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Development of *IPA* Learning Module Using STEMK WASAKA Learning Model to Improve Learning Outcomes

Rabiatul Adawiyah*, Syubhan Annur, Mella Mutika Sari

Science Education Study Program, Lambung Mangkurat University, Banjarmasin, Indonesia
*e-mail: rabiatul4388711@gmail.com

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Abstract: The way students learn science at SMP Negeri 1 Tabunganen is mostly through lectures and is teacher-focused, which leads to poor learning results, students not being actively involved, and trouble understanding the human digestive system. Because of this, researchers decided to create a science learning module using the STEMK WASAKA model, which emphasises responsibility, discipline, and cooperation. The study aims to check if this module is valid, practical, and effective for teaching the human digestive system. The method used was Research and Development (R&D) with the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). The students involved were from the eighth grade at SMP Negeri 1 Tabunganen. Data was collected using expert validation sheets, student feedback questionnaires, and pretests and posttests. The results showed that the module had moderate validity (average score of 0. 758), high reliability (α = 0. 745), very high practicality (86. 91%), and sufficient effectiveness with an N-gain value of 0. 65. Therefore, the STEMK WASAKA-based science learning module is considered valid, practical, and effective enough to help improve student understanding of the human digestive system.

Keywords: Human Digestive System; Learning Outcomes; Science Learning Module; STEMK WASAKA.

Introduction

Education is important because it helps build a better nation and instils good values in students. Law No. 20 of 2003 states that education should help students reach their full potential and grow into loyal, kind, skilled, and responsible individuals [1]. In this way, studying Natural Sciences (*IPA*) is very important, especially because it helps develop scientific thinking and the skills needed for the 21st century [2].

One of the crucial science materials is the human digestive system. However, in reality, students still have difficulty understanding the concepts in this material, as reflected in the low learning outcomes. Because the teaching method is still boring and too much lecture, students are less active and do not understand the material.

As a solution, a science learning module based on the STEMK WASAKA model was developed. This model integrates the Science, Technology, Engineering, Mathematics, and Character (STEMK) approach with the local values of WASAKA (Waja Sampai Kaputing), which emphasizes characters such as hard work, discipline, and responsibility. This model is considered effective because it encourages active, collaborative, and meaningful learning [3].

This research aims to develop a STEMK WASAKA-based science module focused on the human digestive system. This module is expected to improve students' understanding through a contextual approach relevant to everyday life and that fosters positive character.

Based on observations at SMP Negeri 1 Tabunganen, it was found that learning remained teacher-dominated and one-way. Therefore, the application of STEMK WASAKA-based modules can be an alternative for creating an interactive learning environment and achieving student learning outcomes.

This learning model has been previously developed in the book Earth and Disaster STEMK WASAKA Learning Model [4] and the book STEM-K WASAKA Learning Model for Peatland Fire Disaster Mitigation through Education [5]. Semarang, Central Java: Cahaya Ghani Recovery, which showed its effectiveness in improving learning outcomes and learner engagement. This research draws on the two books for application in the context of science learning, especially the material on the human digestive system. By applying this model, students are expected to be more active and communicative, demonstrating character, thereby significantly improving learning outcomes.

Research Methods

Research: This study employs the Research and Development (R&D) method. This approach is used to create new products.

The design model used in this study is one of the methods for creating learning systems. It uses the ADDIE model, a framework for building effective learning programs. The ADDIE model is based on a systems approach that breaks down the process into five steps. Each step follows logically from the previous one, with the output of one step serving as the input to the next. The five stages of the ADDIE model are: Analyze, Design, Development, Implementation, and Evaluation. Step [5].

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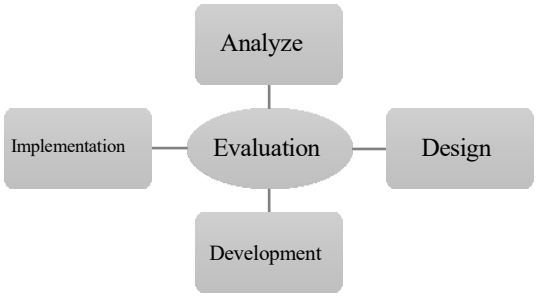

Figure 1. ADDIE Model Development Flow

This study has two variables: the independent variable, Science learning modules, which are teaching materials systematically arranged to facilitate students' understanding of science concepts, especially the human digestive system. This module contains learning objectives, subject matter, steps of learning activities, practice questions, and evaluation instruments to support the achievement of basic competencies. The dependent variable, students' understanding of the human digestive system, was measured by administering a test before and after the learning module. The results were checked using the N-Gain score to determine how much their knowledge improved after studying the module.

