Vol. XI No. 2 December 2025
DOI: https://doi.org/10.19109/bioilmi.v11i2.32044
E-ISSN: 2527-3760
Page: 132 - 145

Development of Student Worksheets (LKPD) based on the 5E Learning Cycle on the Material of Locomotor Systems in Grade XI of Senior High School

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ARTICLE INFO

***Article history*:**
Received: 08/11/2025
Revised: 27/12/2025
Accepted: 28/12/2025

***Keywords*:**
Development
Learning Cycle 5E
LKPD
Movement Systems
SMA Kartika I-2 Medan

ABSTRACT

This study was conducted to address issues in schools, such as students' lack of understanding of the material, the use of conventional learning models, and limited use of learning media. The main goal of the research was to develop a valid, practical, and effective LKPD based on the Learning Cycle 5E model for biology lessons, specifically on the topic of the Movement System for 11th grade students at Kartika I-2 High School in Medan. This research followed the 4D development model, with data collected through observations, interviews, tests, and questionnaires.The study used several data collection instruments: teacher interview sheets, material, learning, and media validation questionnaires, teacher and student response questionnaires, and pretest and posttest questions. The results showed that the validation by material experts resulted in an average percentage of 90.6%, classified as "very feasible." Validation by learning experts showed 84.6%, also categorized as "very feasible," while media expert validation resulted in 90%, considered very feasible.The practicality of the media was confirmed by education practitioners, who gave it a 93% rating of "very practical," and the student response questionnaires showed a 92% rating of "very practical." The N-Gain test from pretest and posttest scores showed an N-Gain of 0.75, indicating effectiveness.In conclusion, the LKPD based on the Learning Cycle 5E model is highly valid, practical, and effective for biology learning, with positive feedback from both teachers and students and significant improvements in learning outcomes.

INTRODUCTION

Education is one of the main pillars in shaping the quality of human resources. Education is also a means to produce students who are creative, talented, skilled, and qualified so that they are more worthy as human beings. Education in schools really needs educators who can be responsible for guiding and directing students through student-oriented learning (Students Centered). Students are required to be more active and play a role in the classroom so that they can build their ability to recognize, find out, learn, and find solutions (fatmawati & yuzrizal, 2020). Education remains in line with existing developments if educators are more creative in creating an interesting and fun atmosphere to attract students' attention at school, especially in biology subjects. Most of biology learning is through real learning. Learning with real experience can affect the processing of information, for example visualization experience will be better than listening experience, as well as the experience of doing will be better than just the experience of seeing. Students who have a high understanding of biology can easily stimulate thinking skills, and be able to solve problems in everyday life.

There are several factors that can affect learning outcomes, namely teacher competence, curriculum system, students, and learning strategies and methods. These components play an important role in achieving learning objectives. Likewise with learning media, learning media is an intermediary that carries messages or information between the source and receiver so that it becomes one of the influential factors in achieving learning effectiveness. Education in schools to support learning requires media and learning models, especially for learning biology which is very abstract so that media and learning models are needed so that teachers can easily convey biology learning information and also teachers understand it more easily, so that there are no difficulties in the teaching and learning process (Mukaromah, 2021).

One of the components of learning tools that can help students to better accept the lessons given by the teacher is the Learner Worksheet (LKPD). LKPD is needed in the learning process because it makes it easier for students to understand the material and practice experiments both inside and outside the classroom and at home. LKPD serves as a student learning guide and also makes it easier for students and teachers to carry out teaching and learning activities. Learning using LKPD is effective for improving student learning outcomes, knowledge, attitudes, and skills. Based on this statement, the availability of LKPD can help in the learning process (Raudoh, 2023).

The results of interviews conducted by researchers with one of the XI grade biology teachers at SMA Kartika I-2 Medan, namely: (1) the learning process only uses teaching materials in the form of printed books. Information was obtained that the teacher has never developed teaching materials in the learning process so that it only uses printed books and questions listed in printed books, even though there are many teaching materials that can be developed by teachers to support the learning process such as modules, LKPD, handouts, and so on. (2) In the learning process, it is still conventional. Teachers have not used a varied learning model. Teachers only use lecture methods and group discussions at some times, even though there are many learning models that teachers can use according to the material being studied. Interviews conducted by researchers with students of class XI IPA 2 that 86.1% of students have never used LKPD in the biology learning process and 13.9% have used LKPD in the learning process but not intensely used, students said that often the teacher only learns using a textbook. In addition, the delivery of material is only by the lecture method. This is less effective, causing students to easily get bored with the subject matter because students are only given reinforcement to remember, do questions in the student book, or make monotonous notes. If students are not given reinforcement to understand the material and make notes, they will be bored (Raudoh, 2023). In addition, 52.8% of students said that the Motion System material is one of the difficult materials to learn in learning biology. This material is considered difficult to understand because there are several sub-materials that require students to be able to identify muscle types, describe muscle structure, explain the location, and how muscles work (Mukaromah, 2021).

