Multiple Intelligences-based Interactive Multimedia to Improve Students' Multiple Intelligences in Kindergarten

Putu Juli Astiti[1*], Ni Nyoman Parwati[2], I Made Tegeh[3], I Komang Sudarma[4] iD

[1,2,3,4] Educational Technology, Universitas Pendidikan Ganesha, Singaraja, Indonesia

A B S T R A K

Masalah utama dalam penelitian ini adalah belum berkembangnya kecerdasan mejemuk siswa sesuai dengan bakat dan minang masing-masing. Penelitian ini bertujuan untuk mengembangkan mengembangkan multimedia berorientasi multiple intelligences, untuk meningkatkan kecerdasan majemuk siswa di taman kanak-kanak. Metode penelitian yang digunakan adalah pengembangan dengan menggunakan model ADDIE. Instrumen yang digunakan adalah kuesioner dan lembar pengamatan. Kuesioner digunakan untuk mengukur validitas dan kepraktisan multimedia dari para ahli dan para pengguna. Lembar pengamatan digunakan untuk mengukur efektivitas multimedia dalam meningkatkan kecerdasan majemuk siswa di taman kanak-kanak. Kuesioner dianalasis secara deskriptif kuantitatif dan lembar pengamatan dianalisis dengan metode analisis deskritif kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa validitas aspek desain sebesar 93,53%, aspek media pembelajaran sebesar 90,00%, dan aspek isi pembelajaran sebesar 95,00%. Kepraktisan multimedia interaktif melalui uji perorangan memperoleh tingkat persentase 96,67% dan kelompok kecil memperoleh tingkat persentase 96,67%. Uji efektivitas menunjukkan bahwa multimedia interaktif mampu mengembangkan kecerdasan siswa khusus pada lima aspek yaitu Logis-matematik, Musical, MI Kinestik, Visual-spasial, dan Linguistik verbal.

A B S T R A C T

The main problem in this research is that students' multiple intelligences have not been developed according to their respective talents and interests. This research aims to develop multiple intelligence-oriented multimedia, to increase the multiple intelligences of students in kindergarten. The research method used is development using the ADDIE model. The instruments used were questionnaires and observation sheets. Questionnaires are used to measure the validity and practicality of multimedia by experts and users. Observation sheets are used to measure the effectiveness of multimedia in increasing the multiple intelligences of students in kindergarten. The questionnaire was analyzed quantitatively and descriptively, and the observation sheet was analyzed using quantitative and qualitative descriptive analysis methods. The research results showed that the validity of the design aspect was 93.53%, the learning media aspect was 90.00%, and the learning content aspect was 95.00%. The practicality of interactive multimedia through individual testing obtained a percentage level of 96.67%, and small groups obtained a percentage level of 96.67%. The effectiveness test shows that interactive multimedia is able to develop students' intelligence specifically in five aspects, namely logical-mathematical, musical, kinaesthetic, visual-spatial, and verbal linguistics.

1. INTRODUCTION

In the digital era, or information era, science and technology are developing rapidly. This development has an increasingly open impact: the spread of information and knowledge from all over the world across the boundaries of distance, place, space, and time. The reality is that human life in this digital era will always be related to technology (Fatimah & Santiana, 2017; Urip Umayah & Riwanto, 2020). Technology is essentially a process to obtain added value from the products it produces so that they are useful. Technology has influenced and changed humans in their daily lives, so if you are currently "technologically illiterate," you will be late in mastering information and will also be left behind in obtaining various opportunities for advancement. Information has an important and real role in the era of the information society, or knowledge society (Das, 2019; Lampropoulos et al., 2019). Modern technology has brought many changes in various areas of life, including in the field of education. The current generation has been introduced to technology from an early age, so technology can significantly influence children's development in the future. To maximize the role of technology and avoid negative influences, its use needs to be designed appropriately, especially in learning. Teachers can use it to create various learning tools that can help teachers in the learning process (Das, 2019; Irving, 2006). This is related to one of the determining factors in the quality of education, namely the quality of the learning process. Quality learning is

learning that is able to inspire students, and provides opportunities for students to interact with teachers, between students, and with other learning resources. The learning atmosphere is fun, challenging, motivating, and provides opportunities for students to develop their full potential. The learning component that has a strategic role in the success of learning in school is the teacher.

One of the determining factors in achieving learning objectives is the selection and use of appropriate media. By selecting and using media that suit the objectives and characteristics, students can easily understand the material presented by the teacher. The function of the media itself is as a medium to clarify messages from the messenger to the recipient of the message, in this case, from the teacher to the students. Especially in kindergarten (TK), the use of varied media is very necessary to develop students' potential or intelligence (including spiritual intelligence, cognitive intelligence, social emotional intelligence, artistic intelligence, and physical intelligence) (Suryani & Seto, 2020; Sutrisno & Siswanto, 2016). In accordance with the National Education System Law of 2003, especially in Chapter II, Article 3, it clearly states that national education functions to develop abilities and shape the character and civilization of a dignified nation in order to make the nation's life more intelligent, aimed at developing the potential of students to become people of faith and piety to God Almighty, have noble character, be healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. In general, media for kindergarten students uses more direct media or concrete media, but there are certain materials that require other media, such as videos, images or photos, text, and other artificial media. One media that can facilitate this is multimedia (Cahyani et al., 2020; Koriaty & Agustani, 2016).