The students in this study were from class VIII at SMP Negeri 1 Tabunganen during the 2024/2025 academic year. There were two groups: class VIII A had 30 students, which was the larger group, and class VIII B had 10 students. Also, 5 expert validators and researchers evaluated the WASAKA character of the students.

The objective of this research is to develop a science learning module that uses the STEMK WASAKA model to teach about the human digestive system. The module's use of Aiken's V scale is evaluated for validity in terms of its accuracy, usefulness in real classrooms, and its effectiveness in helping students learn.

Place and Time: This research was conducted at SMP Negeri 1 Tabunganen, located at Jl. Karokan RT.6, Tabunganen Kecil, Kec. Tabunganen, Barito Kuala Regency, South Kalimantan. The implementation time was on February 18-22, 2025 (even semester), for 5 meetings.

The research tools and instruments used in this research are:

a. Validation Questionnaire Sheet: Used to obtain an assessment from experts regarding the validity of the developed science learning module.
b. Test Item Validation Sheet: Serves to assess the quality of each item through construct validity and reliability tests.
c. WASAKA Character Sheet: Used by researchers to observe the WASAKA character of students during learning, especially during group work.
d. Learner Response Questionnaire Sheet: Used to determine learners' responses to the ease, attractiveness, and benefits of the module. The results are used to assess the module's practicality.
e. Test Instruments (Pretest and Posttest): Used to measure the learning outcomes of students before and after the Science learning modules were used, and the test results were checked to see how well the modules helped improve students' learning outcomes.

Content Validity Analysis

The data analyzed in the content validity analysis, namely: The questionnaire on the content validity analysis was obtained from a validation questionnaire which was analyzed qualitatively and quantitatively. Qualitative data obtained from the form of comments and suggestions from validators. The quantitative data is obtained from the validator's assessment score. Validators will assess the provided categories using a Likert scale.

Table 1. Likert Scale Validity

Description	Score
Very good	5
Good good	4
Enough	3
Good enough	2
Not good enough	1

The study's scores were then used to calculate the learning module's validity using Aiken's V formula. The formula for Aiken's V is as follows:

$$V = \frac{\Sigma s}{n(c-1)}$$

The results of Aiken's scale calculation were then converted into Aiken's V validity criteria.

Table 2. Validity Criteria

Scale Aiken's V	Validation
$V \leq 0{,}4$	Less than
$0{,}4 < V < 0{,}8$	Monderately
$V \geq 0{,}8$	Valid very valid

Construct Analysis

Construct validity analysis is carried out by analyzing the validity of the items to calculate the correlation of each item. The correlation between the question scores on each item can be calculated using the following formula.

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}}$$

[5]

The question items are declared valid or invalid: if rcount > rtable, then the item is valid. If $r_{count} < r_{table,}$ then the item is invalid.

Reliability Analysis

The reliability formula used is the alpha formula, which estimates the reliability of instruments whose scores are not limited to 1 and 0 but use a polytomous Likert scale, such as a questionnaire (Likert scale 1-2-3-4-5) or multiple-choice questions (with a maximum score determined by the researcher). The alpha formula is as follows:

$$\alpha = \left(\frac{k}{(k-1)}\right)\left(1 - \frac{\Sigma\sigma i^2}{\sigma t^2}\right)$$

Reliability test to determine the accuracy or persistence of the test, so whenever the related test is used, it

will give relatively the same results. To interpret the reliable category using the following criteria:

Table 3. Question Reliability Criteria

Score	Criteria
0.80-1.00	Very High
0.60-0.80	High
0.40-0.60	Fair
0.20-0.40	Low
0.00-0.40	Very Low

(6)

The instrument used to create learning modules based on the STEMK WASAKA model is considered reliable if its reliability test results are high or very high.

WASAKA Character Analysis

The WASAKA character analysis in this study is a data analysis sheet observation assessment character WASAKA, which will be validated by five experts using an expert validation sheet to find out whether the WASAKA character sheet for students in WASAKA character is suitable for use during learning.

