementary Students' Responses on EBS Apps

Questionnaires were distributed to 35 elementary school students to find out their responses after using EBS Apps. This study took the student's perspective to determine the ease and practicality of the application, which are visualized below.

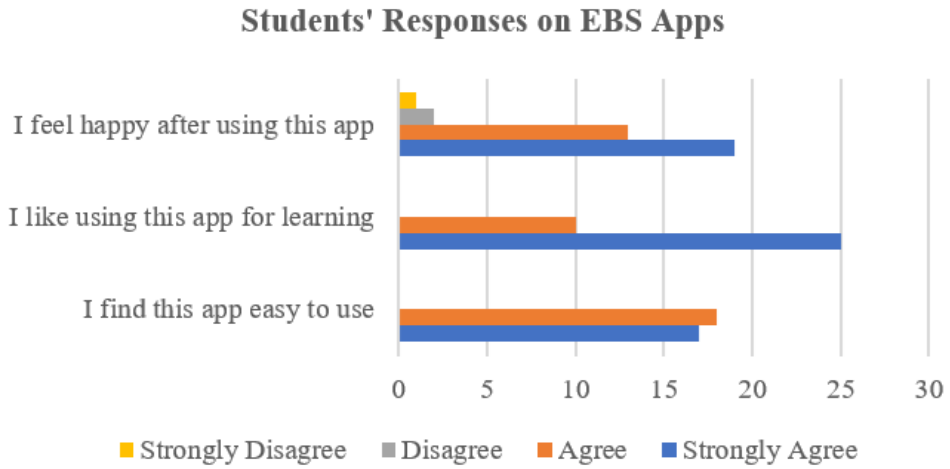

Figure 5.
Results of elementary school students' responses on EBS Apps.

Based on the graph above, 18 (51.5%) students agreed that the application was easy to use and 17 (48.5%) students strongly agreed that the application was easy to use. Next, 25 (71.4%) students strongly agreed that this application could be used in the learning process and 10 (28.6%) students agreed to use the application in the learning process. Then, 19 (54.2%) students strongly agreed that they felt happy after using the application and 13 (37.1%) students agreed that they were happy using the application, in contrast, there were two students who disagreed (5.8%) that they were happy after using the application.

The obtained survey data were expanded using interview instruments to dig deeper data. This interview involved five students who had used the EBS Apps, as presented below.

Q1: Are you happy if EBS Apps are used in the learning process?

P1 : Yes, because there is something new, in the form of an application that can be used when studying.

P2 : Yes, because I was curious about the application.

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P3 : Yes, when answering questions (I) don't get bored anymore.
P4 : Yes, studying becomes more fun and not boring.
P5 : Yes, because I can try new applications in class.

These five students' answers indicated that EBS Apps helped students raising their enthusiasm in the learning. process. Further statements were made to the same students to expand on the research findings, as follows.

Q2 :? How do you feel after trying the EBS Apps application?
P1 : (It's) different from the usual learning process, it makes (me) more enthusiastic.
P2 : Happy to be able to try new things in class.
P3 : Usually bored in class, now I'm not.
P4 : It's fun to be able to use a cellphone while studying.
P5 : Want to learn more about using the application.

These answers above showed a uniform perspective after learning using EBS Apps. The first student stated that the learning process was different from his usual classroom activities, because of the use of gadgets and applications in class. The second student stated that he was happy to be able to try new things, this was supported by the third student's statement that he did not feel bored after trying the EBS Apps application. In line with the fourth student, the implementation of learning can be accompanied by the use of cellphones. Meanwhile, the fifth student stated that the learning process was expected to use applications again. Then, it was followed by question related to evaluation based on the student's perspective, as follows.

Q3 : What needs to be added to EBS Apps?
P1 : Not sure, (I) don't know.
P2 : None.
P3 : To be able to compete with friends.
P4 : To be able play with several friends.
P5 : None.

Based on this answer, the first student expressed his doubts about adding other features to EBS Apps. Meanwhile, two students, namely the second and fifth students, stated that there were no features to be added to the application. This was different from the third and fourth students who proposed playing together with friends to solve the questions.

To support the research conclusions, the survey results of elementary school students' responses to EBS Apps were tested using a one-sample t test. This was carried out to see to what extent the survey results related to elementary school students' positive responses to EBS Apps could be significantly generalized to the research population, as presented in the following table.

Table 1.
One-sample t test result.

Respondent score				**Test value = 3**					
N	**Mean**	**Std. deviation**	**Std. error mean**	**t**	**df**	**Sig. (2-tailed)**	**Mean difference**	**95% confidence interval of the difference**	
								Lower	**Upper**
35	3.54	0.512	0.087	6.269	34	0.000	0.543	0.37	0.72

The table shows that the average score of students was 3.54 with a standard deviation of 0.512. This table was also tested using a one-sample t test at test value=3. The value of Sig. (2-tailed) = 0.000 means that a score of 3.54 was significantly different from a score of 3, as the limit of the negative response category, if the score is less than 3. Therefore, it can be concluded that the students responses to EBS Apps was positive, significantly at a confidence level of 95%.

4.3. Elementary School Students' Interest on EBS Apps

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The followng data are presented based on the questionnaire result. Taking student perspectives was done to obtain findings on the extent to which students were interested in using EBS Apps through four statements asked to 35 students, as described below.

