

Development of Problem-Based Learning Multimedia to Improve the Learning Outcomes of Students of Digestive System Materials in Humans

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ABSTRACT

The learning outcomes of students in the material of the digestive system in humans are relatively low. The purpose of this study is to design a development design, test the feasibility and effectiveness of Problem Based Learning-based multimedia on digestive system materials in human class V SDN 2 Nolakerto, Kendal Regency. This research procedure uses an R&D (Research & Development) model. Data collection techniques used tests (pre-test and post-test) and non-tests (observation, interviews, questionnaires, and documentation). The data analysis test used the normality test, the paired sample t-test, and the N-Gain test. The results of the research in the form of a Problem Based Learning-based multimedia development design developed with Canva consist of usage instructions, activity instructions, materials that include text, images, videos, quizzes (wordwall) and are equipped with a virtual gizmos laboratory. The feasibility of Problem-Based Learning-based multimedia is shown by the assessment of material experts of 92.85% and media experts of 91.07% with the category of very feasible. It was supported by a teacher response questionnaire of 95% and received a response from students of 95.38% with the category of very feasible. The average pre-test score was 53.97 and the post-test average increased to 76.79 with an increase of 22.79. The results of the N-Gain test obtained an average value of 0.4 in the medium category. The conclusion of this study shows that this Problem Based Learning-based multimedia has been successfully developed, feasible and effective to improve student learning outcomes on the material of the digestive system in humans.

Keywords: Learning Outcomes; Multimedia Based Problem Based Learning; Digestive System in Humans

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INTRODUCTION

Education is an effort to realize an active learning process to improve the quality of a person both in terms of knowledge, skills, and character. Education also aims to improve human spirituality, thinking ability, sociability, and mastery of professional skills in accordance with the demands of the times (Syafiyatul et al., 2019). The goals of national education can be achieved through the implementation and development of a curriculum that adapts to the age of knowledge and technology. These adjustments require the support of technology-based learning media that is relevant to the existing curriculum. The independent curriculum is the curriculum currently used in Indonesia. Through the educational process, the independent curriculum seeks to develop the character of students in accordance with the Pancasila student profile (Utari & Muadin, 2023). Learning that implements an independent curriculum emphasizes active, meaningful, and fun learning that is student-oriented (student centered), so that they are able to achieve the expected competencies in the form of learning outcomes. Learning outcomes are abilities that must be mastered by students at each stage of learning, adjusted to the characteristics of each subject, one of which is IPAS learning.

Social studies learning in the independent curriculum is a combination of science and social studies learning at the basic education level. It is based on the knowledge that social studies and science have similar foundations for scientific thinking abilities (Astuti, 2023). Students' curiosity about the phenomena around them can grow as a result of studying science. Social studies learning contains abstract concepts that make it difficult for students to understand, verbal delivery is not necessarily enough to be able to make students understand the concepts given, so there is a need for proof, interpretation, and experimentation to support the delivery of concepts to students (Masruroh et al., 2023). IPAS learning includes many objects and concepts that are difficult to reach directly, one of which is the material on the digestive system in humans in grade V of SD Phase C.

Abstract and it is difficult to observe directly, therefore, effective learning media is needed in visualizing the digestive organs in a concrete and interesting way so that students can understand the material in depth. This is in line with (Ismiyanti, 2020). That learning media can help students learn by serving as a channel for teachers to communicate with them. One of them is through technology-based learning media and making various media in one medium called multimedia.

Multimedia is a combination of several media such as text, sound, images, video, and animation (Wedayanti & Wiarta, 2022). The components contained in multimedia are in the form of a combination of several components, this implies that the content of learning materials can be channeled through the collaboration of various components, starting from visualization, audio, and students' motor skills (Herdiyanto et al., 2020). In science learning, useful multimedia including science information can be presented in an interesting way so that it can increase students' interest, motivation, critical thinking skills, and learning outcomes, as well as provide pictures and simulations that help students understand complex science concepts, providing a variety of interactive learning activities such as Game and quizzes that can help students learn independently, and provide feedback on students' learning progress. The multimedia used is multimedia-based Problem Based Learning, because this learning model requires the active involvement of students in learning.

