

Utilization of Barcode Scanning Media to Optimize Technology-based Science Learning for Elementary School Students

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Abstract

Purpose: This study aims to reveal the use of barcode scan media as an effort to optimize technology-based science learning and obtain student learning outcomes in science subjects that can be operated on devices with the Android system.

Methodology: The method used is descriptive analytical using a qualitative approach. Data collection methods in this study include observation, interviews, and documentation. Observations were conducted at SD Muhammadiyah PK Baturan, especially class 5 with a total of 25 students. The validity of the data to be used in this study is source triangulation and tech-nique triangulation. Data analysis in this case organizes, sorts, groups, codes and categorizes the collected data, both from the field, images, and documents in the form of reports.

Results: The results of the study show that technology-based barcode scanning learning media is very good so that it can be used by students to support learning activities because students are more motivated to learn.

Applications/Originality/Value: The findings of this study can be used as a reference for teachers in teaching students to use learning media to optimize student learning outcomes.

Introduction Section

Education plays an important role in developing a person's interests and talents. Sujana (2019) stated that education is an effort to guide students, both physically and mentally, from their natural traits towards a better human civilization. Therefore, education needs to be instilled from an early age so that students grow into individuals with character. In line with the advancement of the times and technology, the world of education has entered the era of the 4.0 education industry, where technology is used in learning both physically and non-physically. Education is now undergoing a transformation through the 4.0 education industry revolution, which aims to help students develop creative and innovative mindsets and learning methods, in order to produce superior and competitive future generations (Kahar et al., 2021). The digitalization era requires us to move quickly in facing the 4.0 industrial revolution. In 21st century learning, the role of teachers has changed from merely a source of knowledge that dominates the learning process. Learning methods now no longer rely on lectures as the main way to convey information and knowledge to students. With the entry of education into the era of the 4.0 industrial revolution, there is an emphasis on the use of digital technology. Therefore, a good teacher must be able to adapt to the development of the times through the use of existing technology. The existence of the use of technology in learning has been proven through various studies. One study by Rizki Nurhabibi (2020) revealed that technology-based learning media can act as a learning aid that can create a more interesting and enjoyable learning atmosphere.

Learning can take place effectively if supported by various factors, one of which is the use of learning media based on information and communication technology. Aka Widiyanto (2021:216) states that the terms technology and communication have two meanings, namely information technology and communication technology. Interaction between teachers and students does not only occur face-to-face, but also through communication media such as cellphones, computers, and the internet and others. This also makes students confident in the values of hard work, self-discipline, and trust. Independence also helps students develop resilience that allows them to survive in the most challenging life circumstances (Emerson., 2020). According to Manzoni., (2021) in the implementation of technology-based education there are two things that need to be considered, namely the ease of obtaining the technology to be used and the accuracy of the technology to be used.

According to Utami., (2022) shows that in 21st century learning, learning activities are no longer focused on teachers, but on students. As educators, it is important to design learning tools that are in line with existing technological advances. According to Wahyuningtyas (2020:24), the use of teaching media in the teaching and learning process can generate new interests and desires and increase student motivation in learning. Learning media is an important component to support improving student learning outcomes. With the media, learning becomes more interesting so that students find it easier to understand the material presented clearly. Teachers need to create a creative learning atmosphere so that students do not

get bored. Therefore, the use of aids during the learning process is highly recommended. With learning media, teaching and learning activities become easier and more interesting, helping students understand the material better. Students' abilities can also increase according to learning objectives, because the media used by teachers can increase student concentration through more interesting and easy-to-understand presentations according to their needs. Utilization of barcode scanning for student learning in elementary school students This can help students understand the material better, which is in line with research conducted by Ahmad and Axelino (2021) on barcode scan-based learning media. This media has proven to be practical and effective as an alternative for use in learning in elementary schools.

According to Taupik (2021), this learning method can make students feel bored, sleepy, and uninterested in learning. Students tend to prefer to do activities and play that are not related to lessons in class. The use of various learning media can create a more interesting learning atmosphere and motivate students to learn. Ghofur (2020) stated that in the implementation of Natural Sciences (IPAS) learning, special attention must be given, because generally IPAS learning is carried out through textbooks and teacher presentations, which results in low student motivation in participating in teaching and learning activities. Therefore, this study aims to develop IPAS learning media using a barcode scan application that can be accessed on Android-based devices. By using barcode scanning, learning media can be practiced and easily accessed, because large amounts of data can be stored in the form of simple codes that can be read quickly (Setiadi & Rismawarni, 2020).