Table 4. WASAKA Character Validation Scale

Description	Score
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

Based on expert validation results, researchers can use the sheet to assess students' character during learning. The results of the WASAKA character of each group of students, the criteria for assessing the WASAKA character score are as follows:

Table 5. WASAKA Character Assessment (Score) Criteria

Description	Score
Very good	4
Good	3
Less Good	2
Not Good	1

Practicality Analysis

Analysis of practicality in research. This study uses questionnaire data from learner assessments. The learner response questionnaire was analyzed to determine the practicality of the teaching module developed using a Likert scale. Questionnaires given to students use a Likert scale in presentation. In the questionnaire, students are expected to check one of the available answers. The Likert scale of practicality is as follows:

Table 6. Likert Scale of Practicality

Score	Description
90-100	Very good
70-80	Good
50-60	Less good
30-40	Not good

[7]

The practicality value of the learning module is obtained based on the score count of the results of the students' questionnaire answers and can be calculated based on the formula below as follows:

$$\text{Practicality value} = \frac{\text{Score}}{\text{Total score}} \text{ x } 100\%$$

The practicality values obtained from the learner response questionnaire can be matched with the practicality criteria.

Table 7. Practicality Criteria

Interval Presentation Practicality	Description
82-100 %	Very practical
63-81 %	Practical not
44-62 %	Practical
25-43 %	Very impractical

[8]

Effectiveness Analysis

Analysis of the effectiveness of the learning module with the STEMK WASAKA A model was created using material about the digestive system and a knowledge test tool to determine how to improve student learning outcomes. Learning improvement can be measured by comparing pretest and posttest results. The increase in learning is calculated using normalized gain, also called the N-gain equation. Criteria for the effectiveness of learning outcomes that have been obtained based on the calculation of N-gain.

$$(g) = \frac{\text{posttest} - \text{pretest}}{\text{maximum} - \text{pretest}}$$

Table 8. Effectiveness Criteria

Interval	Kriteria
$g > 0.7$	Tinggi
$0.3 \leq g \leq 0.7$	Sedang
$g < 0.3$	Rendah

[9]

Results and Discussion

The product from this study is a science learning module that uses the STEMK WASAKA model to teach about the human digestive system. This module was tested at SMP Negeri 1 Tabunganen and was created using the ADDIE model, which includes Analysis, Design, Development, Implementation, and Evaluation. The development process was carried out in several stages, including expert validation, learning simulations, and classroom trials. The goal is to produce a module that is feasible, valid, practical, and effective to use in learning activities.

Content Validity Analysis

The results of the learning module's expert validation indicate moderate validity, suggesting it is quite feasible to use in learning. This validity is derived from the module's

assessment results for content, presentation, language, and overall feasibility, as shown in the following table.

Table 9. Expert Validity Results

Assessment Item	Validator					V	Description
	1	2	3	4	5		
Content Appropriateness	40	42	36	37	26	0.75	Medium
Presenter Aspect	49	43	38	43	29	0.76	Medium
Language Aspect	30	26	24	25	16	0.75	Medium
Average						0.76	Medium

The module created is a science learning tool based on the STEMK WASAKA model, focusing on the human digestive system for eighth-grade junior high school students. Its validity was assessed by five experts, including three science education professors and two junior high school science teachers. They evaluated the module across three areas: the content, its presentation, and the ease of understanding the language.

The content feasibility received an average score of 0.75, placing it in the medium/valid category. This means the module's material is suitable for use in the science learning process. This shows that the module can help improve students' learning results. The presentation aspect also receives an average score of 0.75, in the medium/valid category, indicating that the module's preparation meets the standards of readability and clear flow for the learning process. The language part received an average score of 0.76, which is in the medium or valid range. The module uses correct Indonesian grammar, making it easy for students to understand [10]. Overall, the validation results show that the science learning module meets the eligibility criteria for use in learning, though improvements are still needed based on the validators' input. The improvements made aim to make the module more effective, interesting, and communicative.

During the learning process, based on the average results of five expert validators who reviewed the science learning module, the result was 0.758. This score places the module in the "medium or valid" category. This indicates that the module already includes suitable material to help students learn about the human digestive system.