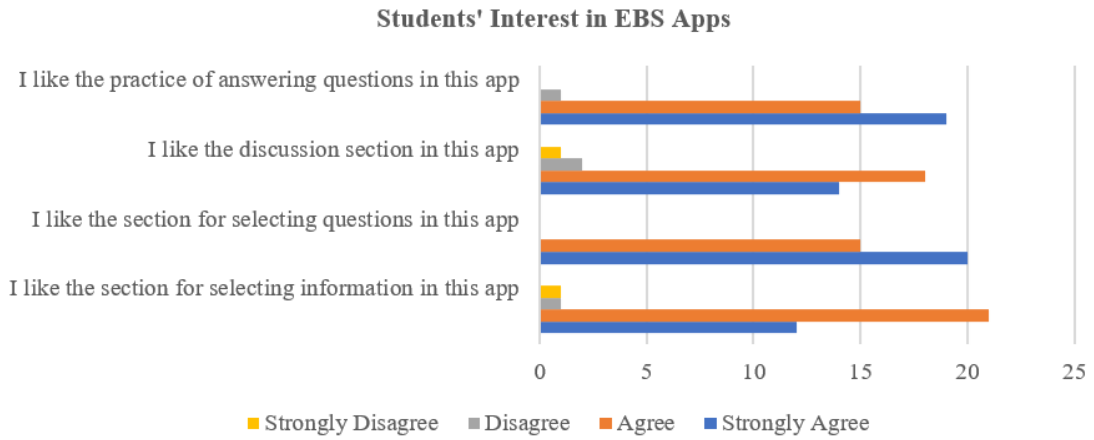

Figure 6.
Survey results of elementary school students' interest in EBS Apps.

Then, regarding the students' interest in the app. The first dimension of answers was dominated by 21 (60%) students who agreed that they liked the selecting information section in the application, while one (2.9%) student each stated that they disagreed and strongly disagreed that they liked the selecting information section in the application. In the second dimension, 20 (57%) students stated that they strongly agreed that they liked the section on selecting questions in the application and 15 (42.9%) students stated that they agreed that they liked the section on selecting questions in the application. In the third dimension, 18 (51.4%) students predominantly stated that they agreed that they liked the discussion section in the application and one (2.9%) student stated that they strongly disagreed that they liked the discussion section in the application. In the fourth dimension, the answer strongly agree dominated in the dimension that 19 (54.2%) students liked practicing answering questions in the application, while one (2.9%) student stated that they did not agree that they like practicing answering questions in the application. Data expansion on these findings was carried out through interview instruments. Two questions were asked to five elementary school students to obtain the features that make students interested, as presented below.

Q4 : Which part do you like most in EBS Apps?
P1 : Answering questions.
P2 : Choosing questions.
P3 : Information.
P4 : Level up.
P5 : Unlocking to play the next part.

In line with the results of student answers, various features were liked by each student. The first student's most liked feature was the challenge of answering questions, while the second student's most liked feature was the part about choosing questions. The third student's liked feature was the selecting information. Correspondingly, the fourth and fifth students' most liked features that they were able to answer, hence, it was possible to level up and move on to the next situation. This indicated that almost all of the EBS Apps features made students interested in using the app. The second question was asked to students to deepen the findings whether the discussion made it easier for students to understand cultural content, as presented below.

Q5 : Does the presentation of discussions in EBS Apps make you understand cultural content easily?
P1 : Yes, easy to understand.
P2 : I understand a little, I have to read it again.

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P3 : (I) don't understand, have to read it several times.
P4 : Yes, it's better to understand than not to read .
P5 : Yes, it's easier to understand.

Based on the answers of the five students, three of them predominantly stated that it was easier to understand cultural content easily through the discussion presented in EBS Apps. Meanwhile, two students stated that they needed to read the discussion several times in order to better understand the cultural content. In addition to qualitative analysis, survey results were also tested quantitatively. The survey results from 35 students were tested using a one-sample t test. This was carried out to review the extent to which the emergence of significant student interest in EBS Apps can be generalized to the research population or whether the data is adequate or not, as presented below.

Table 2.
One-sample t test results.

Respondent Score				**Test Value = 3**					
N	**Mean**	**Std. deviation**	**Std. error mean**	**t**	**df**	**Sig. (2-tailed)**	**Mean difference**	**95% confidence interval of the difference**	
								Lower	**Upper**
35	3.41	0.556	0.094	4.332	34	0.000	0.407	0.22	0.60

The table shows that the average score of students was 3.41 with a standard deviation of 0.556. This table was also tested using a one-sample t test at test value=3. The value of Sig. (2-tailed) = 0.000 means that the value of 3.41 was significantly different from a score of 3, as the limit for the category of student disinterest in EBS Apps, if the score is less than 3. Therefore, it can be concluded that students were interested in EBS Apps, significantly at the confidence level 95%.

4.4. Elementary School Students' Difficulties in Using EBS Apps

Fundamental problems when adapting to technology refer to the emergence of various difficulties, either originating from technical problems or originating from students as users. In line with that, this section deepens the findings of the difficulties encountered from using EBS Apps, as presented below.