Problem Based Learning It is a learning model that starts the learning process by raising problems around students as material for group analysis with the aim of improving problem-solving skills. Learning model Problem Based Learning Encourage students to understand the surrounding environment and improve their understanding of concepts so that students solve a problem. Syntax found on Problem Based Learning includes orienting students, organizing students to learn, guiding individual or group investigations, developing and presenting work, and analyzing and evaluating the problem-solving process (Nilam et al., 2023). Multimedia-based Problem Based Learning This will be in every slide will load the PBL syntax equipped with the laboratory Virtual gizmos, the existence of a laboratory Virtual Gizmos is considered very important because it facilitates learning activities Science, whose contents are essential for laboratory observation and experimentation.

Based on the data from the results of the pre-research through observation, interviews, questionnaires and documentation activities carried out in class V of SDN 2 Nolakerto, several problems were found in the science learning process. The problem is that teachers are not optimal in using technology-based learning media used in the learning process. Teachers only use Microsoft Word to present material without a systematic, coherent presentation, and combine with other learning media such as audio-visual. This leads to a lack of interaction between teachers and students in participating in learning. In line with (Daniyati et al., 2023), multimedia is a means used by teachers, students, in learning activities to build social interaction and foster students' curiosity. In addition, multimedia can also be used to communicate knowledge, skills, and attitudes that can influence students' decisions, emotions, focus, and motivation. As a result, learning can occur efficiently and in a controlled manner (Wulandari & Nurharini, 2025).

Teachers are not optimal in implementing the learning model Problem Based Learning in social studies learning. In the syntax, one teacher only provides stimulus in the form of questions related to material in daily life without any other stimulus. A variety of stimuli is needed so that students do not get bored while learning, in addition it will be easier for teachers to deliver material, manage students during the learning process, and increase students' interest in learning if they use various kinds of stimuli (Ilham Fahmi et al., 2023). In the second syntax, the grouping of students is carried out without cognitive diagnostic assessment, so that learning does not consider the differences in students' initial abilities and has an impact on less than optimal student learning outcomes. By monitoring student development through cognitive diagnostic assessments, teachers can adjust teaching methods to better suit the needs of students (Ilham Fahmi et al., 2023).

The learning outcomes of students in the digestive system material are relatively low with the set KKTP of 75. This is proven by 65% of 25 out of 39 students who have not met the KKTP, while 35% of 14 out of 39 students have met the KKTP. This shows that students' understanding of the digestive system material is not optimal because students do not understand the foreign terms contained in the material of the human digestive system, which causes confusion and different interpretations of the instructions given (Ratu Fauzar et al., 2024). Based on the researcher's observations during the IPAS lesson, students have difficulty in understanding the material of the digestive system because it is abstract such as the gastric organs, small intestine, colon, rectum and anus which cannot be seen directly.

This research is in line with a study entitled "The Effectiveness of Learning Models Problem Based Learning with the media "Vlab temperature and heat" on learning outcomes". This study showed that the results of the normality test in the pre-test were 0.109 and the post test was 0.067 which was normally distributed. The results of the t-test showed an increase in the average score from 48.21 to 80.18 with a significance value of 0.001. The results of the N-Gain test obtained a mean N-Gain Score of 62.9669. Referring to the N-Gain Test Criteria, the value is in the medium category (Aulia et al., 2025).

Based on the identification of the problem above, solutions are needed to overcome the challenges faced by teachers and students through the use of technology-based learning media that is interesting, effective, and practical. Therefore, the researcher aims to develop multimedia based on Problem Based Learning. This development is expected to improve the cognitive abilities and learning outcomes of students of the digestive system material in humans. This study aims to describe the multimedia design based on Problem Based Learning, test the feasibility, and evaluate the effectiveness in improving the learning outcomes of digestive system material in human class V of SDN 2 Nolakerto.

METHODS

This type of development research is R&D (Research & Development). According to (Sugiyono, 2023) (Scott, 2023) types of research and development (Research & Development) is a scientific approach that includes researching, designing, and testing the validity of a product. Based on this understanding, research and development activities can be abbreviated into 4Ps consisting of research, design, production and testing. In multimedia-based development Problem Based Learning, the researcher applied the ADDIE development model. Jenis penelitian pengembangan ini adalah R&D (*Research & Development*).