Construct Validity Analysis

Construct is a validity test conducted to determine the extent to which the items on the research instrument can determine the validity of each item. This validity analysis uses the correlation technique to examine the scores for each question item. The validity test is carried out for each item by administering the question instrument to students. This validity test involved 30 students and 10 multiple-choice questions. As for the results for each item indicating validity, the r count for each item is compared to the r table value of 0.349. The analysis results show that all items have r-count values greater than the r table; thus, all items are valid.

The highest $r_{ecalculated}$ value is in the 9th item, at 0.790, and the lowest values are in the 5th and 6th items, both at 0.360. However, all these values remain above the r-table value, indicating that all items are acceptable and can be used as research tools. These results show that the instruments used in this study have good construct validity and can accurately measure the variables under study.

Table 10. Construct Validation Results

Question Item	r-count	r-table	Description
1.	0.565		Valid
2.	0.662		Valid
3.	0.719		Valid
4.	0.645		Valid
5.	0.360	0.349	Valid
6.	0.360		Valid
7.	0.404		Valid
8.	0.477		Valid
9.	0.790		Valid
10.	0.452		Valid

Reliability Analysis

Reliability is a measuring tool for questionnaire instruments, which are indicators of variables, to determine the consistency of measuring instruments. In this study, reliability testing was done to check if the Cronbach's Alpha (α) value was higher than 0. 60. If it was, the answers from the respondents were considered reliable. However, if the Cronbach's Alpha (α) value was lower than 0. 60, the answers were considered unreliable. The results of the reliability test for the questionnaire used in this research are shown in the table below.

Table 11. Reliability Results

Reliability Statistics			
Cronbach's Alpha	Reliability Standard	Question Item	Description
0.745	0.736	10	Reliable

Reliability is a key measure that helps check how consistent an instrument is. In this study, Cronbach's alpha was used to assess the questionnaire's internal consistency. The result showed an alpha value of 0.745, which exceeds the minimum standard of 0.736. These findings show that the instrument is considered reliable, meaning each question in the questionnaire works well together to measure the topics being studied [11]. Good reliability ensures that the data collected accurately reflects students' situations, allowing it to be used fairly to assess how well the STEMK WASAKA model-based learning module works. When tools are reliable, research findings are more accurate and helpful in creating learning plans that meet students' needs [12].

WASAKA Character

The WASAKA character is part of the 18 educational values instilled in students. By applying this character, students will be more orderly during learning. Based on the

results of the WASAKA character of students when the research was conducted by grouping and assessing it using the rubric that has been provided. During the research, if the WASAKA character is not applied, it can cause problems related to students' character, so it is necessary to apply the WASAKA character to form students with character, namely responsibility, cooperation, and discipline. Character is one of the actions or behaviors and habits that are formed from the beginning in a person, meaning that a person has traits related to personality traits that distinguish behavior and actions between one another [13].

Table 12. WASAKA Character Assessment of Students

Group	Name of learner	Character WASAKA			Score Total
		R	C	D	
1.	1) A. N. A	5	4	5	72
	2) A	5	5	5	
	3) H. A	3	1	4	
	4) M. A	4	3	3	
	5) M. S	3	2	5	
	6) S. B	5	5	5	
2.	1) A. R	2	5	5	74
	2) E. N. Al	3	5	5	
	3) J. L	3	4	4	
	4) M. A	5	4	4	
	5) N. S	5	3	4	
	6) S. A. Z	4	4	5	
3.	1) A. S. J	5	5	5	82
	2) F. N	5	5	4	
	3) L	5	5	5	
	4) M. F. A	4	5	4	
	5) N. S	4	5	5	
	6) S. R	3	5	3	
4.	1) A. A	5	5	5	73
	2) H. N	3	5	3	
	3) M	3	4	2	
	4) M. L. F	4	5	5	
	5) N. H. H	4	4	4	
	6) W. A	3	4	5	
5.	1) A. A	4	5	5	79
	2) M. A. A	3	4	5	
	3) M	4	4	3	
	4) M. N. R	5	5	5	
	5) R. H	4	5	3	
	6) H. A	5	5	5	

Noted: R (Responsibility), C (Cooperation), D (Discipline)

Based on the table results, the research character WASAKA has 30 students in 5 groups, with 6 people per group. Group 1 obtained a total score of 72 in the good category; Group 2 obtained a total score of 82 in the good category; Group 3 obtained a total score of 73 in the good category; and Group 5 obtained a total score of 79 in the good category. These results show that, overall, the implemented learning has succeeded in developing students' WASAKA character, helping them become familiar with it.