Based on the above problems, a solution is needed to overcome these difficulties, namely the need for the development of teaching materials that better support the teaching and learning process. The teaching material to be developed is the Learner Worksheet (LKPD). The constructivism approach in the development of LKPD is very important to improve the quality of the student learning process. With this approach, students can build their understanding independently through active involvement in learning activities. One model that is relevant to this approach is the 5E learning cycle, which consists of five stages: Engage (attracting students' attention), Explore (concept exploration), Explain (further explanation), Elaborate (concept development), and Evaluate (understanding assessment). The 5E Learning Cycle can be defined as a learning method that focuses on activities that encourage students to understand scientific concepts, explore and deepen their understanding, and then apply these concepts to new situations. Through this model, the LKPD designed by teachers is intended to help teachers implement a learning model that is easier for students to understand, create new learning media that align with the current curriculum, provide contextual learning experiences, and enable students to actively develop concepts through practical activities, thereby achieving the desired learning outcomes

(Matitaputty & Sopacua, 2023).

One of the materials for class XI SMA even semester in the Merdeka Curriculum is motion system material. This material is suitable when delivered and assisted by using the Learning Cycle 5E learning LKPD. This is because this material will be easier when conveyed through observation, experimentation, discussion, analysis, and so on. The LKPD can help students build material concepts. Based on the explanation above, the purpose of this study is to produce a LKPD based on Learning Cycle 5E product that is feasible to assist students in learning movement system material.

According to (Wulandari et al., 2024), it is important to implement a new learning model that requires students to play an active role in learning. A learning model that can make learning more active and provide opportunities for students to improve their reasoning skills is the 5E Learning Cycle and the hope after using the 5E Learning Cycle-based LKPD is that students' understanding will improve, student activity will increase, and it will become a fun and effective learning medium.

MATERIALS AND METHODS

1. Time and Place of Research

This research conducted at Kartika I-2 High School in Medan, which is located at Jalan Brigjend H.A Manaf Lubis, Central Helvetia, Medan Helvetia District, Medan City, North Sumatra. The research will be conducted from October 2024 - October 2025.

2. Research Method

The type of this study uses research and development methods. The product developed in this study is a Student Worksheet based on Learning Cycle 5E on Movement Systems materials using the 4D model which consists of 5 stages, namely the Define, Design, Development, and Dissemination.

3. Population and Sample

The subjects of this research were material expert lecturers, media expert lecturers, learning expert lecturers, class XI-2 SMA Kartika I-2 Medan, and one biology teacher of class XI SMA Kartika I-2 Medan. The object of this research is the feasibility of teaching materials in the form of Student Worksheets (LKPD) based on learning cycle 5e movement system material.

4. Research Procedure

The procedure used by researchers in developing products follows the 4-D development model. The following is a chart of the development stages of the 4-D model.

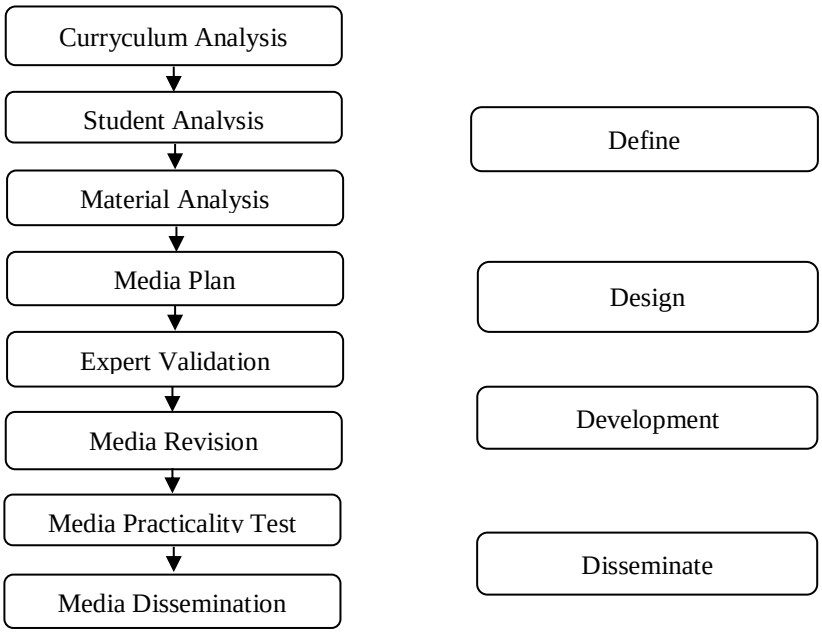


Figure 1. Flow of Research Procedure

At define stage, the initial stage is carried out to fill in the list of learning requirements to see and find problems that exist at SMA Kartika I-2 Medan. Steps at this stage, namely curriculum analysis, material analysis, and student analysis. Design stage is the preparation of Student Worksheet based on Learning Cycle 5E on the material of the Motion System in class XI SMA Kartika I-2 Medan. The purpose of this LKPD design is to ensure that the LKPD is designed with the abilities and needs of students in accordance with the Merdeka curriculum. The steps of designing LKPD include collecting material, selecting formats, preparing test instruments. The development phase is the phase where researchers design the developed product. The elements implemented in the development phase are expert validation, media revision, and media practicality test. After completion of the improvement, the next stage is the dissemination stage. At this stage the LKPD that has been revised during the development stage will be produced for use on a wider scale in other schools, to test the effectiveness of real users of teaching materials over a long period of time.

