JPPIPA (Jurnal Penelitian Pendidikan IPA)

Vol.9 No.2 2024

http://journal.unesa.ac.id/index.php/jppipa

DEVELOPMENT OF KALIKA (FIVE CHARACTER CARDS) LEARNING MEDIA ON THE CLASSIFICATION OF LIVING THINGS USING THE DESIGN THINKING FRAMEWORK

Putri Nurul Fitriyyah [1], *Achmad Samsudin*[2], *Rini Solihat*[3], *Nanang Winarno*[4], *Lea Tarliyah*[5]
[1]Teacher Professional Education, Postgraduate School, Universitas Pendidikan Indonesia, Indonesia
[2]Physics Education Department, Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia, Indonesia
[3]Biology Education Department, Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia, Indonesia
[4]Science Education Department, Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia, Indonesia
[5]SMP Negeri 35 Bandung, Indonesia

Abstract

Learning media is one of the important things of learning tools that can increase students' interest in learning. This study aims to develop KALIKA (Five Character Cards) learning media on the classification of living things using the *Educational Design Research* (EDR) method to enhance student achievement. The development model refers to ADDIE with a design thinking framework. The research was carried out at one of the Junior High School in Bandung City, during the even semester of 2023/2024, with a focus on students in class VII, totaling 21 participants. Convenient sampling was utilized for subject selection. The data collection techniques in this research data are validation sheet, assessment formative (pretest and posttest), and questionnaire user response. The validation sheet and user response questionnaire were processed into percentage data using Microsoft Excel, while the formative test results were processed using the Wilcoxon Signed Rank Test statistical test and N-gain using SPSS. The results of this study showed that the validation test data obtained a validity percentage of 92.4% which categorized as very valid criteria, the Wilcoxon Signed Rank Test results state $p < 0.05$ which means there is a significant difference between the pretest and post-test, and the results of the effectiveness test with N-gain effectiveness results of 0.31 which means the effectiveness of student learning is in the moderate category, and 95% students give positive response to KALIKA as learning media. This shows that using KALIKA learning media is quite effective as a support to improve student learning outcomes on the classification of living things. Previous researchers have never developed card-learning media using ADDIE with a design thinking framework, which contains five characters of 5 kingdoms of living things.

Keywords: Learning Media, Classification, Design Thinking, Development, Living Things

Article History: Received: May 25th, 2024. Revised: October 11th, 2024. Published: December 31th, 2024

[1]**Correspondence Address:**
Teacher Professional Education, Postgraduate School, Universitas Pendidikan Indonesia, Indonesia
E-mail: putrinurullfitriyyah@gmail.com

p-ISSN: 2527-7537
e-ISSN: 2549-2209

INTRODUCTION

The learning process refers to the demands of a curriculum that is always dynamically changing to adapt educational goals along with the development of times. Based on the Decree of the Minister of Research, Technology and Education No. 12 of 2024 concerning Curriculum in Early Childhood Education, Primary Education, and Secondary Education, teachers must create a learning process that favors and actively involves students. To achieve this, efforts are needed from teachers to continue to develop and improve competencies in learning activities, creative and innovative to create teaching modules, and make attractive teaching media, including in science learning at the secondary education level (BPK, 2024).

One of the materials studied in science lessons is the classification of living things, which includes observing morphological and anatomical characteristics, and then grouping living things based on similarities in their characteristics. The purpose of the classification of living things is to facilitate the study of living things that are very diverse on this earth, such as studying their interactions with the environment, which will be useful in conservation efforts (Manishimwe et al., 2021). Classification materials provide a basis for learning and understanding biology and concepts related to the anatomy and physiology of living things (Sami, 2018). Despite the importance of learning the classification of living things, several studies have shown that students at the secondary school level continue to face difficulties in learning classification materials, some of the challenging factors are inadequate teaching methods, complicated topics, learners' learning styles, and lack of teaching resources, including school facilities and teachers (Etobro & Fabinu, 2017; Manishimwe et al., 2021).