Although all groups of students scored in the 'good' category, the absence of scores in the 'very good' or 'poor' categories is an important point that needs further attention. This condition shows that the learning implemented has succeeded in shaping the WASAKA character evenly among students. The characters that have been formed have not fully achieved excellent WASAKA characters. WASAKA characters in the "good" category indicate that students have begun to show behavior in accordance with the values of the three WASAKA characters, namely responsibility, cooperation, and discipline, but are still in the habituation stage. This means that the character is not yet fully embedded in a solid, consistent personality, because students' characters differ, and it is not easy to familiarise each student in a short time [14].

WASAKA character building on three characters, namely responsibility, cooperation, and discipline, was carried out through ratebased assessment on five groups (30 learners). All groups achieved the good category, with scores ranging from 72 to 82. This achievement shows initial success in fostering character habits, but has not yet reached an excellent level, indicating full and sustainable internalisation of values. From the perspective of the STEMK learning model, the presence of the WASAKA character not only shapes attitudes but also serves as an important prerequisite for the success of the scientific-technological approach promoted in STEMK.

Responsibility Encourages learners to plan experiments, follow safety procedures, and validate data independently. More accurate data collection; increased self-reflection. Collaboration facilitates the design of technical/engineering solutions, interdisciplinary discussions, and the sharing of research roles. More diverse ideas; more effective team-based problem solving. Discipline ensures orderly scientific time management and documentation (observation, hypothesis testing, evaluation). The inquiry cycle is systematic; experimental results are replicable [15-16].

By integrating these values, STEMK not only teaches STEM content but also fosters a scientific habitus rooted in character. In other words, the WASAKA character creates or rather, strengthens the STEMK atmosphere in learning:

1) The classroom environment becomes more structured (discipline) and collaborative (cooperation), so that STEMK projects can be implemented without behavioral barriers.
2) Learners show autonomy (responsibility) in completing project-based tasks, an important indicator in the engineering design phase of STEMK.
3) WASAKA local character strengthening provides a relevant cultural context, bridges global STEM concepts with local wisdom, and increases learners' emotional engagement.

Research Implications:

a) The achievement of the good category proves the initial effectiveness of the module, but improvement towards excellent requires further strategies such as post-project character reflection coaching or cross-group peer assessment to embed WASAKA values more firmly.
b) The correlation between character scores and academic performance in the STEMK project deserves quantitative analysis in future research, to map how much character mediates the improvement of science learning outcomes.
c) A long-term learning design (more than one cycle) is recommended, given that character internalization requires time and repetition in real contexts.

Thus, the application of the WASAKA character is not just a moral complement but a strategic component that

enhances the effectiveness of the STEMK learning model in improving understanding of the digestive system and skills in 18 Education characters [16].

Practicality Analysis

The practicality of the science learning module was measured using a student response questionnaire comprising 20 statements, completed by class VIII B students. After the science learning module was validated and revised, the next learning module could be tested in small groups. A small-group test with 10 students was conducted to assess the practicality of the science learning module. The following are the results of the trial of the practicality of the science learning module.

Table 13. Results of Small Group Practicality Trial

Number of Learners	Maximum Score	Percentage	Criteria
10	120	80.5%	Very Practical

Practicality in this study was obtained through a small-group trial with 10 students and a large-group test with 30 students in the field test. This practicality distributes a response questionnaire to students to find out how practical the science learning module is using the STEMK WASAKA learning model. The questionnaire results show that the small-group test achieved a practicality score of 80.5% on the criterion "Very Practical," based on student responses.

Table 14. Practical Results in Large Groups

Number of Learners	Maximum Score	Percentage	Criteria
30	120	86.91%	Very Practical

Furthermore, a large-group trial was conducted to assess the practicality of the science learning module for large-group instruction. with a total of 30 learners. The overall score obtained was 86.91%. This percentage is included in the "Very Practical" category based on the student response questionnaire results, as shown in [17].

This shows that the science learning module using the STEMK WASAKA learning model on the human digestive system to improve student learning outcomes in junior high school is highly practical for students, as it provides clear instructions, easy-to-understand materials, and engaging learning activities. In addition, students can use the science learning module independently without relying heavily on the teacher, which supports an active learning process and improves student learning outcomes [18].