5. Data Collection

The data collection technique in this study was used interview, questionnaires and test. Interviews were conducted to collect information by means of questions and answers between researchers and research subjects. Interviews in this study were conducted at SMA Kartika I-2 Medan by conducting interviews with biology teachers as resource persons. The interview data is the basis for identifying problems related to methods, learning media sources, and learning models. The questionnaire in this study was shown to product validators, namely 3 expert teachers consisting of material experts, learning experts, media experts, and 1 biology teacher. The test method in this study is to conduct a pretest and posttest on students of class XI-2 at SMA Kartika I-2 Medan. The questions given to students are in the form of multiple choices which are used to measure the improvement of student learning outcomes on the material of the motion system after testing using the LKPD based Learning Cycle 5E.

6. Data Analysis

This research uses descriptive data analysis and the data analysis method is divided into two parts, namely data analysis of validation survey results conducted by experts (material, learning, and media),teachers, and students and data analysis of product effectiveness using normalized N-gain. The data obtained from the answers to the questionnaire given were analyzed with a Likert scale.

a. Expert Team Assessment Data Analysis

The data obtained from the answers to the questionnaire given were analyzed with a Likert scale. Data was obtained in the form of a check list summarized in the form of a Likert scale that has been scored as in Table 1.

Table 1. Criteria for Answering Instrument Item Validation with Likert Scale

No	Answer	Score
1	Very Feasible	5
2	Feasible	4
3	Fairly Feasible	3
4	Less Feasible	2
5	Not Feasible	1

From the results of the calculation using the formula above, a number in the form of percentages is produced which is interpreted qualitatively.

Table 2. Presentation of Assessment and Feasibility of Validation Questionnaire Instruments

Score Range	Interval Presentation (%)	Criteria	Qualification
$32{,}5 \leq x \leq 40$	$81{,}25 \leq x \leq 100$	Very Feasible	The questionnaire instrument is ready to be utilized in the field

Score Range	Interval Presentation (%)	Criteria	Qualification
			for research / no revisions
$25 \leq x \leq 32{,}5$	$64{,}28 \leq x \leq 81{,}25$	Feasible	The questionnaire instrument is ready to be used in the field for research / no minor revisions
$17{,}5 \leq x \leq 25$	$44{,}64 \leq x \leq 62{,}5$	Less Feasible	The questionnaire instrument can be continued by adding something missing, making certain considerations, the additions made are not too large.
$10 \leq x \leq 17{,}5$	$25 \leq x \leq 43{,}8$	Not Feasible	Revise the questionnaire instrument by re-examining carefully and looking for weaknesses in the product to be refined.

Table 3. Presentation of Assessment and Feasibility of LKPD for Expert Questionnaire Instruments

Scor Range	Interval Presentation (%)	Criteria	Qualification
$47 \leq x \leq 56$	$83{,}92 \leq x \leq 100$	Very Feasible	LKPD products can be used in the field for learning activities but there are minor revisions / no revisions
$36 \leq x \leq 46$	$64{,}28 \leq x \leq 82{,}14$	Feasible	LKPD products can be used in the field for learning activities but there are minor revisions
$25 \leq x \leq 35$	$44{,}64 \leq x \leq 62{,}5$	Less Feasible	LKPD products can be continued by adding something that is lacking, making certain considerations, the additions made are not too large.
$14 \leq x \leq 24$	$25 \leq x \leq 42{,}85$	Not Feasible	Revise the LKPD by re-examining carefully and looking for weaknesses in the product to be refined.

b. Data Analysis of Teacher & Students Practicality Test Questionnaire Results

The instrument assessment was arranged according to a rating scale calculation scale which was tested on 1 biology teacher at SMA Kartika I-2 Medan. Data obtained in the form of a check list summarized in the form of a Likert scale that has been given a score in table 4. The presentation of the LKPD practicality test by the teacher can be seen in table 4.

Table 4. Criteria for Practicality Test Results by Teachers & Students

No	Interval	Criteria
1	76% - 100%	Very Practical
2	51 % - 75%	Practical
3	26% - 50%	Less Practical
4	0 % - 25%	Not Practical

1) Validity Test

Test validity is used to determine how valid the items used as research instruments are. In the validity test, the product moment correlation technique is used, namely the definition r_{xy} will show the correlation index between variables X and Y using the help of SPSS. To determine the level of validity from the beginning, the validity of the

questions was tested using SPSS. For multiple choice learning outcome tests on the validation test results can be seen in the following table.