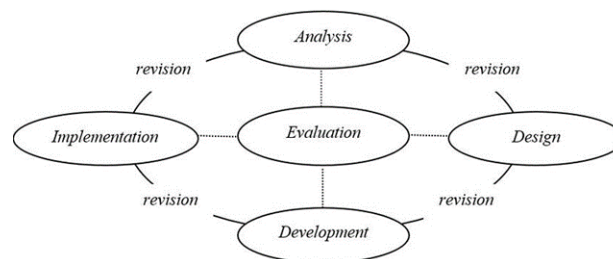


Figure 1. ADDIE Model R&D Steps (Sugiyono, 2023)

Figure 1 shows the R&D steps of the ADDIE model developed by Sugiyono. According to (Sugiyono, 2023). ADDIE's development model is an extension of the Analysis (Analysis), Design (Design), Development (Development), Implementation (Implementasi) and Evaluation (Evaluation). Stages Analysis (Analysis), related to the activity of analyzing the environmental situation. Stages Design (Design), is the process of planning products to be developed. Development (Development), is an activity to conduct a trial of a product to be developed. Implementation (Implementation) is the process of implementing or using products that have been developed, and Evaluation (Evaluation), at this final stage, an assessment of the product is carried out to determine the feasibility and can be held accountable.

This research was carried out at SDN 2 Nolakerto, Kendal Regency in the even semester of the 2025/2026 school year. This study involved 39 students in class V, with 6 students selected as a trial based on the category of cognitive ability (high, medium, low) in the small group, and 33 students in the large group. Subject selection is through purposive sampling technique, which is a sample determination technique with certain considerations relevant to the research objectives (Sugiyono, 2023). The data collection technique is carried out through Test (Pre- test and post test) and non-tests (observation, interviews, questionnaires, and documentation). The data analysis technique used normality tests, t-tests, and N-Gain tests.

RESULT AND DISCUSSION

Multimedia development design Problem Based Learning

Product development design is designing products that will be made and developed based on problems and information data that has been obtained previously (Stefani & Haryudo, 2023). In order for it to serve as a guide for its evaluation or production, the design of the product must be realized in the form of drawings or

charts. This research uses the ADDIE development model, the first stage is Analysis (analysis). The analysis stage is the initial stage of ADDIE model research by conducting observations, interviews, questionnaires, and documentation. This is done to analyze the problems, potentials and needs of teachers and students. The analysis stage plays an important role in the beginning of the research, because if the analysis process is not carried out thoroughly, then the next stage of development has the potential to run less than optimal and not in accordance with the needs of students (Zamsiswaya et al., 2024).

Based on pre-research, the problem found in grade V of SDN 2 Nolakerto is that teachers are not optimal in using technology-based learning media in presenting learning materials. Teachers are not optimal in the implementation of Problem Based Learning syntax. In the syntax, one teacher only provides stimulus in the form of questions related to material in daily life without any other stimulus. In the second syntax, teachers group students without cognitive diagnostic assessment. Then from the results of the interview, it was found that the learning outcomes of students were relatively low in the IPAS material, namely the digestive system in humans with a set IPAS KKTP of 75. This is proven by 65% of 25 out of 39 students who have not met the KKTP, while 35% of 14 out of 39 students have met the KKTP. This shows that students' understanding of the digestive system material is not optimal because students do not understand the foreign terms contained in the material of the digestive system in humans.

Potential is everything that is used or developed will have added value (Sugiyono, 2023). The potential of SDN 2 Nolakerto includes providing a variety of learning support facilities that are quite complete. Each classroom is equipped with a projector, which allows teachers to present learning materials visually and interactively. An adequate internet network in schools is an important support for access to information and the application of technology in the teaching and learning process. In addition, loudspeakers are available to support effective communication in classroom activities and school events. This potential makes SDN 2 Nolakerto have a great opportunity to create innovative and modern learning, especially through the development and use of technology-based learning multimedia that suits the needs of students.

In addition to the problems and potentials analyzed, the researcher uses a questionnaire of teacher and student needs as a reference in designing a study that is tailored to learning conditions and needs. Based on the results of the analysis of the needs of teachers and students and adjusted to the characteristics of class V students who are in the concrete operational stage. Teachers and students need learning media that can support learning and improve understanding of learning materials and improve student learning outcomes. It is shown from the results of the teacher needs questionnaire that the Learning planning, learning activities, and learning media obtained a percentage of 73.61% (feasible), while the learning outcome aspect obtained a percentage of 50% (less feasible). Meanwhile, the results of the student needs questionnaire showed the aspect of participation in learning and the role of learning media by obtaining a percentage of 79.36% (very feasible), while in the aspects of learning outcomes and learning difficulties, it obtained 61.38% (not feasible). This shows the need for the development of learning media that can support learning and improve student learning outcomes. The learning media developed by the researcher is in the form of multimedia which is a combination of several learning media such as text, images, animation, audio visual, quizzes, and labs Virtual. Multimedia-based drafting Problem Based Learning using bright colors and attractive pictures so that students are interested and focused on learning (Putri, 2022).