Motivation is an effort that can encourage individuals or groups to do something to achieve a goal. In the context of education, motivation is very important for the learning process. The role of motivation in learning encourages students to actively participate, excel in class, and have a passion for learning. Learning motivation is the drive that makes someone want to learn. It includes all the driving factors in students that result in learning activities, ensure the continuity of these activities, and provide direction to the learning process so that the desired goals can be achieved. It is believed that the higher a person's learning motivation, the better their learning outcomes. Therefore, learning motivation is a very important aspect in education, because the learning process requires motivation to achieve optimal results. The more appropriate the teacher is in providing motivation, the more successful the learning process will be. So that the adjustment of learning media in the era of the Industrial Revolution 4.0 is becoming increasingly important because it is one of the educational innovations that can improve skills (Khairunnisa, 2020). In the learning process, there are five main components, namely: 1) Learning objectives, 2) Learning materials, 3) Learning methods, 4) Learning media, and 5) Learning evaluation (Husna & Supriyadi, 2023). Interesting learning media can increase students' motivation and interest in learning (Laksana et al., 2019).

Based on the explanation above, the purpose of this study is to determine: 1) the use of barcode scan media in optimizing technology-based science learning, and 2) student learning outcomes in science subjects that can be operated on Android-based devices. The data analysis technique used is descriptive analytic with a qualitative approach. Descriptive analysis is carried out by systematically compiling data in the form of numbers or percentages related to the research object, so that general conclusions can be drawn (Santika & Suastika, 2022). Qualitative data in this study were obtained through observations of students during the learning process. presented to show their improvement during the learning process.

To find the overall level of student success in carrying out the learning process, four categories are used as seen in table 1 below:

Table 1. Student Success Rate

No	Success Rate	Success Predicate
1	70-86%	Very good
2	50-71%	Good
3	55%	Pretty good
4	40	Not good

The success indicators used as a reference in this study include: 1) an average student ability of at least 70%, which indicates that students achieve a score with good criteria, in the range of 70-86. Data for analysis were obtained from the results of the test assessment, namely the initial test before treatment and the final test after treatment. The research is considered successful if the classical completeness of students reaches 70%, which means that 70% of students get grades in the good category. If the material mastery indicators have been met, the research is considered complete and conclusions are made based on.

Research Methods

Type study this use method descriptive analytic with approach qualitative research carried out on objects natural. According to Sugiyono (2019), method study qualitative is a method based on philosophy certain. Research This aiming For record, analyze, describe , and conclude the data obtained through observation, interviews, and data collection information others and documentation. Research objectives This For to reveal Utilization of barcode scanning media as effort optimize learning ipas based on technology and acquire results Study student eye lesson ipas that can run on the

device android based students 5th grade of Muhammadiyah Elementary School PK Baturan. Research This carried out at SD Muhammadiyah PK Baturan, Kec. Colomadu, Regency Karanganyar, Central Java on August 13, 2024 at 07.15-08.50 WIB and August 21, 2024 at 11.20-12.40 WIB. Subject in study This is student grade 5 and class teacher .

Source of data obtained in study This is about Utilization of barcode scanning media for optimize learning ipas based on technology , so that type study This is qualitative data. The source of the data obtained includes : (1) students involved in research . (2) places and events behavior research in space 5th grade of Muhammadiyah Elementary School PK Baturan (3) documents or related archives with problem study.

Stages technique Data collection includes : (1) observation (Observation), namely, data that is collected with method observation in a way direct For observe and optimize How results Study students . Observation data used For know change results Study student . The data that will be collected by researcher is about : a. How utilization of learning media based on barcode scanning technology . b. How response student in accept Science learning through media based technology . ; (2) Interview that is, used For get data that is not in document or No Possible obtained in observation or observation. The data to be taken in interview in study This is interview with teachers, and students concerned with utilization of learning media based on barcode scanning technology on Science learning through media based technology of Muhammadiyah Elementary School PK Baturan . ; (3) Documentation that is, done For support the data collection process. In study This researcher use documentation For learning and getting related data document about optimize results Study students, such as class data, student names with focus study.