Table 5. Criteria for Question Validity

Range	Classification
0,810-1000	Very High Validity
0,610-0,800	High Validity
0,410-0,600	Fair Validity
0,210-0,400	Low Validity
0,000-0,200	Very Low Validity

2) Reliability Test

The reliability test is used to state the consistent level of a test question. With the interpretation of the reliability value as follows

Table 6. Interpretation of the Reliability Value

The value of r	Interpretation
0,00-0,20	Very Low
0,21-0,40	Low
0,41-0,60	Fair
0,61-0,80	High
0,81-1,00	Very High

3) Problem Difficulty Level

Level of difficulty is a number that indicates the difficulty and ease of a question. With criteria as follows

Table 7. Test Score Question Difficulty

Question Difficulty Level	Question Category
0,00-0,29	Difficult
0,30-0,69	Medium
0,69-1,00	Easy

4) Differentiating Power

In determining the differentiating power of the question, with criteria as follows

Table 8. Criteria for Question Distinguishing Power

Criteria for Question Distinguishing Power	Interpretation
0,00-0,20	Bad
0,21-0,40	Fair
0,41-0,70	Good
0,71-1,00	Excellent

5) Data Analysis of Product Effectiveness Assessment

Development Research in the field of education to see its effect can be directly carried out product assessment after being simulated, the assessment is carried out to obtain the feasibility or effectiveness of the product results. The developed LKPD product is tested for its effect in the teaching and learning process. The design was carried out with One-Group Pretest-Posttest Design. The implementation used one class with a total of 36 students with the research design listed in table 9.

Table 9. One – Group Pretest – Posttest Design

Class	Pre-Test	Treatment	Post-Test
XI SMA Kartika I-2 Medan	A_1	With LKPD	A_2

With the gain index interpretation criteria shown in the following table 10:

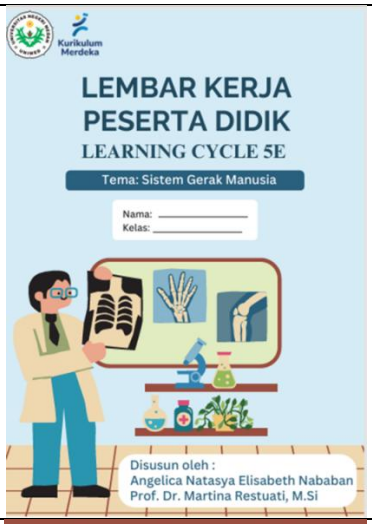
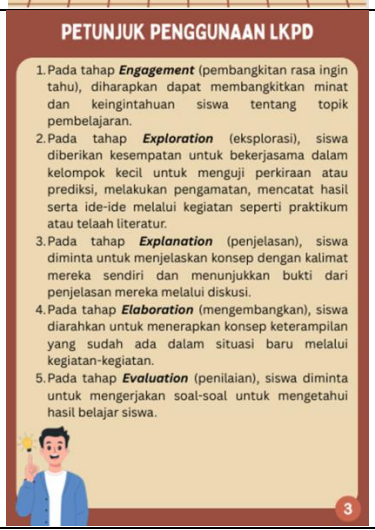
Table 10. N-Gain Category

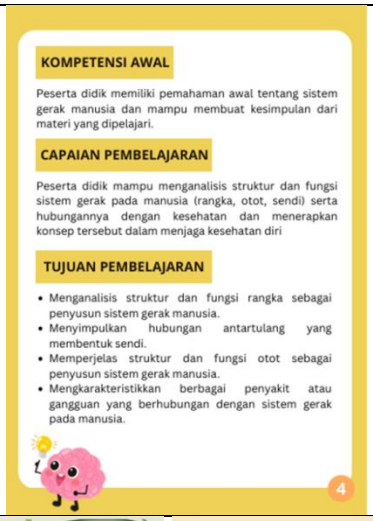
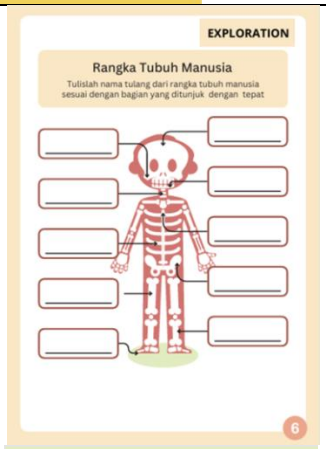
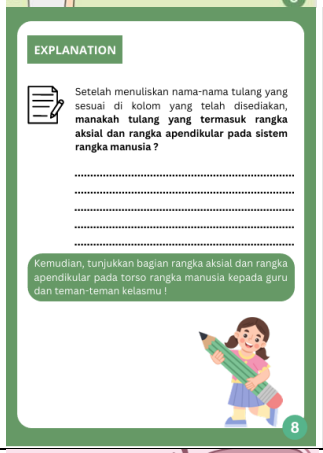
Nilai N – Gain	Category
N – Gain ≥ 0,70	High
0,30 < N – Gain ≥ 0,70	Medium
N – Gain ≤ 0,70	Low