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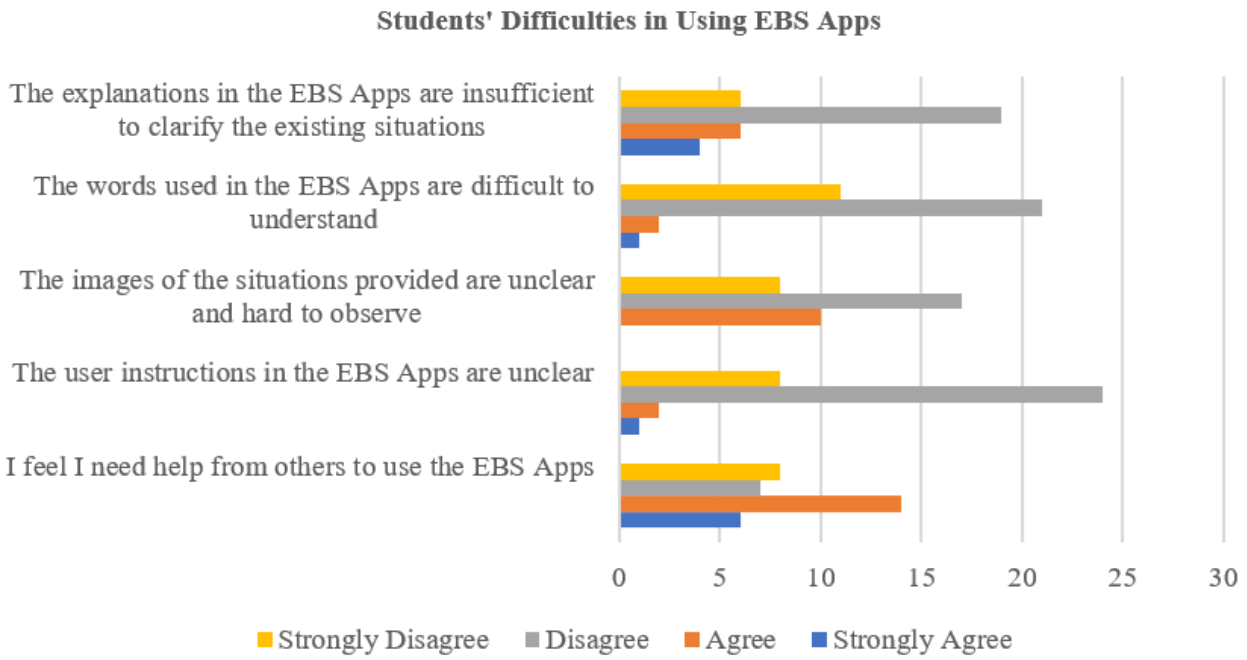

Figure 7.
Elementary School Students' Difficulties in Using EBS Apps

Based on this visualization, five dimensions were proposed to 35 students to explore the difficulties encountered by them when using EBS Apps. The first dimension, the completeness of the discussion to explain the situation, showed that 19 (54.3%) students stated that they did not agree that the discussion in EBS Apps was not complete enough to explain the situation and 4 (11.4%) students stated that they strongly agreed that the discussion in EBS Apps was not complete enough to explain the situation. The second dimension, the words in the application were difficult to understand, showed that 21 (60%) students stated that they strongly disagreed that the words in EBS Apps were difficult to understand, while at least one (2.9%) student stated that he strongly agreed with this second dimension statement. The third dimension, the image was not clear enough to be observed, showed that 17 (48.6%) students said they disagreed and eight (22.8%) students said they strongly disagreed. The fourth dimension, the instructions for using the application were not clear, received a dominant answer where 24 (68.6%) students disagreed and at least one (2.9%) student said they strongly agreed.The fifth dimension, help from other people in using EBS Apps, showed 14 (40%) students agreeing and six (17.1%) students strongly agreeing.

Further information from the survey results was obtained through interviews with five elementary school students. A total of two questions were asked to students to obtain findings about students' difficulties and needs for help from other people in using the application, as presented below.

Q6: What difficulties do you experience when using EBS Apps?
P1: Answer questions.
P2: The questions.
P3: There is little time to answer questions.
P4: Read the discussion.
P5: Answer the questions.

Based on the results of these answers, the most dominant difficulty that students raised was when they worked on questions in EBS Apps, three out of five students stated the same thing. Meanwhile, the third student found it difficult to balance time when answering questions and the fourth student had difficulty understanding the discussion. The next question was asked to students regarding the need for help from other people.

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Q7 : Do you need help from other people to use EBS Apps?
P1 : Yes, I need.
P2 : Yes, necessary but not always necessary.
P3 : Yes, just to explain how to play.
P4 : No, can do it by myself.
P5 : No need.

The results of the answers prove that in most uses of EBS Apps, students needed the help of other people to show them how to use the application. However, this does not deny that students can independently use the application.

Quantitative analysis of survey results was carried out in this study to strengthen student answers. The survey results from 35 students were tested using a one-sample t test. This was carried out to review the extent to which the forms of student difficulties that arise and the need for help from others in using EBS Apps can be significantly generalized to the population in the study or whether the data were sufficient or not, as presented below.

Table 3.
One-sample t test results.

Respondent score				Test value = 3					
N	Mean	Std. deviation	Std. error mean	t	df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
								Lower	Upper
35	2.90	0.735	0.124	-0.782	34	0.439	-0.097	-0.35	0.16

The table shows that the average score of students was 2.90 with a standard deviation of 0.735. This table was also tested using a one-sample t test at test value=3. The value of Sig. (2-tailed) = 0.439 which means that a score of 2.90 was not significantly different from a score of 3, in other words, students did not experience any difficulties in operating EBS Apps and did not need help from other people.

4.5. Elementary School Students' Critical Thinking Skills after Using EBS Apps

The following findings represent the fundamentals of the research, namely discussing the critical thinking skills of elementary school students in using EBS Apps, as visualized below.