Validity of data in study This done through triangulation sources and triangulation technique. According to Helaluddin & Wijaya (2019), triangulation is method checks carried out with review data reset , ok before and also after analyzed. Triangulation source done with verifying data obtained from various sources sources, for example with ask accuracy information to informant others, such as compare answer between students. Purpose triangulation source is For test data credibility with compare data from various sources source . Meanwhile , triangulation technique done with check data from the same source use different methods. Results data analysis will then be agreed upon together with informant related .

According to Husaini ., (2020) data analysis is a process or effort For to arrange and organize notes results observation , interviews , and documentation in a way systematically so that researchers can more understand case study This currently ongoing. Technique applied data analysis aiming For answer question research and provide expected meaning by researchers, as well as support achievement objective research . The data analysis process includes organizing , sorting , grouping, giving code, and categorization of data obtained from various sources sources, such as field, image, and document report . After the data is collected , the next step next is data processing and analysis . where the methods applied in analysis qualitative explained through words and numbers. The data is obtained use various techniques, such as technique observation and interviews , documentation.

Research Results and Discussion

Research Results

The application of this research was carried out at Tunas Bakti Kindergarten in the 2023/2024 even semester academic year. The implementation of the research utilizes Canva application-based visual learning media to increase the interest and motivation of children aged 4-5 years to learn. The instruments used in this research are observation, interviews and documentation as follows: This research was conducted at SD Muhammadiyah PK Baturan on 25 5th grade students. This classroom action research took place over 2 meetings. The first meeting was held on August 13, 2024 at 07.15-08.50 WIB, while the second meeting was held on August 21, 2024 at 11.20-12.40 WIB. The material used in this study was the science lesson on the human digestive system. In order to utilize barcode scanning in learning, students were asked to bring their cellphones from home and download the barcode scanner application from the Playstore. After the application is installed, students can scan the barcode that has been prepared by the teacher about the human digestive system which is already available in the barcode such as learning videos, learning materials, questions, and student worksheets. The steps for using the barcode scan learning media are as follows: 1) the teacher gives each student a barcode in the form of a barcode paper sheet that has been provided. 2) each student scans the barcode via cellphone with the help of the barcode scanner application. 3) students work on the questions through the student worksheets that have been provided by the teacher. 4) After the task completion time is over, each student collects the student worksheets that have been completed and returns to their respective seats. 5) After each one scans the barcode via cellphone to find out whether what was done was correct or not.

After carrying out the action, the researcher then conducted an observation. Based on the results of the observation, during the learning process using barcode scanning learning media as a teacher's aid in explaining the material, it was seen that students were more active and enthusiastic in participating in the learning. The use of this media also has an impact on improving student learning outcomes in the subject of science.

The values used are derived from formative values. Comparison of student learning outcomes before and after treatment shows differences, which can be seen in table 2 below:

Table 2. Differences in Student Learning Outcomes Before and After Using

Before Using	After Using
Average : 50%	Average 70%

Based on the research conducted at SD Muhammadiyah PK Ba-turan especially class 5, the researcher found several aspects that have been studied starting from student learning outcomes before and after using barcode scan learning media, teacher results before and after implementing barcode scan learning media, and the benefits of using barcode scan learning media. The student learning outcomes before and after being given treatment can be seen in the differences in Figure 1.