The next stage is the design stage. A plan for the product to be developed, complete with product specifications can be made during the design phase. A well-designed learning environment will ensure that learners' needs are met and learning objectives are achieved (Zamsiswaya et al., 2024). At this stage, multimedia-based Problem Based Learning designed by constructing a framework (prototype) which is then designed as attractive as possible. The product design is adjusted from the results of the questionnaire to the needs of teachers and students. The results of the questionnaire of the needs of teachers and students are analyzed and used as a reference in the creation of multimedia-based Problem Based Learning. The researcher designed the product using the Canva application and was equipped with a virtual lab and quizzes in wordwall.

Canva is an online design program that provides a variety of templates, such as presentations, social media content, printed materials, office documents, posters, and e-book covers (Hidayat et al., 2024). With Canva, researchers can design development products easily and affordably. In addition to Canva, this development product is equipped with a laboratory Virtual Gizmos, which provides users with a self-contained simulation

experience of practicum activities anywhere and anytime like working in a real lab. This development product also presents quizzes in wordwall which aims to strengthen the material for students. So it can be concluded that researchers use the Canva application to help develop designs equipped with laboratories Virtual Gizmos and quizzes wordwall Become a multimedia-based Problem Based Learning.

On multimedia-based design Problem Based Learning includes text, images, and audio-visual regarding the material of the digestive system in humans. In multimedia-based Problem Based Learning equipped with a laboratory Virtual gizmos. Multimedia-based Problem Based Learning It is designed in an attractive way to increase students' understanding so that it can improve student learning outcomes on the material of the digestive system in humans (Hafizah, 2024). Multimedia-based Problem Based Learning consists of 1) Cover, 2) Main Menu, 3) Instructions, 4) Learning Competencies, 5) Learning Materials, 6) Concept Maps, 7) Learning with Syntax Application Problem Based Learning, 8) Gizmos Virtual Lab, 10) Summary, 11) Glossary, 12) Quizzes, 13) Evaluation, 14) Bibliography, and 15) Developer Profile.



Figure 2. Learning Outcome Design, Learning Objectives, Concept Map, and GizmosVirtual Lab

Figure 2 shows that in multimedia there is a learning competency menu that contains learning outcomes and learning objectives as a reference in measuring knowledge, attitudes, and skills by describing them through learning objectives (Setyobudi et al., 2025). Then there is a concept map that aims to be like a learning goal flow that provides information to users related to what material is learned in the multimedia. Next there is a laboratory Virtual Gizmos which seeks to teach students to understand the subject matter in a fun way, by asking them to practice the material through the sequencing of the organs of the digestive system.



Figure 3. Syntax Material Presentation Design 1 and 2 Problem Based Learning in Learning 1 and 2

Figure 3 shows the implementation of syntax Problem Based Learning in syntax 1 and 2. In syntax 1, it is to orient students to problems by presenting learning videos containing problems that aim to provide an initial stimulus for students. This initial stimulus is given with the aim of stimulating the initial response of students before starting learning (Fatmawati & Anjarsari, 2021). After being given problems, in the syntax 2 students were grouped into 5 groups of 6 children according to the results of a cognitive diagnostic assessment in the form of a pre-test. In learning 1 student, a picture of the body skeleton containing the organs of the digestive system was presented, and in learning 2 students were presented Barcode which contains a video of the problem and a short story.



Table 4. Syntax Material Presentation Design 3 and 4 Problem Based Learning in Learning 1 and 2

Figure 4 shows the design in syntax 3 Problem Based Learning i.e. guiding individual/group experiences, the researcher provides directions to access the laboratory Virtual as an initial understanding before doing the LKPD, then students are given an LKPD that can encourage the effectiveness of learning and students'

understanding and be able to develop basic potential in accordance with competency indicators (Rosmana et al., 2024). The researcher also provides guidance to students to access the url that has been provided in the form of teaching materials to find and analyze the LKPD that is being done. Similar to learning 1, in learning 2 the LKPD can be accessed through a barcode, then the answer is written on the answer sheet found in the teaching materials that have been provided through the url. In syntax 4, which is to develop and present results, in learning 1 and 2 after guiding students in working on the LKPD, the teacher gives an opportunity to the group who have finished working on the LKPD to explain the results in front of the class and give appreciation for their courage in doing the LKPD with good cooperation (Muh et al., 2024).