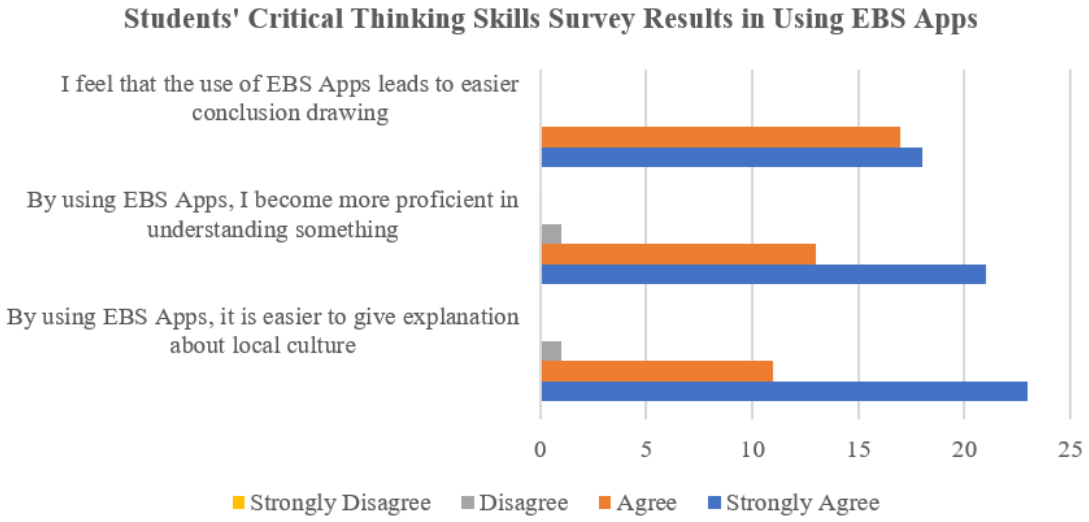

Figure 8.
Elementary school students' critical thinking skills survey results after using EBS Apps.

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The first dimension, namely the ease of students in making conclusions after using EBS Apps, found that 18 (51.4%) students strongly agreed and 17 (48.6%) students agreed. The second dimension, namely EBS Apps helps students become more skilled in understanding, predominantly 21 (60%) students said they strongly agreed and only one (2.9%). student said they disagreed. The third dimension, namely the ease of students in explaining culture after using EBS Apps, was obtained by 23 (65.7%) students strongly agreeing and one (2.9%) student disagreeing.

The survey results were supported through questions asked to students to obtain data on students' critical thinking skills in more depth, as follows.

Q8: Can you easily explain the meaning of local wisdom by using EBS Apps?

P1: Yes, because it's easier with pictures so (I) remember more.

P2: Yes, because there are practice questions and discussions.

P3: Yes, because the features in the application are complete, there are discussions, additional information and practice questions.

P4: Yes, because I can read and try several questions.

P5: Yes, because I focus more on learning to use applications.

Q9: Can using EBS Apps help in distinguishing between several discussion groups that are easy to understand and those that are a little difficult to understand?

P1: Yes, differentiate it through easy, medium and difficult levels.

P2: Yes, from the words presented through the discussion.

P3: No, because every situation has a certain type of discussion.

P4: Yes, the discussion is easiest at the easy level, sometimes at the medium level.

P5: No, because I think every discussion is easy to understand.

Q10: Does using EBS Apps make it easier to provide reasons or other answers that suit the question?

P1: Yes, because it is accompanied by pictures.

P2: Yes, because there are many answer choices I can choose.

P3: Yes, because if I answer incorrectly, the application will immediately notify.

P4: Yes, because I can keep trying until getting the correct answer.

P5: Yes, because after trying there is an image that can be observed and matched with the answer.

Q11: Does using EBS Apps help you to be able to summarize local wisdom easily?

P1: Not really, I need to re-read the discussion and information questions.

P2: Yes, but I need to be careful in reading the discussion.

P3: Yes because conclusions can be drawn from the information that I answered correctly.

P4: Yes because there are pictures, information to choose from, and complete discussion.

P5: Yes, but I need to repeat the questions and discussion.

Most of the students' interview answers showed changes in a positive direction, such as making it easier to re-explain definitions, classify easy and slightly difficult discussions, provide reasons or other answers, ask questions, and make conclusions. Based on the results of student answers, EBS Apps made it possible to help students' develop critical thinking skills in the learning process.

In order to strengthen the research conclusions, the survey results of elementary school students' responses to EBS Apps were also tested using a one-sample t test. This was carried out to see to what extent the survey results related to the increase in students' critical thinking skills after using EBS Apps could be significantly generalized to the research population. The test results are presented in the following table.

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Table 4.
One-sample t test result.

Respondent score				Test value = 3					
N	Mean	Std. deviation	Std. error mean	t	df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
								Lower	Upper
35	3.57	0.502	0.085	6.728	34	0.000	0.571	0.40	0.74

The table shows that the average score of students was 3.57 with a standard deviation of 0.502. It was tested using a one-sample t test at test value=3. The value of Sig. (2-tailed) = 0.000, which means that the score of 3.57 was significantly different from the score of 3, as the category limit that did not increase the critical thinking skills of elementary school students (if the score is less than 3). Therefore, it can be concluded that there was an increase in elementary school students' critical thinking skills after using EBS Apps, significantly at the 95% confidence level.