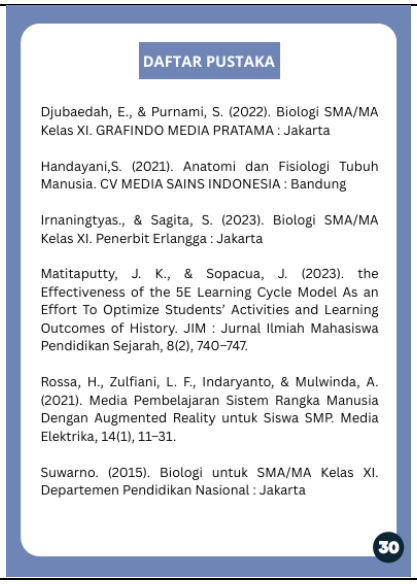
RESULTS AND DISCUSSION

This study produced a product in the form of a Student Worksheet (LKPD) based on the 5E Learning Cycle for Grade XI high school students on the subject of motion systems. This LKPD was created using the 4D development model with the stages Define, Design, Develop, and Disseminate, which was developed by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel in 1974. The first stage in this research is definition. The creation of a product begins with analyzing the requirements for the development of that product. Therefore, at this stage, an analysis was conducted on the requirements for developing LKPD based on the 5E Learning Cycle for the Motion System material in grade XI at Kartika I-2 High School in Medan. The definition stage involved curriculum analysis, student analysis, and material analysis. At design stage, preliminary LKPD design is carried out with the aim of obtaining a framework or initial concept for product design. This stage consists of instrument preparation and media selection.

Table 11. LKPD based on Learning Cycle 5E on Movementt Systems Material

No.	Student Worksheet	Explanation
1		The first page (cover) of the LKPD consists of the LKPD title, independent curriculum logo, the agency logo, the learning model used in the LKPD, the material to be discussed, the name of the LKPD athor, and a space for students to write their identity (name and class).
2		Page 3 contain instructions for using the LKPD. This page provide information on how to use the LKPD based on learning cycle 5e learning cycle in accordance with the stages of learning model.

No.	Student Worksheet	Explanation
3		Page 4 consists of Basic Competencies, Learning Outcomes, and Learning Objectives in accordance with the material being studied.
4	   	The image above is the seventh component of the LKPD, namely the content section. On pages 5-13, there is material that will be studied by LKPD the learning cycle 5E based skeletal system. The content of the material is adjusted to the stages of the learning model, namely Engagement, Exploration, Explanation, Elaboration, and Evaluation. Engagement contains key learning activities that stimulate students' curiosity about the learning topic, namely the skeletal system. Exploration contains key learning activities that involve students and provide them with the opportunity to build their own understanding. Explanation contains key learning activities that give students the opportunity to communicate what they have learned so far and explain its meaning
5	 	On pages 14-19, there is material that students will learn about joints based on the 5E Learning Cycle. The content of the material is tailored to the stages of the learning model, namely Engagement, Exploration, Explanation, Elaboration, and Evaluation. Engagement contains the main learning activities that stimulate students' curiosity about the learning topic, namely joints. Exploration contains key learning activities that involve students in discovering their own understanding, such as finding out about the types of joints and their

No.	Student Worksheet	Explanation
		functions. Evaluation is the final stage of learning, which consists of activities for students to evaluate their understanding. Students are asked to write answers to questions about joints in a crossword puzzle.
6	 	On pages 20-24, there is material that students will learn about muscles based on the 5E Learning Cycle. The content of the material is adapted to the stages of the learning model, namely Engagement, Exploration, Explanation, Elaboration, and Evaluation. Engagement consists of key learning activities that stimulate students' curiosity about the learning topic, namely muscles. Evaluation is the final stage of learning, which contains activities for students to evaluate their understanding. Students are asked to write answers to questions about muscles in the column provided based on what they have learned.
7	 	On page 25-29, there is material that students will learn about disorders of the musculoskeletal system based on the 5E Learning Cycle. The content of the material is adapted to the stages of the learning model, namely Engagement, Exploration, Explanation, Elaboration, and Evaluation. Engagement consists of key learning activities that stimulate students' curiosity about the learning topic, namely disorders of the human motor system. Evaluation is the final stage of learning, which contains activities for students to evaluate their understanding. Students are asked to write down their answers.
8		References

After completing the design and media creation stages, the next step taken by the researcher was to develop the media. The media development stage aimed to produce a good LKPD based on Learning Cycle 5E after receiving revisions, suggestions, and input from experts. The suggestions and input received by the researcher were used as a reference for improving the 5e learning cycle-based LKPD developed by the researcher (Matitaputty & Sopacua, 2023).