Figure 5. Design of material presentation with the application of Problem Based Learning Syntax and Learning Evaluation in learning 1 and learning 2

Figure 5 shows the implementation of syntax 5 Problem Based Learning, in learning 1 student was given reinforcement related to LKPD regarding the material of organs and their functions, digestive glands, and types of digestion through slide with Visual interesting. In lesson 2, the material presented was in the form of types and disorders of the digestive system, and how to maintain health. After implementing 5 syntax Problem Based Learning, students are given quizzes using wordwall as an initial reinforcement before working assessments formative in the form of evaluation questions. In learning 1 quiz presented in the form of matching organs to their functions, while in learning 2 quizzes presented in the form of multiple-choice questions related to indigestion and how to maintain health. After doing the quiz, students are given a formative assessment in the form of 5 evaluation questions to strengthen the material that has been studied. Learning evaluation aims to find out whether a learning system is running or not (Mursawan & Idi Warsah, 2022).

The next stage is Development (Development). During the development stage of the ADDIE model, learning media activities that were previously created were prostrated into ready-to-use products (Zamsiswaya et al., 2024). This stage consists of validation of material experts and media experts, validation of material experts is validation carried out by experts who really understand the concept or design of the material. The purpose of subject matter expert validation is to assess the systematization, completeness and other related issues of the material (Sarip et al., 2022). The adequacy and accuracy of the product content, which will be verified by subject matter experts in the field of science, as well as the presentation of the suitability of the material with the curriculum, are all reviewed by subject matter experts. Meanwhile, media validation is validation carried out by professionals in the field of learning media. The purpose of media validation is to ensure that every aspect of the media is worth using (Armanda et al., 2025). Furthermore, distributing the response questionnaire of teachers and students related to development products that have been tested in grade V of SDN 2 Nolakerto, the purpose of taking the response questionnaire is to compare whether the results of the validation of materials and experts are the same as the responses of teachers and students related to problem-based learning-based multimedia development products that have been designed and tested in the classroom.

The next stage is Implementation (implementation). Multimedia-based Problem Based Learning that has gone through a validation process from material experts and media experts and has been declared suitable for use and then applied to real situations (Zamsiswaya et al., 2024). By conducting a test of questions in the first grade at a higher level than the class that will be the subject of the research. The researcher conducted a test of questions in class VI of SDN 2 Nolakerto with the number of students of 42 by giving 40 test questions which were then retested to get valid questions by conducting validity tests, reliability tests, question difficulty level tests, and question differentiation tests (Saputri et al., 2023). Of the 40 questions that have been tested in class VI, 20 questions were found that were declared valid and reliable. With a moderate level of difficulty, it is easy

and very easy. Of the 20 questions that are valid, they will be used as a pre-test and post-test as a reference in determining the improvement of student learning outcomes.

The next stage is Evaluation (Evaluation). The evaluation stage of ADDIE's development research is carried out after the creation and validation of the product during the development stage and its use during the implementation stage, the next stage is to use student responses to assess the quality of the product (Zamsiswaya et al., 2024). In this evaluation, the researcher conducted a normality test, t-test, and N-Gain. Before using non-parametric statistics to determine whether the data is distributed normally, a normality test is carried out to ensure whether the data is distributed normally, a normality test is used (Sonjaya et al., 2025).

The Normality Test helps the author to determine the data analysis technique to be used based on the data obtained. If the data is normally distributed, then the author will use parametric statistical techniques, if it is not normally distributed, then the author will use non-parametric statistical techniques. The results of the normality test with the Shapiro-Wilk test were obtained in respondents less than 30, while Kolmogorov-Smirnov was obtained in respondents over 30. The decision-making criteria of the Shapiro-wilk test are as follows: if the significance value is > 0.05 , then the data distribution meets the assumption of normality. If the significance value < 0.05 , then the data distribution does not meet the assumption of normality (Sari et al., 2024).