4.6. Elementary Students' Problem Solving Skills after Using EBS Apps

Similar to the previous findings, the following sub-findings were obtained through surveys and interviews. Distribution of the survey to 35 students utilized three prompt statements, while two interview questions were asked to obtain data reinforcement, as presented below.

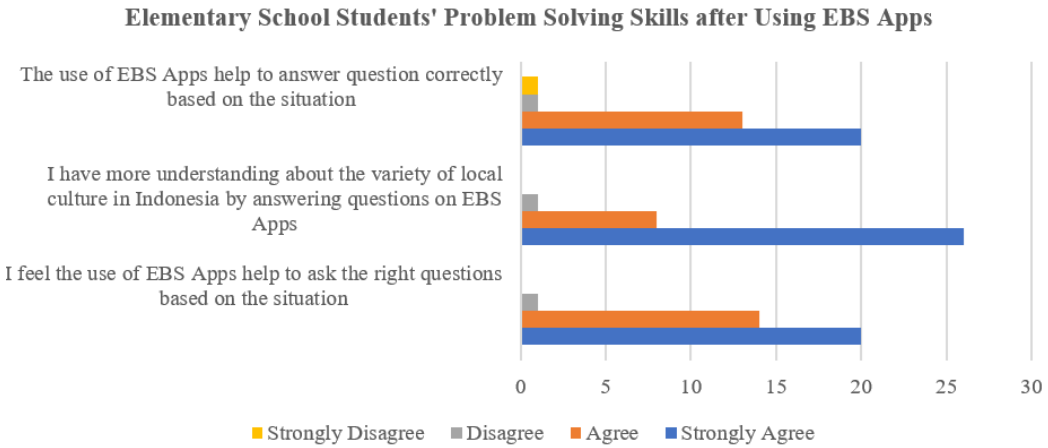

Figure 9.
Elementary School Students' Problem Solving Skills after Using EBS Apps.

The first dimension, the use of EBS Apps helped students to solve appropriate questions based on the situation, obtained the most dominant response with 20 (57.1%) students stating that they strongly agreed (57.1%) and one (2.9%) student stated that they disagreed. The second dimension, EBS Apps makes students understand more about the variety of local wisdom that exists in Indonesia, got 26 (74.2%) students who strongly agreed and one student (2.9%) who disagrees. The third dimension, the use of EBS Apps helps students to ask the right questions based on the situation, obtained dominant results with 20 (57.1%) students strongly agreed and one (2.9%) student disagreeed. Two interview questions were asked to five students to strengthen the survey results, as follows.

Q13: Does using EBS Apps help you convey problems well?

P1: Yes, because learning new things such as local wisdom in Indonesia is easy to find.

P2: Yes, because the discussion is quite complete.

P3: Yes, but I need to be more careful when reading the discussion and repeatedly answering questions.

P4: Yes, because it is already in the information sentence and chooses the question.

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P5: Yes, because the topic proposed is not difficult, it is about local wisdom.

Q14: Does using EBS Apps make it easier for you to answer questions well?

P1: Yes, because there is a wrong answer and a right answer feature, so it's easier to find the right answer.

P2: Yes, because the questions are easy to understand.

P3: Yes, because I can try again and again after reading the discussion.

P4: Yes, because the answer can be selected according to the image without having to search for information outside the application.

P5: Yes, because there is a clear picture.

Dominantly, the results of student answers tended to agree that EBS Apps helped students convey problems and answer questions easier. This was accompanied by various reasons, such as the context of the questions about local Indonesian wisdom according to the student's situation, the inclusion of images to accompany the questions, and the application's response feature if the answer is wrong.

Quantitative analysis of the survey results on problem-solving skills findings was needed to strengthen research conclusions using a one-sample t test. This was carried out to see to what extent the survey results related to the increase in problem solving skills of elementary school students after using EBS Apps could be significantly generalized to the research population. The test results are presented in the following table.

Table 5.
One-sample t test result.

Respondent Score				Test Value = 3					
N	Mean	Std. deviation	Std. error mean	t	df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
								Lower	Upper
35	3.58	0.562	0.095	6.113	34	0.000	0.581	0.39	0.77

The table shows that the average score of students was 3.58 with a standard deviation of 0.562. This table was also tested using a one-sample t test at test value=3. The value of Sig. (2-tailed) = 0.000, meaning that the value of 3 was significantly different from the score of 3, as the category limit that did not increase the problem solving skills of elementary school students (if the score is less than 3). Therefore, it can be concluded that there was an increase in elementary school students' problem solving skills after using EBS Apps, significantly at the 95% confidence level.

5. Discussion

Learning activities using EBS Apps start with selecting Situation 1 at the easiest level. Each situation includes two types of questions: selecting information and forming questions. Asking questions and information helps students spark their thinking process. This effort is a form of habituation for students when facing a certain situation and at the same time how to find efforts to find a solution to the problem [31]. Teaching critical thinking skills is essential for students to realize their potential and develop the universal skills necessary to compete globally, enabling them to quickly adapt and respond to information [38]. Research findings indicate that students believe EBS Apps assist them in recreating explanations, analyzing findings, and drawing conclusions based on prior knowledge. This encourages students as individuals who can socialize to face the era of globalization by having problem-solving skills [41], [42]. The process of finding the right answer is obtained by students after doing it repeatedly, namely when reading discussions, information, and asking questions about topics/situations. This is in line with making decisions based on previous experience and knowledge while considering decisions from several points of view [43], [44], [45], [46]. EBS Apps also help students define problems within the context of local wisdom in Indonesia. This is in line with opinion of Butterworth & Thwaites (2013) [49] that measuring students' problem-solving skills involves assessing their ability to

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define the problem, explore alternative solutions, select the most appropriate one, implement it, and predict the outcomes. However, students reported various difficulties and challenges while using EBS Apps, with the nature of these challenges differing based on individual experiences and knowledge. This variaton aligns with Mayer & Wittrock's (2006) [48] observation that the perceived difficulty of a problem depends on personal preferences and prior experience.