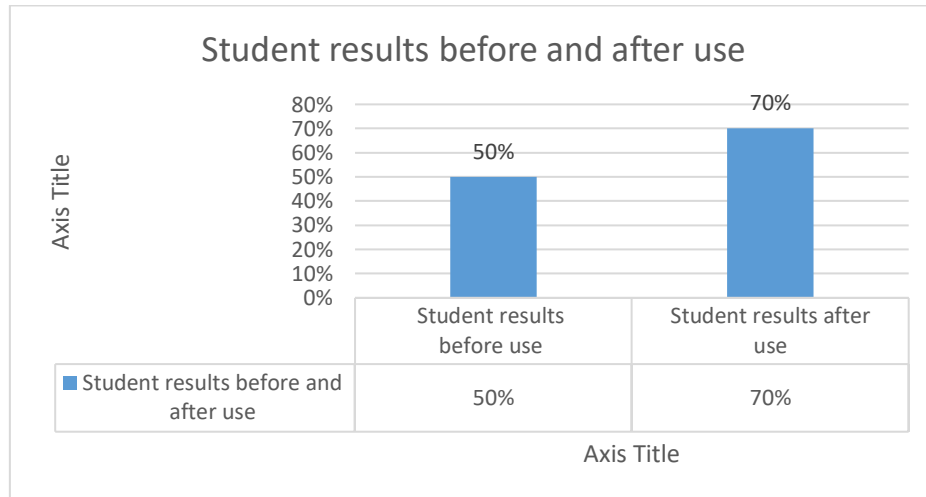


Figure 1. Student results before and after using

These results serve as guidelines in conducting research aimed at improving the learning process through the stages of planning, implementation, observation, and reflection. Based on the picture above, the learning outcomes of students before using barcode scan media, researchers took action with an average percentage of 50% and after using barcode scan media, researchers showed that the completeness of students' abilities increased by 70%. This means that the use of technology-based barcode scan learning media in the process of learning science subjects can improve student learning outcomes. The level of ability to use barcode scan learning media from teachers before implementing it can be seen in Figure 2.

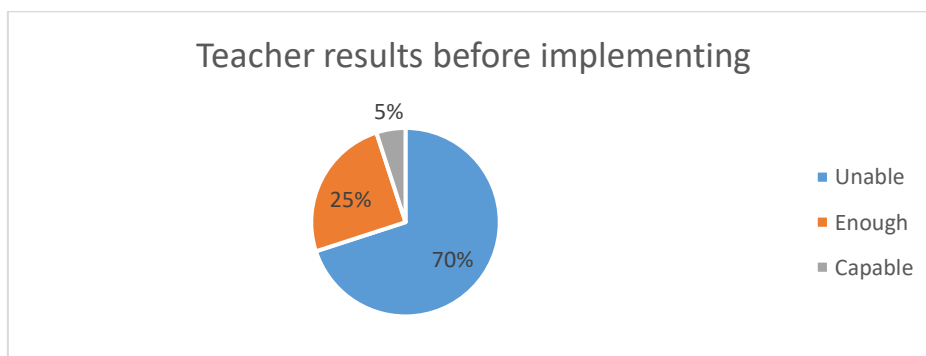


Figure 2. Teacher results before implementing

From the results of teachers before implementing barcode scanning learning media, 70% were unable to use barcode scanning learning media and did not know how to make it, 25% were quite familiar with barcode scanning learning media, 5% were able to use barcode scanning learning media. The level of ability to use barcode scanning learning media from teachers who have implemented it can be seen in Figure 3.

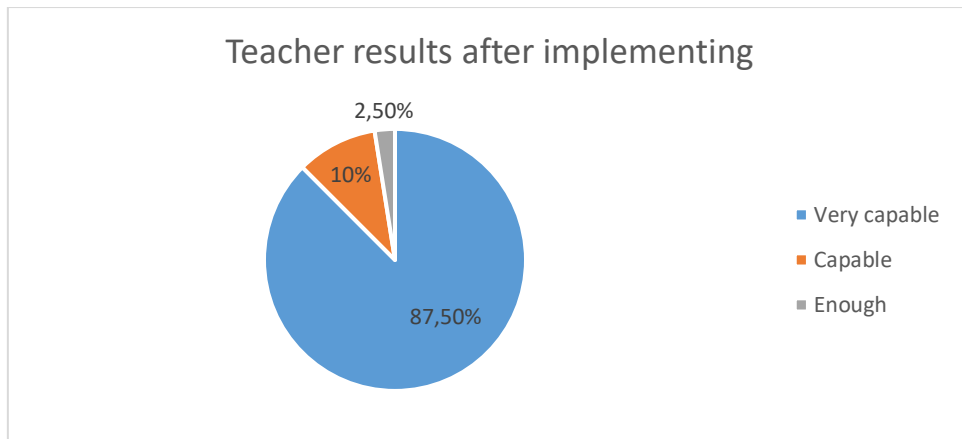


Figure 3. Teacher results after implementing

From the results obtained 87.50% are very capable of using barcode scan learning media, 10% are capable of using barcode scan learning media, and 2.50% are sufficient in using barcode scan learning media. so it can be concluded that there is an increase from before using barcode scan learning media and after using barcode scan learning media. From the results of the benefits of using bar-code scan learning media obtained in Figure 4.