The challenges and problems experienced by students can be explored more deeply using design thinking. Design thinking is a framework for researchers to find and design the best solution to solve a problem, which is carried out with 5 stages, there are 1) empathize, 2) define, 3) ideate, 4) prototype, and 5) test (Christian & Natatdaja, 2022). Based on the results of interviews with students using the in-depth interview (IDI) technique, as part of the empathy stage, information was obtained that learning in the classroom is still often done by the lecture method, this happens because the facilities in classrooms and schools to support the learning process are limited. As in the case of learning the classification of living things, school facilities are not adequate for observations on all types of microscopic living things, thus making students bored and unmotivated to learn, because the learning style of students in the classroom is mostly kinesthetic, where they like to do practicum, learn through games and learn in heterogeneous groups.

Referring to the learning challenges and the results of interviews with students, there are several ideas for solutions that can be applied, but there is one best solution that suits the conditions and facilities of the school, which is to develop learning media. Learning media is defined as everything related to tools, materials, and environments that are utilized in teaching and learning activities. The selection of interesting media is very important to foster student interest in understanding concepts, optimize student comprehension, and encourage student motivation to learn (Kurniawan et al., 2020; Kurniawan & Hasanah, 2022; Wahjusaputri et al., 2023). One type of learning media that is interesting and can actively involve students in learning is card game media. This media is adapted from the quartet card game, which is a game in the form of a group of cards that have pictures and descriptions and are played by students in groups.

Several studies on the application of card media to the classification of living things have been conducted, such as research by Prasetyaningtyas (2020) which states that the use of card media to learn classification material can make students actively involved in learning, facilitate communication between friends, and make the learning atmosphere in the classroom more enjoyable. Another study at the junior high school level stated that the application of card media on the classification of living things received a percentage of 92.5% which stated that students were interested in learning classification material using card game media (Kurniawan & Hasanah, 2022). The research that has been done, proves that the use of card learning media can make students interested and motivated to learn the classification of living things. to create an interesting learning process and see its effect on student learning outcomes.

METHOD

This research is an EDR (Education Design Reseach) development research. The EDR research method is used, because the design and development of learning media is carried out in the scope of education (Kopcha et al., 2015). In this study, the product produced and tested for validity was the Five Character Card (KALIKA) 5

Kingdom of Living Things. The development stages used refer to the ADDIE development stage, which consists of five phases or stages, there are (a) Analysis (b) Design (c) Development (d) Implementation (e) Evaluation (Hadiyanti, 2021; Nurmalasari et al., 2022), and is based on the design thinking framework with 5 stages, there are empathize, define, ideate, prototype, and test (Christian & Natatdaja, 2022). The use of the design thinking framework has similarities with the ADDIE development stages, so they can be applied together. The application of design thinking can bring more empathy to students, thus helping teachers find and determine the right and appropriate solutions to students' problems in the classroom (Kasri et al., 2021; Shé et al., 2022). Figure 2 show a scheme of the design thinking framework combined with ADDIE.

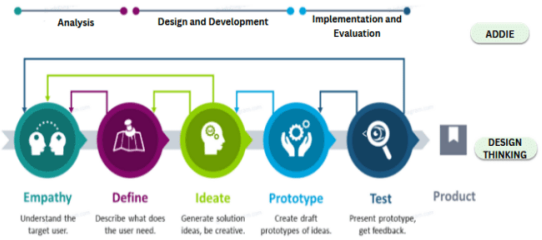

Figure 1. Scheme of the design thinking framework combined with ADDIE

Research Design

The research design used was a one-group pretest-posttest design (Kuntjoyo, 2009) to determine the effect of using KALIKA learning media on learning the classification of living things, as shown in Table 1.

Table 1. One-group pretest-posttest research design

Subject	*Pre*	*Action*	*Pasca*
1 Group	O	X	O

(Kuntjoyo, 2009)

The instruments used in this study include 1) Teaching media for Five Character Cards (KALIKA), 2) a teaching media validation sheet by teachers, 3) a teaching media validation sheet by lecturers, 4) a questionnaire sheet for teaching media users (students), and 5) pre-test and post-test questions on the classification of 5 kingdoms.

The validation sheet is used to obtain data from validators consisting of science teachers and lecturer, regarding the quality of learning media, including suitability of language, presentation, material content, and design. The four validators which consist of 3 teachers and 1 lecturer fills in this sheet by checking the column that matches the statement given and is expected to provide suggestions on the validation sheet (Ilma, 2022).