This t (2-tailed) sample test was used to test the difference in sample average between subjects with identical data, but experienced different treatments, namely before being given treatment and after being given treatment. The following hypotheses were tested in the mean difference test: $H_0 : \mu_1 > \mu_2 =$ Multimedia Development based on Problem Based Learning Digestive system material in humans is not effective in learning IPAS on student learning outcomes. While $H_a : \mu_1 < \mu_2 =$ Multimedia Development based on Problem Based Learning of the digestive system material in humans is effectively used in learning science on student learning outcomes (Adellina et al., 2023).

The N-Gain test is used to calculate the average increase in student learning outcomes before and after using multimedia-based Problem Based Learning of digestive system materials in humans with a classification, namely, if $N\text{-Gain} > 0.70$ then the criteria are high, if $0.30 < N\text{-Gain} < 0.70$ is the medium criterion, and $N\text{-Gain} < 0.30$ is the criterion (Oktavia & Prasasty, 2019).

Feasibility of Problem-Based Learning multimedia

The feasibility of Problem Based Learning-based multimedia for the digestive system material in humans is determined based on the assessment of the validation of material experts and media experts as well as teacher responses and student responses related to the Problem Based Learning-based multimedia that has been developed.

Table 1. Results of Material Validation Test and Media Experts

Validation	Percentage	Criteria
Material Expert	92,85%	Highly Feasible
Material Expert	91,07%	Highly Feasible

In table 1, it shows that the development products that have been tested on material experts obtained 92.85% (very feasible) and media experts obtained 91.07%. The material validation questionnaire includes 14 questions and 3 aspects, namely the suitability of the material with learning, appropriate to support the content of learning and stimulus can help understand the material, by obtaining a total score of 52 with a percentage of 92.85% of the category is very feasible. Meanwhile, the media expert included 14 questions with 2 aspects, namely the quality of the content and the purpose, as well as the intrusional aspect by obtaining a score of 51 with a percentage of 91.07% of the very feasible category. In addition, the researcher created a questionnaire on the response of teachers and students to find out the responses of teachers and students after using Problem Based Learning-based multimedia in learning. The questionnaire of teacher and student responses to the trial will be filled out by teachers and 39 students.

Table 2. Results of Teacher and Student Responses

Response	Percentage	Criteria
Teacher	95%	Highly Feasible
Students	95,38%	Highly Feasible

In table 2, it is shown that the teacher's response to the use of Problem-Based Learning-based multimedia in the trial of use received a score percentage of 95% with very feasible criteria and from 39 students received an average percentage of 95.38% of the very feasible criteria. Thus, problem-based learning multimedia received a very decent response from teachers and students in the use trial, so that multimedia problem-based learning is very feasible to be used in learning.

The effectiveness of Problem-Based Learning multimedia

The effectiveness of Problem-Based Learning-based multimedia was tested using the normality test, the t-test for dependent samples (paired samples), and the N-Gain test on the pre-test and post-test that had been given to grade V students of SDN 2 Nolakerto, Kendal Regency.

Table 3. Pre-test and Post-test Result

Aspects	Pre-test	Post-test
Minimum Score	20	60
Maximum Score	80	90
Average	53,97%	76,79%

In table 3, it shows an improvement in pre-test and post-test results after using Problem Based Learning-based multimedia. With the value of increasing the pre-test from 20 to 80, and the post-test from 60 to 90 with an average score of 76.79%.

Table 4. Normality Test Result

Kolmogorov-Smirnov	Significance Value (Sig.)	Kategori
Pre-test	0,132	Normal
Post-test	0,136	Normal

Table 4 shows the results of normality tests in the pre-test and post-test. Based on the table above, the results of the normality test of the significance value of the pre-test are $0.132 > 0.05$, so the data distribution meets the assumption of normality. The results of the post-test normality test showed a significance of $0.136 > 0.05$, so the data distribution met the normality assumption. So, it can be concluded that the two data, namely the pre-test and the initial post-test, are more than 0.05 so that both data are distributed normally.