Effectiveness Analysis

Effectiveness is measured through a student learning outcome test consisting of 10 multiple-choice pretest and posttest questions. A small-group trial was also conducted with 10 students to determine the effectiveness of the developed science learning module. The test was calculated using normalized gain, also known as the (N-gain) equation. Pretest and posttest results [19].

Table 15. Average Pretest and Posttest Scores for Small Groups

Number of Participants	Pretest	Average Posttest	N-gain	Student Criteria
10	31	58	0.36	moderate

After conducting a small group trial with ten students, a trial was then conducted to determine the effectiveness of the science learning module in learning or a large group, namely class VIII A students of SMP Negeri 1 Tabunganen with a total of 30 students.

Table 16. Average Results of Pretest and Posttest Scores for Large Groups

Number of Students	Average Pretest	Average Posttest	N-gain	Criteria
30	37.33	81.33	0.65	Sedang

The effectiveness of the developed science learning module can be determined by calculating both student learning outcomes using learning outcome tests administered to students before and after using the developed science learning module [20]. These learning outcome tests are divided into two categories: a pretest, administered before using the science learning module, and a posttest, administered after using the science learning module [21].

Effectiveness testing was conducted by administering a learning outcome test on the human digestive system in a small-group trial with 10 students. The pretest average was 31 and the posttest average was 58, resulting in an N-gain of 0.36, categorized as moderate [22].

A large-group trial with 30 eighth-grade students at SMP 1 Tabunganen was conducted. The test was conducted twice: a pretest and a posttest. Based on data obtained from the 30 students, the average pretest score was 37.33, increasing to 81.33 in the posttest. The N-gain value calculated from this difference was 0.65, which is categorized as "moderate."

The N-gain value for the small group was 0.36, which falls in the low category because it lies within the medium N-gain range ($g < 0.3$). Meanwhile, the N-gain value for the large group was 0.65, which falls within the medium category because it falls within the medium N-gain value of "$0.3 \leq g \leq 0.7$." According to Hake (1998), the N-gain score category is considered effective if the N-gain value is greater than 0.3, which falls within the medium or high criteria. Therefore, with N-gain values of 0.36 in the small-group test and 0.65 in the large-group test, indicating an improvement between the two, it can be concluded that the module or learning method used has a positive impact on student learning outcomes.

The N-gain results in this study indicate that the learning conducted is classified as moderate, although it has not yet reached the highest category. However, this value also indicates that some students did not achieve optimal improvement from pretest to posttest [23].

The science learning module used was designed to encourage active student learning, improve learning outcomes, and connect the subject matter to everyday life. This module also helped students understand the material through exploration and problem-solving activities, while simultaneously instilling the WASAKA character values

[24]. Therefore, the moderate N-gain results demonstrate that the science learning module used in this study was indeed effective in improving student learning outcomes, particularly in the human digestive system [25].

This improvement indicates that the learning module using the WASAKA STEMK learning model had a significant impact on improving student understanding of the human digestive system. The use of the science learning module based on the WASAKA STEMK learning model was shown to increase student engagement and overall understanding [26].

Evaluation Stage

Evaluation is the final stage in the development of a Science Learning Module using the STEMK WASAKA Learning Model. In this study, researchers conducted evaluations at each stage. In the analysis stage, researchers conducted evaluations based on the results of the needs and curriculum analysis. This evaluation aimed to ensure optimal learning and improve student outcomes, particularly in understanding the human digestive system. Therefore, researchers designed a Science Learning Module incorporating the STEMK WASAKA learning model. During the design stage, evaluations were conducted to improve the Student Worksheets and instruments in the Science Learning Module, based on the supervisor's suggestions and input. During development, evaluations were conducted to assess the suitability of the Science Learning Module for use and to revise it based on the validator's suggestions and input. The implementation stage included evaluations aimed at improving the Science Learning Module using STEMK WASAKA, based on data from student response questionnaires. The evaluation stage was the final one, aimed at ensuring the developed product achieved its intended objectives. Based on the validation results, student responses, and test results, it can be concluded that the Science Learning Module is suitable for use in the learning process.