Table 12. Material Validation Results

No	Assesment Aspects	Score Total
1	Content Feasibility	31
2	Presentation Feasibility	13
3	Language Feasibility	24
Total		**68**
Average Value		$\frac{68}{75}$ **= 0,906**
Average Percentage		$\frac{68}{75}$ **x 100% = 90,6%**
Category		**Very Feasible**

The material validation was conducted at the Faculty of Mathematics and Natural Sciences. After revisions were made following the material validation, the material developed by the researcher received a score of 90.6% in the validation. According to opinion Saputri et al. (2023), The total percentage shows that the media is "Valid/No Revision Needed" and falls into the "Highly Suitable" category for use in the learning process.

Table 13. Learning Validation Results

No	Assesment Aspects	Score Total
1	Content Feasibility	27
2	Learning Components	28
Total		55
Average Value		$\frac{55}{65}$ **= 0,846**
Average Percentage		$\frac{55}{65}$ **x 100% = 84,6%**
Category		**Very Feasible**

Content validation was carried out at the Faculty of Mathematics and Natural Sciences. After revisions were made following content validation, the material developed by the researchers received a score of 84.6% in the validation process. According to Saputri et al. (2023), the total percentage shows that the media is "Valid/No Revision Needed" and falls into the "Highly Suitable" category for use in the learning process.

Table 14. Media Validation Results

No	Assesment Aspects	Score Total
1	Software	24
2	Visual Communication	39
Total		63
Average Value		$\frac{63}{70}$ **= 0,9**
Average Percentage		$\frac{63}{70}$ **x 100% = 90%**
Category		**Very Feasible**

The material validation was conducted at the Faculty of Mathematics and Natural Sciences. After revisions were made following the material validation, the material developed by the researcher was given a score of 90%. According to Saputri et al. (2023), The total percentage shows that the media is "Valid/No Revision Needed" and falls into the "Highly Suitable" category for use in the learning process.

Table 15. Teacher's Response Results

No	Assesment Aspects	Score Total
1	Learning Design	25
2	Operational	8
3	Visual Communication	22
Total		**56**
Average Value		$\frac{56}{60}$ **= 0,93**
Average Percentage		$\frac{56}{60}$**x 100% = 93%**
Category		**Very Feasible**

Through the assessment results of education practitioners, the average score for the 5E Learning Cycle LKPD was 93%. According to Saputri et al., (2023), The media was declared "No Revision/Valid" and classified as "Highly Suitable." The validation assessment by education practitioners included the practicality of the media, and based on the percentage of scores obtained, the media was declared "Highly Practical.

Through the student response questionnaire, the percentage of the LKPD Learning Cycle 5E media score was 92%. Media categorized as "Very Practical" according to the categorization value by Saputri et al., (2023). The responses to the media contained in the questionnaire showed that students were generally happy and enthusiastic about learning biology when using the 5E Learning Cycle media. This was because the media used was designed with various attractive images and colors. Students also stated that the media is very easy and practical to use, thereby improving their understanding and knowledge of the material on the musculoskeletal system and encouraging activity and cooperation among groups of students in class XI at Kartika I-2 High School in Medan during learning. Based on the results of validation by education practitioners and student response questionnaires, it can be concluded that the Learning Cycle 5E media is "Very Practical."

Table 16. Comparison of Pretest and Posttest Score for Class XI-2

	Pretest Score	Posttest Score	Description
Total Amount	1320	2265	Increased
Average	50,76	87,11	

From the results of the Pretest and Posttest calculations, it is known that the average Pretest score was 50.76, while the average Posttest score increased to 87.11. Furthermore, an analysis was conducted using the N-Gain test, which aims to measure the effectiveness of learning or intervention in improving student learning outcomes in this study, using the following formula.

Based on the overall N-Gain score calculated using the pretest and posttest scores, the average N-Gain Score was found to be "0.75," which according to the N-Gain Score interpretation table by Kurniawan & Hidayah (2020), showed a "High" increase. In addition, the average N-Gain Score (%) was found to be "74.58%", according to the N-Gain Score (%) interpretation table by Kurniawan & Hidayah (2020), stated that the media used was "effective." It can be further noted that there was an increase in student learning outcomes before and after using the LKPD learning media based on the 5E Learning Cycle. Therefore, it can be concluded that the LKPD learning media based on the 5E Learning Cycle for teaching biology material on the musculoskeletal system in class XI-2 can be considered effective.

CONCLUSION

Based on the results of the research and discussion previously described, the conclusions obtained are as follows, The feasibility of LKPD media based on the 5E Learning Cycle for motion system material, according to subject matter experts, is categorized as highly feasible with an

average percentage score of 90.6%. The feasibility of LKPD media based on the 5E Learning Cycle in motion system material according to learning experts is categorized as highly feasible with an average percentage score of 84.6%. The feasibility of LKPD media based on the 5E Learning Cycle in motion system material according to learning experts is categorized as highly feasible with an average percentage score of 90%. Based on the responses from biology teachers, the practicality of the 5E Learning Cycle-based LKPD for the musculoskeletal system material was categorized as very practical, with an average percentage score of 93%.Based on the responses from students, the practicality of the 5E Learning Cycle-based LKPD on the subject of the motion system was categorized as very practical, with an average percentage score of 92%. Based on the N-Gain test conducted on the effectiveness of the 5E Learning Cycle-based LKPD learning media for motion system material, the LKPD media developed falls into the high category with a percentage of 75%.