The development procedure carried out in this research uses a design thinking framework. The following stages are carried out by the five principles of design thinking:

1. Emphatize
   This is the first stage of design thinking, which is carried out to find information about the problems experienced by students in the learning process. The in-depth interview (IDI) method is used to interview learners (Juniantari et al., 2023).
2. Define
   Information found in the empathize stage will be summarized and begin to determine goals in this stage (Laksono & Islam, 2020; Mahardika et al., 2022). The technique of formulating objectives in Design Thinking also uses the principle of empathy; where users and their aspirations/needs are specifically stated in the formulation of the objectives. The define process can be done by designing the formulation of How Might We (HMW) (Juniantari et al., 2023).
3. Ideate
   The third stage of the design thinking framework is the development of ideas as a solution to the problem, called the ideate phase. The Ideate phase becomes the initial foundation for creating prototypes as innovative solutions to solve problems faced by teachers and learners (Kelley & Brown, 2019).
4. Prototype
   The prototype stage is a time for designers to realize ideas in the form of models that show the features of the solution (Ansori et al., 2023).
5. Test/Evaluate
   At this stage, the prototype that has been designed is implemented for students as users (Wijaya et al., 2022). Before the implementation is carried out, the prototype needs to be validated by expert validators. This aims to determine the quality of the appearance and material of the learning media being developed.

Reseacrh Target

This study was conducted in grade 7th with an average age of 14 years old students, with a sample size of 21 people consisting of 12 boys and 9 girls, in one of the public junior high schools in Bandung city. Research sampling is convenient sampling.

Because the determination of sampling is not planned in advance, but according to the subjects available to researchers when data collection will be carried out (Kuntjoyo, 2009). In this condition, the samples were students who were taught by the researchers themselves. The research was conducted in semester 2, academic year 2023/2024, on March 21, 2024.

Data Analysis

Quantitative descriptive analysis was carried out to describe the results of the pretest and posttest as a description of the learning outcomes of students after the use of KALIKA teaching media in learning the classification of living things. Quantitative data on instrument quality is calculated using the following calculation formula 1:

$$X = \frac{Y}{N} x\ 100\%$$

Notes:
X = Quality score
Y = Total empirical score
N = Total expected score

The X value obtained from each validator will be recalculated by finding the average value using the following calculation formula 2:

$X = \frac{X1+X2+X3+X4+X5}{3}$ .....(2)

Notes:
X = Average total value of expert validation
X1 = Validation value by the lecturer
X2 = Validation value by the Science teacher 1
X3 = Validation value by the Science teacher 2
X4 = Validation value by the Science teacher 3
X5 = Validation value by the Science teacher 4

Table 2. Learning media validity criteria

Percentage (%)	Criteria	Description
$0 \leq x \leq 50$	Not valid	Should not be used
$50 \leq x \leq 70$	Invalid	Recommended not to be used, needs major revisions
$70 \leq x \leq 85$	Valid	Can be used, but needs minor improvements
$85 \leq x \leq 100$	Very valid	Can be used without improvement

(Uma'iyah et al., 2023)

Test Analysis

The effectiveness of the learning media is analyzed through the effectiveness test. This effectiveness test is based on the calculation of data obtained to get an overview of the media developed by researchers, using the following formula 3:

$$\langle g \rangle = \frac{Spost - Spre}{Sm\ ideal - Spre}$$ .....(3)

Notes:
<g> = average normalized gain score
Spost = average post-test
Spre = average pre-test
Sm-ideal = maximum score
The average value of N-gain is then categorized based on the following table 3:

Table 3. Average score of N-gain criteria

Criteria	Description
$\langle g \rangle \geq 0.7$	High
$0.3 \leq \langle g \rangle \geq 0.7$	Moderate
$\langle g \rangle < 0.3$	Low

The results of the pretest and posttest scores were statistically tested using the Wilcoxon Signed Rank Test on IBM SPSS Statistics 24 to identify significant differences in student learning outcomes after the learning process using KALIKA. Wilcoxon Signed Rank Test using a significance level of 0.05, then the decision-making criteria are as follows:

1) If Asymp.sig (2-tailed) > 0.05 Rejected
2) If Asymp.sig (2-tailed) < 0.05 Accepted

Before conducting the Wilcoxon Signed Rank Test, the data was tested for normality using the Shapiro Wilk test, using a significance level of 0.05, then the decision-making criteria are as follows:

1) If Asymp.sig (2-tailed) <0.05 Rejected
2) If Asymp.sig (2-tailed) > 0.05 Accepted

Teachers can analyze whether the learning results from the posttest using KALIKA are better than the previous test results. If student learning outcomes improve, then learning is said to be successful.