6. Conclusion

There are several levels that students can play on EBS Apps, including easy, medium and difficult. Each level has four situations that describe local Indonesian wisdom. The correct information selection feature allows students to observe, repeat, and investigate appropriate answers based on time. The choice of choosing questions trains students to ask questions, introduces students to interrogative sentences, and adapts situations to sentences that can be asked. The use of EBS Apps partially received positive responses from students, based on five findings, namely through surveys and interviews. Most students stated that the image feature and application feature responding to incorrect answers in EBS Apps helped them find answers easily, especially as the questions asked to students were in the context of local Indonesian wisdom, hence, the correct answer could be easily found.

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References

[1] B. M. Ghanem, "Assessing Educational Management Strategies in the Era of Education 4.0 and TOPSIS Analysis: A Comprehensive Literature Review," *-manager's J. Educ. Technol.*, vol. 20, no. 1, pp. 1–10, 2023, doi: https://doi.org/10.26634/jet.20.1.19837.

[2] Z. Yaraş and F. K. Öztürk, "Society 5.0 in Human Technology Integration: Digital Transformation in Educational Organizations," *Int. J. Progress. Educ.*, vol. 18, no. 1, pp. 458–474, 2022, doi: 10.29329/ijpe.2022.426.26.

[3] A. Tahar, P. B. Setiadi, S. Rahayu, M. M. Stie, and M. Surabaya, "Strategi Pengembangan Sumber Daya Manusia dalam Menghadapi Era Revolusi Industri 4.0 Menuju Era Society 5.0," *J. Pendidik. Tambusai*, vol. 6, no. 2, pp. 12380–12381, 2022.

[4] D. D. Dziwa and L. Postma, "Building Creative Capacities through Art Teacher Education in Zimbabwe," *Bulg. Comp. Educ. Soc.*, vol. 18, pp. 277–283, 2020.

[5] A. M. Rahmat, A. H. M. Adnan, and N. M. Mohtar, "Industry 4.0 Skillsets and 'Career Readiness'': Can Malaysian University Students face the Future of Work?,'" in *International Invention, Innovative & Creative (InIIC) Conference*, MNNF Network, Ed., MNNF Publisher, 2019, pp. 28–37.

[6] E. Care, P. Griffin, and B. McGaw, *Assessment and Teaching of 21st Century Skills*. Springer, 2012.

[7] National Council for the Social Studies, "Principles for Learning: A Foundation for Transforming K-12 Education," 2010. [Online]. Available: http://www.ncss.org/system/files/images/documents/Principles_for_Learning.pdf

[8] B. Trilling and C. Fadel, *21st century skills: Learning for life in our times*. John Wiley & Sons, 2009.

[9] E. Özeren, "Predicting Secondary School Students' 21st-Century Skills Through Their Digital Literacy and Problem-Solving Skills," *Int. Educ. Stud.*, vol. 16, no. 2, p. 61, 2023, doi: 10.5539/ies.v16n2p61.

[10] E. P. Mariana and Y. D. Kristanto, "Integrating STEAM Education and Computational Thinking: Analysis of Students' Critical and Creative Thinking Skills in an Innovative Teaching and Learning," *Southeast Asia Math. Educ. J.*, vol. 13, no. 1, pp. 1–18, 2023, [Online]. Available: https://eric.ed.gov/?q=Critical+thinking+skills+and+problem+solving+skills+of+students+in+Indonesia+are+still+low&id=ED629819

[11] B. Benyamin, A. Qohar, and I. M. Sulandra, "Analisis kemampuan berpikir kritis siswa SMA kelas X dalam memecahkan masalah SPLTV," *J. Cendekia J. Pendidik. Mat.*, vol. 5, no. 2, pp. 909–922, 2021.

[12] M. Wayudi, S. Suwatno, and B. Santoso, "Kajian analisis keterampilan berpikir kritis siswa sekolah menengah atas," *J. Pendidik. Manaj. perkantoran*, vol. 5, no. 1, pp. 67–82, 2020.

[13] F. Hidayat, P. Akbar, and M. Bernard, "Analisis kemampuan berfikir kritis matematik serta kemandiriaan belajar siswa