ACKNOWLEDGEMENTS

Praise and gratitude to God Almighty who has given His grace and gifts, so that the author can complete this research well. The author also wishes to convey appreciation to the teacher who provided direction and invaluable assistance throughout the research. Additionally, the author is grateful to the students of Class XI-2 SMA Kartika I-2 Medan for their active participation, time, attention, and exceptional cooperation. The contributions and enthusiasm from all parties greatly aided in achieving the objectives of this research. May this collaboration continue and bring benefits to all parties in the future.

REFERENCES

Adzani, I., Rifanty, A. P., Oktafiani, S. A., Isnindriani, R. F., Kaamilah, H., Deandatita, R. Z., Firdaus, M. S., Desmawati, D., & Harjani, H. J. (2024). Efforts to optimize spinal health in adolescents: Enhancing awareness of scoliosis and body posture at SMA Negeri 3 South Tangerang City. *Community Empowerment*, *9*(2), 248–257. https://doi.org/10.31603/ce.10561

Akmal, M., Taqwa, S. F., Masyitha, D., Rahmi, E., Salim, M. N., & Amiruddin. (2022). Study Of Histology, Histomorphometry, and Glychogenes Distribution of Chest and Thigh Muscle in Chicken (Gallus Gallus Domesticus) Pre and Post hatch Period. *Jurnal Ilmiah Mahasiswa Veteriner* , *6*(3), 153–161.

Almira, V. H., Zulkifli, S., & Eni, S. (2017). Pengembangan Lembar Kerja Pesrta Didik (LKPD) Pada Materi Pokok Eubacteria Berbasis Pendekatan Ilmiah. *Jurnal Pelita Pendidikan*, *5*(3), 330–338.

Alonso-Gonzalez, R., Massarella, D., & Swan, L. (2023). Skeletal system in adult congenital heart disease. *International Journal of Cardiology Congenital Heart Disease*, (*13)*, 1–5. https://doi.org/10.1016/j.ijcchd.2023.100460

Ani Anjarwati, Ryzca Siti Qomariyah, Alvin Kurnia, Putri Fatimattus Az Zahra, & Muhimma Yatun Nisa'ul Ulya. (2021). Training and Assistance in Making E-LKPD Using "LiveWorksheets" Aplication at SD Alam Cordova Probolinggo. *GANDRUNG: Jurnal Pengabdian Kepada Masyarakat*, *2*(2), 340–354. https://doi.org/10.36526/gandrung.v2i2.2037

Asmaranti, W., Pratama, G. S., & Wisniarti. (2023). Desain Lembar kerja Peserat Didik (LKPD) Matematika Dengan Pendekatan Saintifik Berbasis Pendidikan Karakter. *Seminar Nasionall Etnomatnesia*, 639–646.

Asyafah, A. (2020). Menimbang Model Pembelajaran (Kajian Teoretis-Kritis atas Model Pembelajaran dalam Pendidikan Islam). *TARBAWY : Indonesian Journal of Islamic Education*, *6*(1), 19–32. https://doi.org/10.17509/t.v6i1.20569

Azzani, E. ., Ristiono, Helendra, & Hartanto, I. (2020). Pengaruh Penerapan Model Pembelajaran Learning Cycle 5E Terhadap Kompetensi Belajar Peserta Didik Tentang Materi Sistem Gerak Kelas XI MIPA SMA Pertiwi 1 Padang. *Bioilmi: Jurnal Pendidikan*, *6*(1), 46–54.

Burgawanti, Kartono, Ghasya, D. A. V., Kresnadi, H., & Suparjan. (2023). Kelayakan Lembar Kerja Peserta Didik Berbasis Liveworksheet Pada Pembelajaran Tema 3 Subtema 2 Kelas IV SD Negeri 01 Jagoi Babang. *Jurnal on Education*, *5*(4), 11558–11565.

Dodi, M., Tresnaningsih, E., Mitra, M., Zaman, M. K., & Putri, R. (2022). The Risk of Awkward Posture with the Incidence of Work-related Musculoskeletal Disorders (WMSDs) in Massage Therapist. *Jurnal Kesehatan Komunitas*, *4*(3), 81–87. https://doi.org/10.25311/keskom.vol4.iss3.256

Hanafi. (2020). Konsep Penelitian R&D Dalam Bidang Pendidikan. *Saintifikasi Islamica : Jurnal Kajian Keislaman*, *4*(2), 129–150. https://doi.org/10.4324/9780367352035-10

Handayani, N. D., & Djukri. (2024). Development of Electronic Student Worksheet Based on Problem-Based Learning for Material on Environmental Change Geoheritage Gumuk Pasir. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2438–2445.

Hardiyono, B., Pratama, B. A., & Laksana, A. A. N. P. (2023). The effect of the dominant muscle strength and self confidence on the results climb of the rock climbing ' s athlete. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, *5*(1), 124–139.