Table 5. Paired Sample t-test Result

Treatment	N	Mean	T	Sig. (2-tailed)
Pre-test	33	51,36	-14,114	0,000
Post-test	33	75,30		

In table 5, it shows that the average pre-test score is 51.36 and the average post-test score is 75.30 so there is an increase of 23.94. So there is an increase in student learning outcomes after using Problem Based Learning-based multimedia. In addition, based on the Paired Samples Test the significance value (2-tailed) is 0.000 which based on the criteria of the value is below 0.05, so H_0 is rejected. So, since the significance value (2-tailed) is $0.000 < 0.05$ then H_0 is rejected and H_a is accepted. So there is an increase in the value of learning outcomes of class V students on a small scale after using Problem-Based Learning-based multimedia

Table 6. N-Gain Test Result

Treatment	Aspect	Mean (N-Gain)	Criteria
Pre-test	51,36	0,4878	Sedang
Post-test	75,30		

In table 6, showing the results of the N-Gain test shows a mean result of 0.4878. The result of the N-Gain test in the pre-test and post-test, which was 0.4878, was included in the medium criterion, influenced by the readiness of students to participate in learning. With the results of N-Gain, it can be concluded that the development of multimedia based on Problem Based Learning is effective in improving students' learning outcomes on the material of the digestive system in humans in grade V of SDN 2 Nolakerto. This shows that multimedia-based Problem Based Learning in improving student learning outcomes is effective. The average

increase in student learning outcomes during the trial of the use of problem-based learning-based multimedia is shown in diagram 1 below :

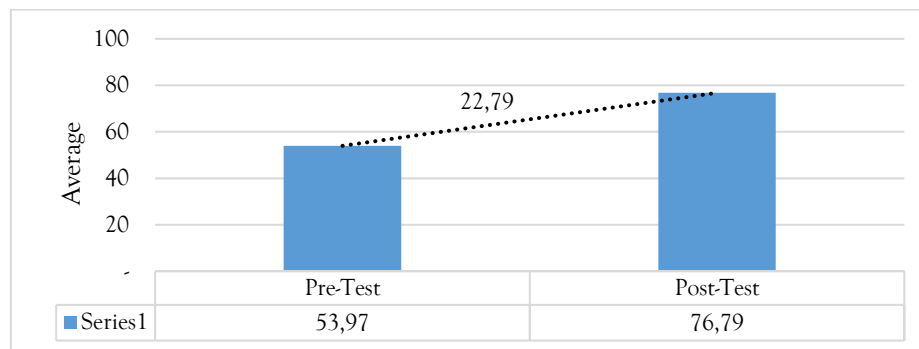


Diagram 1. Average Results of Pre-test and Post-test Scores of Students Class V SDN 2 Nolakerto, Kendal Regency

Based on diagram 1, it shows an increase in pre-test and post-test results with an average pre-test percentage of 53.97 and an average post-test result of 76.79, so an increase in pre-test to post-test is 22.79. Student scores are divided into the categories of highly skilled, skilled, and less proficient caused by differences in the level of understanding and ability of students. The increase in the N-Gain score to the medium category is influenced by several factors, including the readiness of students before participating in learning, including physical, psychological, and material needs, as well as the ability to respond and interact during learning (Harefa et al., 2023). In addition, school facilities that support the use of technology-based learning media that make it easy for researchers to convey material on the digestive system to humans. This is in line with research conducted by (Rahmadhani et al., 2022) showed an increase in learning outcomes using multimedia in pre-test and post-test results increased with an average pre-test score of 58.12 and an average post-test score of 71.87.

Problem-based learning multimedia is adjusted to the learning style of students, namely the presence of visual, auditory, and kinesthetic media that facilitate the learning process (Fanilasari & Usman, 2023). The visual style is helped by the presentation of text, images, animations, and virtual lab gizmos. Auditory learning style through the explanation of material with interesting audiovisual, visual, and animation. The kinesthetic learning style is actively involved through direct observation activities. Environmental factors, also known as external factors, play an important role in improving learners' learning outcomes. Learning activities take place in an educational environment, which has a significant impact on students' ability to achieve the best academic results (Innesh et al., 2024).

CONCLUSION

Based on the results of the research and data analysis that has been carried out, it can be concluded that multimedia based on Problem Based Learning material on the human digestive system was developed using the Canva application with components in the form of instructions for use, activity instructions, materials that include text, images, animations, videos, quizzes (wordwall) and equipped with a virtual laboratory gizmos. The results of validation by material experts and media experts, as well as the response questionnaire of teachers and students, show that the multimedia developed is in the category of very feasible. The effectiveness of multimedia is shown by the increase in pre-test and post-test scores. This is supported by the results of the paired sample t-test which showed significant differences before and after using the development product, as well as the results of the N-Gain test which obtained the medium category. Thus, the development of multimedia based on Problem Based Learning has been successfully developed, feasible and effective to improve the learning outcomes of students in the science subject of digestive system material in human class V SDN 2 Nolakerto.

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