RESULT AND DISCUSSION

Five Character Cards (KALIKA) classification of 5 kingdoms, is a learning media in the form of cards that have 5 characters from 5 kingdoms of living things. Each card has a picture, a general character of a kingdom, a typical character of a kingdom, and an explanation of each character. In its implementation, each learner will play in groups, and try to collect 5 characters owned by each kingdom. Classification card learning media can foster a spirit of collaboration, make learning more interesting, and improve student learning outcomes (Angela et al., 2020; Prasetyaningtyas, 2020). The five-character card learning media (KALIKA) was developed using a design thinking framework. This design prioritizes more empathy for learners, thus helping teachers find and determine the most appropriate and suitable solutions to solve learner problems in the classroom (Shé et al., 2022). The following are the stages of the research conducted, based on the design thinking framework.

1. Emphatize

This is the first stage of design thinking, which is carried out to find information about the problems experienced by learners in the learning process (Juniantari et al., 2023). The in-depth interview (IDI) method is used to interview learners, the advantage of this method is to obtain complex knowledge, from a small number of members of the target population, based on a well-thought-out research design that is built to maximize credible and analyzable results. The IDI was conducted with 7 learners representing low, medium, and high-ability learners. Based on the interview results, information was obtained that the learning process in the classroom is often carried out using the lecture method so students feel bored and less motivated because they are not actively involved in the learning process. The boredom experienced by these learners is also related to learning styles because based on the results of the interview, the dominant learners have a kinesthetic learning style.

2. Define

At this stage, the information found at the empathize stage will be concluded and begin to determine the objectives (Laksono & Islam, 2020), The problems that can be concluded based on the interview results at the empathize stage are as follows.

1) Learning is often done with the lecture method
2) Learning activities have not met the learning styles of students
3) Learners feel bored and unmotivated when listening to the teacher's lecture
4) The use of teaching media that is less varied
5) A learning atmosphere that is not conducive
6) Learning facilities in classrooms and schools are inadequate.

Based on the conclusion of the problems experienced by students above, the research objectives were formulated. The technique of formulating objectives in Design Thinking also uses the principle of empathy; where users and their aspirations/needs are specifically stated in the formulation. The following is the formulation of the objectives of this study.

1) "How to get students excited and actively involved in learning?"
2) "What are the forms of learning activities that can meet the learning styles of students?"
3) "How can learning remain interesting, despite the limited learning facilities at school?"

3. Ideate

After formulating the objectives, the next phase is the development of ideas as a solution to the problem, or called the ideate phase. The Ideate phase becomes the initial foundation for creating prototypes as innovative solutions to solve problems faced by teachers and learners (Kelley & Brown, 2019). The ideation process in Design Thinking is made in such a way as to bring up as many solution ideas as possible (both in number and variety). Table 4 show the solution ideas that emerged from the students' problems.

Table 4. Idea to solve students' problem

Number	Students' Problem	Solution
1	Learning is often done using the lecture method	• Conduct learning using teaching media game cards • Using flash card media • Work sheet for observation practicum
2	Learning activities have not met the learning styles of students	
3	Learners feel bored and unmotivated when listening to teacher lectures	
4	Less varied use of teaching media	
5	Learning atmosphere that is not collaborative	
6	Inadequate learning facilities in classrooms and schools	

The solution ideas that have been written down are then reconsidered, and adjusted to the needs of students so that the best solution can be further developed in the prototype process. The solution of using flash cards is good enough to be a variation of learning media, but it still has shortcomings to spark students' collaboration skills, because students will not work in groups, so a collaborative learning atmosphere will not be created. On the other hand, practicum activities are good activities to use in learning, but schools have limited facilities for direct observation of the entire kingdom of living things, especially microscopic living things such as bacteria and protozoa, so this activity cannot be implemented optimally in schools. Therefore, to conduct learning under the conditions of students, that is want interesting teaching media, collaborative activities, and actively involved in learning, the solution that can be developed is to develop teaching media game cards on the material of classification of living things. Because card learning media does not require special tools, is easy to use, and students can see microscopic images of living things that have been printed on cards, to make it easier for them to learn.