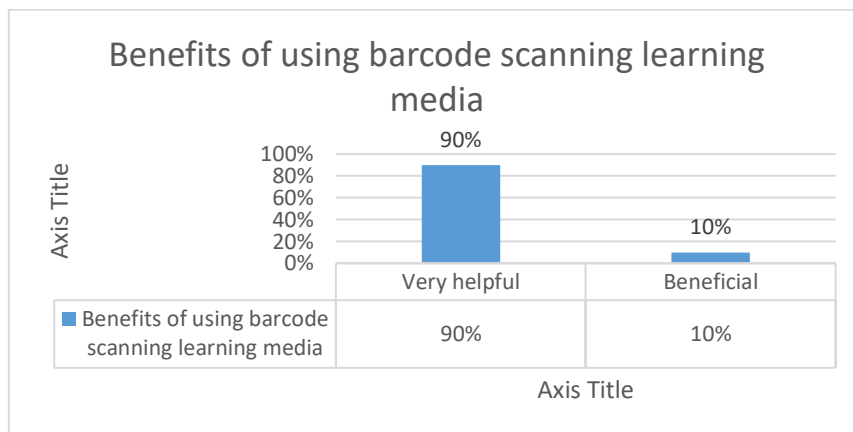


Figure 3. Benefits of using barcode scanning learning media

From the results of the benefits of using technology-based barcode scanning media in the learning process, 90% of students stated that it was very useful and 5 students or 10% stated that it was useful.

The results in the diagram above show the ability of students of Muhammadiyah Elementary School PK Baturan out of 25 students, there are 20 students who meet the good criteria, while 5 students do not meet the criteria. The results of the study before and after showed that the completeness of student abilities increased. This increase reached 70%, indicating that the use of technology-based learning media such as barcode scanning can improve student learning outcomes. Before the study, the ability of students at Muhammadiyah Elementary School PK Baturan was still very low, with an average value of 50%. Based on observations, the low ability of students is caused by a lack of enthusiasm in learning the material and exploring information, as well as the lack of use of innovative learning media that can motivate students, so they look bored during learning, which affects low learning outcomes.

Discussion

Learning media are various tools or means used in the learning process to help convey information and make it easier for students to understand the material being taught. According to Budiyo (2020), every learning media has the potential to be the right tool, but it is not always appropriate because each media has special characteristics that are suitable for conveying certain materials. Learning media can attract students' attention, thereby increasing their motivation and enthusiasm for learning (Syaparuddin & Elihami, 2020). After using technology-based learning media, students showed high interest and enthusiasm in following the material. This media contains learning videos and other materials that help students better understand the topics being taught. Hermansah (2022) also stated that devices such as cellphones and computers can increase student participation in teaching and learning activities.

Teachers need to focus more on interactions with students, provide regular feedback, and monitor student learning progress more closely (Pujiastuti, 2019). The use of less than optimal learning media can lead to misunderstandings and result in decreased learning quality, as explained by Widyatnyana & Rasna (2021). Based on interviews with teachers, it was found that not all schools have adequate facilities to use digital-based learning media. According to Lailiyah & Mardiyah (2021), the main obstacle in the use of technology-based learning media lies in its availability.

The researcher's findings are in line with previous studies showing that school facilities are not optimal. Good facilities play an important role in supporting the success of teaching and learning activities (Suranto et al., 2022). However, the results of the researcher's study show that facilities in various regions are uneven, causing gaps in the use of digital learning media. Pramadhani (2022) stated that the digital divide is caused by a lack of access to digital devices such as computers and cellphones. In addition, Hermansah (2022) explained that the use of media such as Android and computers can increase student participation in the learning process.