Ibrahim, I., Kosim, K., & Gunawan, G. (2020). Pengaruh Model Pembelajaran Conceptual Understanding Procedures (CUPs) Berbantuan LKPD Terhadap Kemampuan Pemecahan Masalah Fisika. *Jurnal Pendidikan Fisika Dan Teknologi*, *3*(1), 14–23.

Kurniawan, A. B., & Hidayah, R. (2020). Uji NGain Untuk Keefektifan Model Pembelajaran CRH. *UNESA Journal of Chemical Education*, *9*(3), 317–323.

Matitaputty, J. K., & Sopacua, J. (2023). the Effectiveness of the 5E Learning Cycle Model As an Effort To Optimize Students' Activities and Learning Outcomes of History. *JIM : Jurnal Ilmiah Mahasiswa Pendidikan Sejarah*, *8*(2), 740–747.

Mukaromah, H. (2021). Peningkatan Aktivitas dan Hasil Belajar Siswa Melalui Penggunaan Media Audio Visual Pada Materi Sistem Gerak. *Jurnal Penelitian Sains Dan Pendidikan (JPSP)*, *1*(2), 136–142.

Nurulia, G. S., Biologi, P., Matematika, F., Ilmu, D., & Alam, P. (2022). *Pengembangan E-LKPD Berbasis Learning Cycle 5E Materi Sistem Pencernaan Untuk Meningkatkan Keterampilan Proses Terintegrasi Peserta Didik Kelas XI*. *11*(2), 285–293. https://ejournal.unesa.ac.id/index.php/bioedu

Okpatrioka. (2023). Research And Development (R&D) Penelitian Yang Inovatif Dalam Pendidikan. *Dharma Acariya Nusantara: Jurnal Pendidikan, Bahasa Dan Budaya*, *1*(1), 86–100.

Rahmawati, L. H., & Wulandari, S. S. (2020). Pengembangan Lembar Kegiatan Peserta Didik (LKPD) Berbasis Scientific Approach RnD dan 4D. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, *8*(3), 504–515. https://journal.unesa.ac.id/index.php/jpap/article/view/8445/4095

Raudoh, R. (2023). Lembar Kerja Peserta Didik (LKPD) IPAS SMK Materi Makhluk Hidup dan Lingkungannya. *Bionatural*, *10*(1), 116–122.

Riani Johan, J., Iriani, T., & Maulana, A. (2023). Penerapan Model Four-D dalam Pengembangan Media Video Keterampilan Mengajar Kelompok Kecil dan Perorangan. *Jurnal Pendidikan West Science*, *01*(06), 372–378.

Rossa, H., Zulfiani, L. F., Indaryanto, & Mulwinda, A. (2021). Media Pembelajaran Sistem Rangka Manusia Dengan Augmented Reality untuk Siswa SMP. *Media Elektrika*, *14*(1), 11–31.

Salong, A., & Lasaiba, M. A. (2024). Efektivitas Model Learning Cycle 5E dalam Meningkatkan Hasil Belajar Siswa. *SAP (Susunan Artikel Pendidikan)*, *9*(1), 36.

Saputri, D., Mellisa, Hidayati, N., & Fauziah, N. (2023). Lembar Validasi: Instrumen yang Digunakan Untuk Menilai Produk yang Dikembangkan Pada Penelitian Pengembangan Bidang Pendidikan. *Biology and Education Journal*, *3*(2), 133–151.

Setyo, F., Pribowo, P., & Surabaya, U. M. (2018). Pengembangan Instrumen Validasi Media Berbasis. *Junal Pendidikan Dan Ilmu Pengetahuan*, *18*(1), 1–12.

Sibuea, A. S., & Wandini, R. R. (2023). Pengembangan Lembar Kerja Tematik Untuk Meningkatkan Pendidikan Karakter Pada Siswa. *Jurnal Pendidikan Dan Konseling*, *5*(2), 5314–5318.

Susana, & Ramadan, Z. H. (2022). Lembar Kerja Peserta Didik Berbasis Model Pembelajaran Learning Cycle 5 E Untuk Siswa Kelas V Sekolah Dasar. *ElementerIs: Jurnal Ilmiah Pendidikan Dasar Islam*, *4*(November), 36–51.

Tanfiziyah, R., Khasanah, M., Riandi, R., & Supriatno, B. (2021). Inovasi Pembelajaran Berbasis Teknologi Informasi: Model Learning Cycle 5E Menggunakan Gather Town pada Materi Protista. *Biodik : Jurnal Ilmiah Pendidikan Biologi*, *7*(3), 1–10.

Wulandari, T., Suteno, Diah, W. (2024). Pengaruh Model Learning Cycle 5E Disertai LKPD Berbasis Diagram Berpikir Multidimensi Terhadap Kemampuan *Scientific Reasoning Siswa SMP*. *Jurnal Sains dan Edukasi Sains*, 7(1), 1-11.