4. Prototype

The prototype stage is a time for designers to realize ideas in the form of models that show the features of the solution (Ansori et al., 2023). At this stage, the selection of learning media card layouts, colors, fonts, images and supporting features that make it easier for students to learn is carried out. This process is quite time-consuming, because it must be well thought out, how an attractive design, easy to read and can make it easier for students to learn.

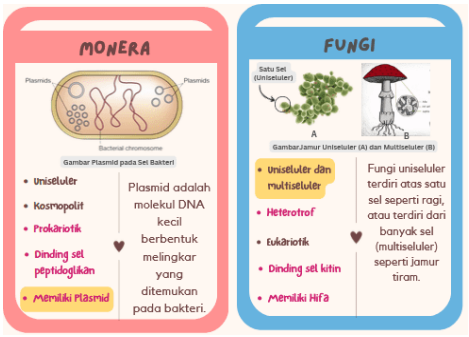

Figure 2. KALIKA Prototype

5. Test

At this stage, the prototype that has been designed is implemented to students as users (Wijaya et al., 2022). However, before the implementation is carried out, the prototype is first validated by expert validators. This aims to determine the quality of the appearance and material of the learning media being developed. The validators consisted of 4 Biology and Science teachers, and 1 lecturer in the Biology Education Study Program at the University of Education Indonesia (UPI).

Table 5. Results of validation of five character card learning media (KALIKA)

Validator	Number of Validation Criteria	Y	N	Percentage (%)	Criteria
1	15	70	75	93	Very Valid
2	15	71	75	95	Very Valid
3	15	63	75	84	Valid
4	15	70	75	93	Very Valid
5	15	73	75	97	Very Valid
Percentage of Total Validation				92.4	Very Valid

Based on the data presented in Table 5, the results of the validation of KALIKA learning media from 5 validators are classified in the very valid category, with a percentage of 92.4%. This validation score was achieved by several revisions, according to suggestions from validators, including improvements in the selection of images that match the content, image size, text color, brief description on the card, to the characteristics of a kingdom that need to be marked, to make it easier for students to learn. Until finally the media gets a validation score of 92.4% which is classified as very valid, and is ready to be used in the classroom. The very valid criterion is obtained from several aspects, including the accuracy in the selection of colors and fonts on the card, making it easier for students to read the content on the card. The same thing is stated in other studies that develop card learning media, that cards with clarity of writing (appropriate size and type of font) will make it easier for users to read and are categorized as very valid for use in the learning process (Aprilia et al., 2016; Pratiwi &

Wiguna, 2022), the language that is easy to understand and the availability of material with the level of achievement of students also gets a good score, and supports the validity of KALIKA learning media. The validity of KALIKA is accordance with another research, that say one of the roles of learning media is the communicative function, which aims to facilitate communication and delivery of messages, making it easier for students to understand the material (Ilhami & Budiyanto, 2022; Nurrita, 2018). After validation process done, KALIKA was applied on a sample of grade 7 students in one of the public junior high schools in Bandung City. The following is a description of the learning implementation that has been carried out.

1. Starting Activity

The initial activity lasts for 15 minutes. The activity begins with the teacher telling students to pray, then saying greetings, and checking student attendance. Next, the teacher distributed the pretest link using the Quizziz application -to the class leader. The pretest was conducted for 10 minutes, before starting the lesson. After taking the pretest data in the form of 10 multiple choice questions, the teacher makes an apperception by asking questions to explore students' curiosity about the material to be learned. Furthermore, the teacher asked students to open and read science books on the material of classification of living things. The teacher conducts questions and answers with students.