The teaching and learning process begins by introducing the learning media that will be used, namely technology-based learning media. The use of this media provides a new experience for students, because previously they were accustomed to direct learning models. As a result, students' interest and response to this learning are still lacking. Many students seem confused by the new learning model, which can be seen from the lack of student attention during the learning process. Some students seem unfocused on the teacher's explanation. According to Nurcahya (2020), providing reinforcement in the learning process will be difficult if the teacher does not fully understand the meaning of the reinforcement. Barcode scanning is a code created with the aim of making it easier to access and search for information (Zakaria et al., 2020). In this learning activity, the enthusiasm and involvement of all students are clearly visible. From the good practices carried out, it can be concluded that learning motivation has increased, as seen from the number of students who stated that they enjoyed learning science subjects using barcode scanning technology-based learning media. The use of this Android-based media in science learning is needed to increase student motivation, because generally science teachers rarely use digital media in learning. Most teachers still prefer to use lecture methods or tools available at school, such as LCD projectors and whiteboards. The use of learning media with barcode techniques is expected to be an innovative solution. An alternative for teachers to use in various science learning scenarios in schools (Ghofur, A., 2020).

Therefore, innovation is needed in the learning process so that teachers can optimize the use of learning media (Putri, 2019). This is in line with Pratiwi's opinion (2019) which states that learning with media containing elements of images, colors, shapes, and movements can make students enjoy the learning process more. This opinion is supported by Sadiman (2019), who emphasizes that learning activities that inspire students will help them achieve their learning goals. The main purpose of learning media is to support teaching, while influencing the arrangement, conditions, and atmosphere of learning.

Maharuli (2021) added that the quality of the teaching and learning process can be improved by using learning media, which can also increase student involvement and make learning more interesting and enjoyable. Student results after using technology-based barcode scan media in learning can optimize their learning outcomes. So that students do not feel bored and tired if learning without media and only using lecture and question and answer methods. With this barcode scan learning media, students are also interested and motivated to be active in the learning process. In addition, based on the results of the survey, interesting learning media can help students get and understand learning materials and can increase students' enthusiasm for learning. This is because learning is supported by the cellphones owned by each student. The results of teachers after implementing technology-based barcode scan learning media are that teachers find it practical to present material. Because in it there are already learning videos, learning materials, questions, and student worksheets. Teachers also make more use of technology-based learning media because with the development of the times that continue to advance.

From the description above, it is known that the use of barcode scanning learning media based on technology at SD Muhammadiyah PK Baturan has a very important role in the learning process. With the existence of barcode scanning technology-based learning media, students become more active and motivated. The use of this media also requires supervision from teachers so that students remain focused on the use of barcode scanning in science learning. In this way, students do not feel bored with only lecture methods, questions and answers, and the learning outcomes are also more optimal. The roles of teachers, students, and learning media support each other in the learning process. In addition, learning media must be adjusted to the needs of teachers and students, and be relevant to the lessons and interests of students. Therefore, in this increasingly advanced technological era, teachers need to choose the right learning media to use. their students.

Based on these problems, the purpose of this study is to improve the quality of education (Fauziah, 2021). The average score before the study was 50%. This result has not met the established success indicators, due to problems or obstacles in the learning process, such as lack of student enthusiasm, boredom when participating in class learning, and low student science learning scores. The corrective actions taken by the researcher are as follows: 1) utilizing learning media to explain the material, 2) creating innovative media to encourage students to explore information related to the material being taught, and 3) learning media designed to include videos, materials, questions, and student worksheets, so that students do not feel bored and tired. After being given treatment, students' abilities increased, as seen from the average score percentage which increased by 70%. This finding is in line with previous research which shows that improvement efforts made by teachers can help improve students' grades that have not been completed.

Conclusion

Based on the research results and explanations, it can be concluded that the use of barcode scan media as an effort to optimize technology-based social science learning and obtain student learning outcomes in social science subjects that can be run on Android-based devices. Students and teachers are interested in using barcode scan learning media so that it is easier to understand social science subject material. With the presence of barcode scan learning media, students tend to be very active. Because students can use their cellphones to learn and access the material in it. Teachers also feel more practical with the presence of barcode scan learning media which already contains learning videos, learning materials, questions, and student worksheets. The use of learning media has a significant impact on increasing students' enthusiasm for learning. This study shows that the use of technology-based barcode scan media has a major impact on learning outcomes and student motivation to learn.

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