Conclusion

Based on the results of research and development of science learning modules using the STEMK WASAKA learning model on human digestive system material to improve student learning outcomes. The development of science learning modules using the STEMK WASAKA learning model on the human digestive system to improve student learning outcomes in junior high schools yielded a value of 0.758, meeting the medium criteria. This science module, using the STEMK WASAKA model to help junior high school students understand the material on the human digestive system and increase their scores, is considered very practical, achieving a 86.91% score. This science module, using the STEMK WASAKA model to help junior high school students understand the material of the human digestive system and increase their scores, was declared moderate by obtaining an N-gain of 0.36 in the small group and was declared moderate by obtaining an N-gain of 0.65 in the large group, so it was declared effective in the science learning module in this study.

Author's Contribution

R. Adawiyah: Initiated the research idea, designed the study, and developed the Science Learning Module. M.M. Sari: Contributed to the research design, supervised the development of the instrument. Syubhan Annur: Supported data collection and validated the learning materials.

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References

[1] D. Afrila, A. Yarmayani, S. Pamungkas, D. Syaputra, A. Albetris, and A. I. Siregar, "Pelatihan penyusunan modul guna meningkatkan kompetensi profesional guru MTsS Jauharul Islam di Penyengat Olak Kabupaten Muaro Jambi," *Abdimas Ekodiksosiora: Jurnal Pengabdian Kepada Masyarakat Ekonomi, Pendidikan, dan Sosial Humaniora*, vol. 3, no. 2, pp. 97–102, 2023.

[2] A. N. Amalia and R. Arthur, *Penyusunan Instrumen Penelitian: Konsep, Teknik, Uji Validitas, Uji Reliabilitas, dan Contoh Instrumen Penelitian*. Penerbit NEM, 2023.

[3] S. Annur, A. Rusilowati, S. Supriyadi, and W. Sumarni, *Bumi dan Kebencanaan Model Pembelajaran STEMK Wasaka*. Yogyakarta: Aswaja Pressindo, 2022.

[4] S. Annur, A. Rusilowati, S. Suprijadi, and W. Sumarni, "Pengajaran IPA, pendekatan STEM dan kearifan lokal dalam mitigasi bencana: Sebuah studi review tahun 2011–2019," in *Prosiding Seminar Nasional Pascasarjana (PROSNAMPAS)*, vol. 5, no. 1, pp. 1075–1080, 2022.

[5] M. I. Anshari, R. Nasution, M. Irsyad, A. Z. Alifa, and I. A. Zuhriyah, "Analisis validitas dan reliabilitas butir soal sumatif akhir semester ganjil mata pelajaran PAI," *EDUKATIF: Jurnal Ilmu Pendidikan*, vol. 6, no. 1, pp. 964–975, 2024, doi: 10.31004/edukatif.v6i1.5931.

[6] E. F. Kurniawati and Y. Yuhana, "Pengembangan instrumen tes untuk kemampuan berpikir reflektif matematis pada materi aljabar," *Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika*, vol. 5, no. 2, pp. 1021–1030, 2024.

[7] A. Wahyuni and E. Yusmaita, "Perancangan instrumen tes literasi kimia pada materi asam dan basa kelas XI SMA/MA," *Edukimia*, vol. 2, no. 3, pp. 106–111, 2020, doi: 10.24036/ekj.v2.i3.a186.

[8] R. S. Firmansyah and P. W. Rusimanto, "Validitas dan kepraktisan modul pembelajaran human machine interface pada mata pelajaran instalasi motor listrik di SMK 3 Jombang," *Jurnal Pendidikan Teknik Elektro*, vol. 9, no. 2, pp. 395–403, 2020, doi: 10.26740/jpte.v9n2.

[9] R. R. Hake, *Analyzing Change/Gain Score*. USA: Department of Physics, Indiana University, 1998.

[10] B. Munawaroh, Y. S. Rahayu, and A. Bashri, "Profil permainan edukatif ludo pada materi plantae untuk melatihkan kemampuan berpikir kritis siswa," *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, vol. 13, no. 1, pp. 254–265, 2024.