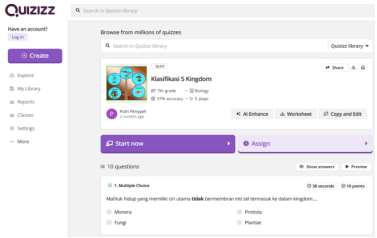

Figure 3. Quizziz display for pretest and posttest questions

2. Main Activities

The main activities lasted for 45 minutes, using the Jigsaw-type cooperative learning model. It begins with providing motivation and delivering learning objectives. Furthermore, as can be seen in Figure 4, the teacher explains the learning activities that will be carried out, namely learning the material of the classification of the 5 kingdoms by playing KALIKA cards, and explains how to play to students. Next, the teacher conditions students to form groups of 5 people. When the groups are formed, the teacher distributes 5 types of cards according to the 5 types of kingdoms of living things, then learners play according to the directions that have been delivered (Figure 5). During the game process, the teacher observes and guides learners who are still confused about the rules of the game. Next, as shown in Figure 6, each winning child is responsible for becoming an expert group, then gathering with other expert groups, to discuss the characteristics of the kingdom, along with its benefits, and return to the original group. The next stage is evaluation, at this stage, students display the results of their discussion in front of the class, and the teacher gives awards in the form of applause.

Figure 4. The teacher explain learning activities and how to play kalika

Figure 5. Students study and play KALIKA in group

Figure 6. Students discussion in group

3. Closing Activities

There are 10 minutes left for the teacher to close the learning activities. At this stage the teacher and students reflect on the learning activities that have been carried out, then conclude the learning on that day. Next, students are given a posttest of 10 multiple choice questions through quizziz, then a reflection of learning is carried out and learning activities are closed with greetings.

To find out the learning outcomes of students after using the media, an effectiveness test is carried out by calculating the N-gain score of students' learning outcomes obtained through giving pretests and posttests; as well as statistical analysis using the Wilcoxon Signed Rank Test, to see the difference when before using KALIKA and after using KALIKA. The results of learning effectiveness can be seen in Table 6.

Table 6. KALIKA learning media effectiveness analysis results

Sample	Number of Students	Average Score of Pretest	Average Score of Posttest	N-gain Average	N-gain category
Grade 7th	21	46.67	63.3	0.32	Moderate

Based on Table 6, the N-gain value is 0.32 which is classified as a moderate category, it states that there is an increase in student scores after being given learning treatment using KALIKA media. The increase in learning outcomes using KALIKA media also indicates that the learning media development process using the framework of designing thinking has met its objectives. Development process using the design thinking framework has been in accordance with its purpose, which is to produce the right solution to solve students' problems (Kubiak, 2024). This media also received positive responses from students, in the user response questionnaire, 95% of students stated that KALIKA media made it easier for them to learn the characters in each kingdom of living things, felt happy and wanted this media to be applied to other materials or subject matter. These results are in line with the statement that the selection of interesting media is very important to foster student interest in understanding concepts (Kurniawan & Hasanah, 2022). One type of learning media that is interesting and can actively involve students in learning is card game media, because in the learning process, students not only listen, but are actively involved in the learning process (Nurrita, 2018; Sanjaya, 2012).

Based on statistical tests, Table 7 states that pretest data is normally distributed, while posttest data is not normally distributed. Therefore, the difference test was continued using the Wilcoxon Signed Rank Test (Table 8). The results of the difference test presented in the Table 8 state that the p value = 0.029, then the p value <0.05, so it can be concluded that there is a significant difference between the pretest and posttest scores.

Table 7. Normality test result

Topic	Tes	Statistics	p	skewness	kurtosis	Interpretation
Classification of Living Things	Pretest	0.983	0.196	-0.401	-0.483	Normal Distribution
	Posttest	0.870	0.010	0.304	-1.429	Non-normal distribution

p > .05 = normal distribution

Table 8. Wilcoxon signed rank test result

Topic	Rank	N	Mean Ranks	Sum of Ranks	Z	p
Classification of Living Things	Negative Rank	6	6.83	41.00	-2.186	0.029 (sig)
	Positive Rank	13	11.46	149.00		
	Ties	2				

p < .05 = Significant difference

The improvement in learning outcomes after using KALIKA cards is in line with the results of research conducted in 2022, which states that the learning process is a process of understanding that can be seen with the understanding of thinking concepts, not changes in behavior that are physically visible (Ilma, 2022).