smp terhadap materi SPLDV," *J. Educ.*, vol. 1, no. 2, pp. 515–523, 2019.
[14] Y. Li *et al.*, "Critical thinking, emotional intelligence and conflict management styles of medical students: A cross-sectional study," *Think. Ski. Creat.*, vol. 40, p. 100799, 2021.
[15] R. A. Negoro, H. Hidayah, B. Subali, and A. Rusilowati, "Upaya Membangun Ketrampilan Berpikir Kritis Menggunakan Peta Konsep untuk Mereduksi Miskonsepsi Fisika," *J. Pendidik. Teor. dan Prakt.*, vol. 3, no. 1, pp. 45–51, 2018, doi: https://doi.org/10.26740/jp.v3n1.p45-51.
[16] S. T. Martaningsih *et al.*, "Stem Problem-Based Learning Module: A Solution to Overcome Elementary Students' Poor Problem-Solving Skills," *Pegem J. Educ. Instr.*, vol. 12, no. 4, pp. 340–348, 2022, doi: 10.47750/pegegog.12.04.35.
[17] M. Lynch and E. Bowen, "Evaluating an Interdisciplinary and Multi-Pedagogical Approach to Equipping Students to Create Social Change.," *Int. J. Teach. Learn. High. Educ.*, vol. 35, no. 2, pp. 1–10, 2023, [Online]. Available: https://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=169721652&site=ehost-live
[18] T. A. Susanto, "Pengembangan E-Media Nearpod melalui Model Discovery untuk Meningkatkan Kemampuan Berpikir Kritis Siswa di Sekolah Dasar," *J. Basicedu*, vol. 5, no. 5, pp. 3498–3512, 2021, [Online]. Available: https://jbasic.org/index.php/basicedu/article/view/1399
[19] A. D. Suyanto and A. Djihad, *Bagaimana Menjadi Calon Guru dan Guru Profesional*. Multi Pressindo, 2013.
[20] H. Basri, *Landasan Pendidikan*. Pustaka Setia, 2013.
[21] P. Nuryani, Y. Abidin, and Y. T. Herlambang, "Model Pedagogik Multiliterasi Dalam Mengembangkan Keterampilan Berpikir Abad Ke-21," *EduHumaniora | J. Pendidik. Dasar Kampus Cibiru*, vol. 11, no. 2, pp. 117–126, 2019, doi: 10.17509/eh.v11i2.18821.
[22] F. Firmadani, "Media Pembelajaran Berbasis Teknologi sebagai Inovasi Pembelajaran Era Revolusi Industri 4.0," *KoPeN Konf. Pendidik. Nas.*, vol. 2, no. 1, pp. 93–97, 2020.
[23] M. T. Qurohman, M. S. Sungkar, and T. Abidin, "Development of Mathematics Learning Application Based on Android," *J. Pedagog.*, vol. 6, no. 2, pp. 475–513, 2019, [Online]. Available: https://ejournal.unuja.ac.id/index.php/pedagogik/article/viewFile/735/463
[24] M. M. E. I. Bali, "Implementasi Media Pembelajaran Berbasis Teknologi Informasi dan Komunikasi dalam Distance Learning," *J. Tarbiyatuna Kaji. Pendidik. Islam*, vol. 3, no. 1, pp. 29–40, 2019.
[25] J. Marzal, "Pengembangan Skill dan Kompetensi TIK Guru Matematika dan IPA Kota Jambi Melalui E-Tutorial Berbasis Kebutuhan Guru," *Tekno-Pedagogi J. Teknol. Pendidik.*, vol. 3, no. 1, 2013.
[26] A. Rasyid, A. Arif, and M. Kurnia, "Pengembangan Media Pembelajaran Berbantuan Game Android untuk Meningkatkan Kemampuan Berpikir kritis Siswa," *Pros. Semin. Nas. …*, p. 16, 2019, [Online]. Available: https://proceeding.unnes.ac.id/index.php/snpasca/article/view/239
[27] H. Susanto, I. Irmawati, H. Akmal, and E. W. Abbas, "Media Film Dokumenter dan Pengaruhnya Terhadap Keterampilan Berpikir Kritis Siswa," *Hist. J. Progr. Stud. Pendidik. Sej.*, vol. 9, no. 1, p. 65, 2021, doi: 10.24127/hj.v9i1.2980.
[28] F. A. Bakhtiar, "Pengembangan Aplikasi Berbasis Multimedia pada Pembelajaran Tematik Kelas III Sekolah Dasar," *Mimb. Sekol. Dasar*, vol. 5, no. 1, p. 16, 2018, doi: 10.17509/mimbar-sd.v5i1.9363.
[29] E. Mariana, E. Sutisna, and ..., "The Use of Cooperative Integrated Reading and Composition (CIRC) Technique on Students' Reading Comprehension," 2020, *repository.unpak.ac.id*. [Online]. Available: https://repository.unpak.ac.id/tukangna/repo/file/files-20201104073509.pdf
[30] M. Agustin and Y. A. Pratama, *Keterampilan Berpikir dalam Konteks Pembelajaran Abad ke-21: Kajian Teoretis dan Praktis Menuju Merdeka Belajar*. Refika Aditama, 2022.
[31] N. Supriatna, *Ecopedagogy: Membangun kecerdasan ekologis dalam Pembelajaran IPS*. Remaja Rosdakarya, 2017.
[32] D. T. Tempelaar, "The role of metacognition in business education," *Ind. High. Educ.*, vol. 20, no. 5, pp. 291–297, 2006.
[33] F. J. King, L. Goodson, and F Rohani, *Higher Order Thinking Skills: Definition, Teaching Strategies, & Assessment*. A Publication of the Educational Services Program, 2018.
[34] R. H. Ennis, "Critical thinking Upper Saddle River," *NJ Pract. Hall*, 1996.
[35] C. Wijaya, *Pendidikan Remidial: Sarana Pengembangan Mutu Sumber Daya Manusia*. Remaja Rosdakarya, 2010.
[36] G. Walker, "Critical Thinking in Asynchronous Discussions," *Int. J. Instr. Technol. Distance Learn.*, vol. 2, no. 6, 2005, [Online]. Available: https://itdl.org/Journal/Jun_05/article02.htm
[37] I. Isrokatun, N. Hanifah, Y. A. Rohman, R. Rosmiati, and R. Khoerunnisah, "Enhancing critical thinking skills for low-grade elementary school students using mobile apps," *Cypriot J. Educ. Sci.*, vol. 17, no. 9, pp. 3218–3237, 2022.
[38] R. J. Marzano, D. Pickering, and J. McTighe, *Assessing student outcomes: Performance assessment using the dimensions of learning model*. ERIC, 1993.
[39] W. Sopandi and dkk., *Model Pembelajaran RADEC: Teori dan Implementasi di Sekolah*. UPI Press, 2021.
[40] R. H. Ennis, "The nature of critical thinking: An outline of critical thinking dispositions and abilities," *Univ. Illinois*, vol. 2, no. 4, pp. 1–8, 2011.
[41] A. B. Susilo, "Pengembangan Model Pembelajaran IPA Berbasis Masalah untuk Meningkatkan Motivasi Belajar dan Berpikir Kritis Siswa SMP," *J. Prim. Educ.*, vol. 1, no. 1, pp. 57–63, 2012, [Online]. Available: https://journal.unnes.ac.id/sju/index.php/jpe/article/view/58#:$~$:text=Pengembangan
[42] I. N. Dewi, S. Poedjiastoeti, and B. K. Prahani, "ELSII Learning Model Based Local Wisdom to Improve Students' Problem Solving Skills and Scientific Communication," *Int. J. Educ. Res.*, vol. 5, no. 1, pp. 107–118, 2017, [Online]. Available: https://www.researchgate.net/publication/333772671_ELSII_LEARNING_MODEL_BASED_LOCAL_WISDOM_TO_IMPROVE_STUDENTS'_PROBLEM_SOLVING_SKILLS_AND_SCIENTIFIC_COMMUNICATION