[11] R. Slamet and S. Wahyuningsih, "Validitas dan reliabilitas terhadap instrumen kepuasan kerja," *Aliansi: Jurnal Manajemen dan Bisnis*, vol. 17, no. 2, 2022, doi: 10.46975/aliansi.v17i2.428.
[12] M. F. Ramadhani, R. A. Siroj, and M. W. Afgani, "Validitas dan reliabilitas," *Journal on Education*, vol. 2, no. 5, pp. 10967–10975, 2024.
[13] E. Rianti and D. Mustika, "Peran guru dalam pembinaan karakter disiplin peserta didik," *Murhum: Jurnal Pendidikan Anak Usia Dini*, vol. 4, no. 2, pp. 360–373, 2023, doi: 10.37985/murhum.v4i2.325.
[14] C. H. Ferrary *et al*., "Urgensi memahami karakteristik peserta didik dalam pembelajaran pada Kurikulum Merdeka," *Jurnal Basicedu*, vol. 8, no. 5, pp. 3985–3997, 2024.
[15] L. N. Sari and P. Bintang, "Konsep sistem pencernaan pada manusia berdasarkan Al-Qur'an dan hadits," *Jurnal Penelitian, Pendidikan dan Pengajaran (JPPP)*, vol. 3, no. 3, pp. 248–255, 2022, doi: 10.30596/jppp.v3i3.13222.
[16] S. Nabila, I. Adha, and R. Febriandi, "Pengembangan media pembelajaran popup book berbasis kearifan lokal pada pembelajaran tematik di sekolah dasar," *Jurnal Basicedu*, vol. 5, no. 5, pp. 3928–3939, 2021, doi: 10.31004/basicedu.v5i5.1475.
[17] N. M. Yuliarmi and A. A. I. N. Marhaeni, *Metode Riset Jilid 2*. Denpasar: CV. Sastra Utama, 2019.
[18] A. P. Wulandari, A. A. Salsabila, K. Cahyani, T. S. Nurazizah, and Z. Ulfiah, "Pentingnya media pembelajaran dalam proses belajar mengajar," *Journal on Education*, vol. 5, no. 2, pp. 3928–3936, 2023, doi: 10.31004/joe.v5i2.1074.
[19] A. Fitri, L. Efriyanti, and R. Silmi, "Pengembangan modul ajar digital informatika jaringan komputer dan internet menggunakan Canva di SMAN 1 Harau," *JATI (Jurnal Mahasiswa Teknik Informatika)*, vol. 7, no. 1, pp. 33–38, 2023.
[20] W. Hidayatillah, E. T. Wisudaningsih, and L. D. Pratama, "Kepraktisan media pembelajaran interaktif berbasis Google Sites berorientasi pada hasil belajar dan minat belajar siswa," *Laplace: Jurnal Pendidikan Matematika*, vol. 5, no. 1, pp. 93–104, 2022, doi: 10.31537/laplace.v5i1.675.
[21] N. P. Y. Lestari, I. B. P. Arnyana, and I. M. Candiasa, "Pengembangan media interaktif berbasis web untuk meningkatkan hasil belajar sistem organ manusia," *PENDASI Jurnal Pendidikan Dasar Indonesia*, vol. 8, no. 1, pp. 54–68, 2024, doi: 10.23887/jurnal_pendas.v8i1.3127.
[22] A. Arif and R. Masdalipa, "Pelatihan modul pembelajaran menggunakan MS Word bagi guru SMP dan SMA di Pulau Pinang Lahat," *NGABDIMAS*, vol. 3, no. 2, pp. 41–50, 2020.
[23] A. T. Widianto and M. S. Prastiwi, "Kepraktisan media pembelajaran gamifikasi materi limbah (Megali) untuk meningkatkan hasil belajar siswa," *BIOCHEPHY: Journal of Science Education*, vol. 4, no. 2, pp. 754–759, 2024, doi: 10.52562/biochephy.v4i2.1261.
[24] M. Sarumaha *et al*., "Penggunaan model pembelajaran artikulasi terhadap hasil belajar siswa pada mata pelajaran IPA terpadu," *Aksara: Jurnal Ilmu Pendidikan Nonformal*, vol. 8, no. 3, pp. 2045–2052, 2022.
[25] R. Rahimah, "Peningkatan kemampuan guru SMP Negeri 10 Kota Tebing Tinggi dalam menyusun modul ajar Kurikulum Merdeka melalui kegiatan pendampingan," *ANSIRU PAI*, vol. 6, no. 1, p. 92, 2022, doi: 10.30821/ansiru.v6i1.12537.
[26] A. Nazara, A. O. Harefa, and A. R. Harefa, "Pengembangan modul pembelajaran matematika berbasis inkuiri kelas X SMAK Arastamar Lotu," *Formosa Journal of Applied Sciences*, vol. 1, no. 5, pp. 653–666, 2022, doi: 10.55927/fjas.v1i5.1477.