Other research regarding card games at the junior high school level in science class showed that games can make students remember material in the long term, make learning more fun, and become a reinforcement in making conclusions, learning

more fun, as well as being a reinforcement in making conclusions at the end of learning the end of learning (Prasetyaningtyas, 2020).

From the result above, it means that KALIKA learning media is quite effective in supporting learning activities on the classification of living things, which can improve student learning outcomes, because it makes significant difference from pretest to posttest. Another research state the same results, that card learning media can increase student achievement (Yulivia & Sari, 2023).

CONCLUSIONS AND SUGGESTIONS

The Five Character Card (KALIKA) learning media developed using the material of classification of living things is a learning media that is suitable for use in the learning process, because the validity score is very valid. The impact of using KALIKA in sub-topic classification of 5 kingdoms can improve student learning outcomes in the moderate category so it can be concluded that KALIKA media can be a support in the learning process in the classroom. The increase in learning outcomes using KALIKA media also indicates that the learning media development process using the framework of design thinking has met its objectives. Development process using the design thinking framework has been in accordance with its purpose, which is to produce the right solution to solve students' problems. So that the learning outcomes learning outcomes have increased after the use of learning media KALIKA. This research was used Jigsaw learning model, so future research can use KALIKA in other learning models, such as in the discovery learning process, but some characters should not appear first on the cards, so that students can find the characters themselves. The formative assessment used can also be changed into an essay form, and continued until the summative assessment.

ACKNOWLEDGEMENTS

The researcher would like to thank the Ministry of Education, Culture, Research and Technology, which has supported and assisted in providing scholarships for teacher professional program education, so that this research can be carried out.

REFERENCES

Angela, L., Noveri, M., & Tiara, T. (2020). Classification-Card Media: Its Effect towards Learning Achievement in Biology Subject. *Indonesian Journal of Science and Mathematics Education*, *3*(1), 74–78. https://doi.org/10.24042/ijsme.v3i1.5884

Ansori, S., Hendradi, P., & Nugroho, S. (2023). Penerapan Metode Design Thinking dalam Perancangan UI/UX Aplikasi Mobile SIPROPMAWA. *Journal of Information System Research (JOSH)*, *4*(4), 1072–1081. https://doi.org/10.47065/josh.v4i4.3648

Aprilia, D., Indana, S., & Lisdiana, L. (2016). The Validity of Make A Match Cards on Cell Topic Grade XI of Senior High School. *Bioedu Berkala Ilmiah Penddikan Biologi*, *5*(3), 207–212.

BPK, J. (2024). *Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Nomor 12 Tahun 2024 tentang Kurikulum pada Pendidikan Anak Usia Dini, Jenjang Pendidikan Dasar, dan Jenjang Pendidikan Menengah*. https://peraturan.bpk.go.id/Details/281847/permendikbudriset-no-12-tahun-2024

Christian, J. E., & Natatdaja, L. (2022). Analisis Proses Desain Di Tempat Magang Dan Di Kuliah Dengan Menggunakan Teori Design Thinking. *Jurnal DKV Adiwarna*, *1*, 7.

Hadiyanti, A. H. D. (2021). Pengembangan Media Kartu Permainan IPA untuk Perkuliahan IPA Biologi. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(6), 4356–4362. https://doi.org/10.31004/edukatif.v3i6.1336

Ilhami, F. B., & Budiyanto, M. (2022). Effectiveness of Development Learning Media Using Electrocardiograms (Ecg) in Electricity and Magnetic Lectures. *Jurnal Penelitian Pendidikan IPA*, *7*(2), 67–71. https://doi.org/10.26740/jppipa.v7n2.p67-71

Ilma, Z. F. (2022). Pengembangan Media Pembelajaran Kartu Make a-Match Pada Materi Jaringan Hewan untuk Meningkatkan Hasil Belajar Kognitif. *Jurnal Pendidikan Biologi*, *11*(3), 672–678.

Juniantari, M., Ulfa, S., & Praherdhiono, H. (2023). Design Thinking Approach in The Development of Cirgeo's World Media. *Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI)*, *12*(1), 42–55. https://doi.org/10.23887/janapati.v12i1.55203

Kasri, M. A., Novan, Y., & Ramadhani, I. A. (2021). Penerapan Model Design Thinking pada Pengembangan Media Pembelajaran Berbasis Macro Media Flash. *JURNAL PETISI (Pendidikan Teknologi Informasi)*, *2*(2), 60–71. https://doi.org/10.36232/jurnalpetisi.v2i2.1531

Kelley, D., & Brown, T. (2019). An introduction to

Design Thinking Process Guide. *Institute of Design at Stanford*.