[43] J. Y. Chao, P. W. Tzeng, and H. Y. Po, "The Study of Problem Solving Process of E-Book PBL Course of Atayal Senior High School Students in Taiwan," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 13, no. 3, pp. 1001–1012, 2017, doi: 10.12973/eurasia.2017.00654a.

[44] E. O. I. Amanso and B. A. Basseyii, "Assessment of Selected Science Process Skills Acquisition Among Senior Secondary Schools Students in Calabar Education Zone of Cross River State, Nigeria," *Int. J. Sci. Res. Educ.*, vol. 10, no. 1, pp. 119–126, 2017, [Online]. Available: https://www.semanticscholar.org/paper/Assessment-of-Selected-Science-Process-Skills-among-Amanso/20e0e51deb50aeb4dc61d00f5125895394c5139f

[45] B. Priemer *et al.*, "A Framework to Foster Problem-Solving in STEM and Computing Education," *Res. Sci. Technol. Educ.*, vol. 38, no. 1, pp. 105–130, 2020, doi: 10.1080/02635143.2019.1600490.

[46] V. Temel, "The Problem-Solving Skills of The Teachers in Various Branches," *Educ. Res. Rev.*, vol. 10, no. 5, pp. 641–647, 2015, doi: https://doi.org/10.5897/ERR2014.2059.

[47] S. Widodo and R. Kusuma Wardani, "Mengajarkan Keterampilan Abad 21 4C (Communication, Collaboration, Critical Thinking and Problem Solving, Creativity and Innovation) Di Sekolah Dasar," *Model. J. Progr. Stud. PGMI*, vol. 7, no. 2, pp. 185–197, 2020, doi: https://doi.org/10.36835/modeling.v7i2.665.

[48] R. E. Mayer and M. C. Wittrock, "No Title," in *Handbook of Educatiobal Psychology*, P. A. Alexander and P. H. Winnie, Eds., Lawrence Erlbaum Associates Publishers, 2006, pp. 287–303.

[49] J. Butterworth and G. Thwaites, *Thinking skills: Critical thinking and Problem Solving*. Cambridge University Press, 2013.

[50] M. T. Huang and W. D. Chen, "Problem Solving Abilities," *Sci. Educ. Mon.*, vol. 273, pp. 21–41, 2004.

[51] G. Polya, *How to Solve It*, no. 246. Princeton university press, 2004.

[52] R. Rosmiati, I. Isrokatun, N. Hanifah, Y. A. Rohman, and R. Khoerunnisah, "The development of android-based learning mobile app to practice critical thinking skills for elementary school students," *Pegem J. Educ. Instr.*, vol. 13, no. 2, pp. 161–172, 2023.

[53] D. J. Skeel, *Elementary Social Studies: Challenges for Tomorrow's World*. Harcourt Brace College Pub., 1995.

[54] American Psychological Associations, *One-group pretest–posttest design*. 2020. [Online]. Available: https://bit.ly/3B0hAQW

[55] A. T. Capinding, "Utilization of 'Quizizz" a Game-based Assessment: An Instructional Strategy in Secondary Education Science 10,'" *Eur. J. Educ. Res.*, vol. 11, no. 4, pp. 1959–1967, 2022, [Online]. Available: https://eric.ed.gov/?q=one+group+pretest+posttest+design&id=EJ1356888

[56] J. Creswell, *Education Research (Planning, Conducting, and Evaluating Quantitative and Qualitative Research)*, Fifth Edit. Pearson Education, 2015.

[57] Riry, "Ethnopedagogy-Based Situation (EBS Apps)," 2022, *Google Play Store*. [Online]. Available: https://play.google.com/store/apps/details?id=emcorp.studio.ebsapps

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