Kopcha, T. J., Schmidt, M. M., & McKenney, S. (2015). Special issue on educational design research (EDR) in post-secondary learning environments. *Australasian Journal of Educational Technology*, *31*(5), i–ix.

Kubiak, K. (2024). Design Thinking in Lighting Design to Meet User Needs. *Sustainability*, *16*(3561).

Kuntjoyo. (2009). *Metodologi Penelitian*.

Kurniawan, R. A., & Hasanah, R. (2022). Pengembangan Game Quarted Card pada Materi Klasifikasi Makhluk Hidup Kelas VII SMP/MTs. *Bioeduca: Journal of Biology Education*, *4*(2), 1–11.

Laksono, Y. T. A., & Islam, M. A. (2020). Penerapan Design Thinking Dengan Menggunakan Gaya Desain Monoline Pada Perancangan Logo D'Papo Surabaya. *Jurnal Barik*, *1*(2), 261–274. https://ejournal.unesa.ac.id/index.php/JDKV/

Mahardika, I. G. A., Putra, I. G. J. E. P., & Tiawan, T. (2022). Solusi Inovatif Dengan Pendekatan Design Thinking Untuk Menggali Potensi Ekonomi Desa. *Jurnal Teknik Informasi Dan Komputer (Tekinkom)*, *5*(2), 197. https://doi.org/10.37600/tekinkom.v5i2.532

Nurmalasari, L., Akhbar, M. T., & Syaflin, S. L. (2022). Pengembangan Media Kartu Hewan dan Tumbuhan (TUHETU) Pada Pembelajaran IPA Kelas IV SD Negeri. *Jurnal Riset Pendidikan Dasar*, *5*(1), 1–8. http://journal.unismuh.ac.id/index.php/jrpd

Nurrita, T. (2018). Pengembangan Media Pembelajaran Untuk Meningkatkan Hasil Belajar Siswa. *MISYKAT : Jurnal Ilmu-Ilmu Al-Qur'an, Hadist, Syariah, Tarbiyah*, *03*, 171–187.

Prasetyaningtyas, S. (2020). Penerapan Metode Permainan Kartu Kwartet Untuk Meningkatkan Prestasi Belajar Dan Keaktifan Belajar Pada Materi Klasifikasi Makhluk Hidup Kelas Vii Smp N 1 Semin. *Ideguru: Jurnal Karya Ilmiah Guru*, *5*(1), 100–108. https://doi.org/10.51169/ideguru.v5i1.118

Pratiwi, A. S., & Wiguna, F. A. (2022). Analisis Efektivitas LKPD Berbasis Phet Simulation Terhadap Pemahaman Siswa SMP Materi Bentuk dan Perubahan Energi. *GRAVITASI Jurnal Pendidikan Fisika Dan Sains*, *5*(02).

Sanjaya, W. (2012). *Media Komunikasi Pembelajaran*. KENCANA.

Shé, C. N., Farrell, O., Brunton, J., & Costello, E. (2022). Integrating design thinking into instructional design: The #OpenTeach case study. *Australasian Journal of Educational Technology*, *38*(1), 33–52. https://doi.org/10.14742/ajet.6667

Uma'iyah, N., Wahyuni, S., & Nuha, U. (2023). Development of E-Modules Based On Mobile Learning Applications to Improve Students' Critical Thinking Skills in Science Subject. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *12*(2), 122–137. https://doi.org/10.26740/jpps.v12n2.p122-137

Wijaya, V., Fadli, M., Dharma, Y. A., Muhammad, &, & Pribadi, R. (2022). Pengembangan UI/UX pada aplikasi Go-Print Dengan menggunakan metode design thinking. *MDP Student Conference 2022*.

Yulivia, A. D. Y., & Sari, M. P. (2023). Implementation of Cooperative Learning Index Card Match on Secondary Students' Science Cognitive Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *8*(2), 89–97. https://doi.org/10.26740/jppipa.v8n2.p89-97