One of the unique characteristics of students that needs attention is their multiple intelligences (MI). Multiple intelligences are types of intelligence that are very necessary in the 21st century, such as intrapersonal intelligence and interpersonal intelligence (Istiningsih et al., 2018; Sitorus et al., 2019). Intrapersonal intelligence is related to the ability to manage oneself well, be responsible, have a work ethic, and be punctual. This character is an embodiment of the soft skills needed by the world of work now and in the future. Likewise, interpersonal intelligence is very necessary in terms of communication, diplomacy, and cooperation as competencies that must be mastered, as well as capital for the nation's competitiveness.

Learning in Kindergarten (TK) generally still focuses on empowering academic intelligence such as reading and arithmetic (linguistics and logic-mathematical) (Tatminingsih, 2019; Yansyah et al., 2021). Apart from that, the existence of appropriate learning media with learning objectives and student characteristics has not been developed specifically to foster multiple intelligences. Based on observations and interviews with teachers at the Undiksha Laboratory Kindergarten, it is known that some materials still lack appropriate media for presenting them. Apart from that, there is no media that has been specifically developed to facilitate students' multiple intelligences. If you look at the completeness of the facilities and infrastructure at the Undiksha Laboratory Kindergarten, it is quite complete, including laptops, LCDs, speakers, and large televisions. Furthermore, based on information from the teacher, there are several themes or topics that are difficult to create media for; learning mostly uses student worksheets and crayons or colored pencils in learning, so that learning seems monotonous. Learning still cannot facilitate the multiple intelligences of students optimally, tends to generalize the intelligence of each individual, and provides rewards mostly with words.

Judging from the students' perspective, they are already familiar with gadgets according to the characteristics of the alpha generation. The results of previous research show that smartphone use among the alpha generation, especially children aged 4-6 years, is 94%. The causes of the high level of smartphone use include: 1) smartphones and tablets as a means of introducing information and communication technology; 2) smartphones and tablets as educational media to broaden children's insight; and 3) smartphones and tablets as a means of entertainment so that children are not fussy (Wahyudi et al., 2019).

Fun learning is very important to implement in kindergarten. The development of children's musical, kinesthetic, and visual-spatial intelligence is also important to develop, besides logical-mathematical intelligence. This can be seen from the results of observations and interviews with teachers: there are still some children who have the attitude of wanting to win alone. For example, there are still children whose toys cannot be borrowed; if they play together, they are the only ones who have toys in kindergarten. He's looking for excuses not to come to school because he's bored at school; he's still shy about singing; he doesn't want to run because he gets tired quickly. Kindergartens where children play while learning have the responsibility to foster children's enjoyment of learning so that they can develop their abilities and talents optimally (Dong et al., 2020; Lau & Lee, 2021).

Developing children's love for learning will form children who are creative, have high motivation to find out, feel dissatisfied with the knowledge they have gained, and have an attitude of hard work and never giving up. Children's love for learning can only be fostered with a learning system that is fun (joyful learning) and involves children actively (student active learning) (Fitria & Rohita, 2019; Waruwu et al., 2022). The aim is to make the learning process more creative and interesting so that children will be happier coming to school, providing initial knowledge, and being able to independently learn using these media both at school and at home. Children who can do their assignments well will be given rewards in the form of stickers or funny pictures. Giving rewards in the form of stickers is very useful to appreciate each child's efforts in doing extraordinary things.

Based on the problems above and the analysis of needs in the Undiksha Kindergarten Lab, it is necessary to develop interactive multimedia oriented to multiple intelligences. The development of interactive multimedia is very necessary, both as a classical learning media and as an independent learning media. This multi-intelligence-oriented interactive learning multimedia is attractively designed with interesting applications that should be used to develop MI intelligence in kindergarten, such as videos, educational game applications, electronic puzzles, digital puzzles, and music. Some materials will be designed interactively so that students can be actively involved in learning. It is hoped that the use of this media can develop students' multiple intelligence abilities, especially students' multiple intelligences in logical-mathematical, musical, kinetic, visual-spatial, and verbal linguistics.

2. METHOD

In this research on the development of interactive multimedia for multiple intelligence-oriented learning, the development model used is the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The aim of choosing this model is to provide guidelines for developers in designing multimedia, where the ADDIE model has a systematic and structured flow, so that it can make it easier for developers to design this multimedia. The steps contained in the ADDIE model consist of: (1) analysis; (2) design; (3) development; (4) implementation; and (5) evaluation (Branch, 2009). At this stage of interactive multimedia development, it refers to the ADDIE model. In the development procedure carried out, there are several stages. The stages in developing learning multimedia are shown in Figure 1.
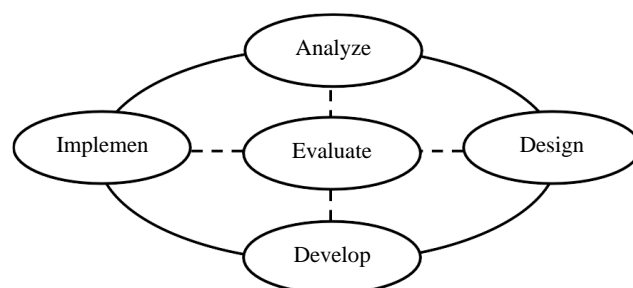

Figure 1. The ADDIE Development Stages

There are several instruments needed in this research, starting from the media development process to the learning media analysis process. The instruments that will be used include validation instruments for content and material experts, design experts, and media experts. The expert instruments used are shown in Table 1, Table 2, and Table 3.

Table 1. The Instruments for Content/Learning Material Experts

No	Indicator	Scoring Scale				
		1	2	3	4	5
1	Concept truth					
2	Material actuality					
3	The urgency of each material					
4	Material systematics					
5	Suitability of material for students					
6	Sufficiency of material to achieve goals					
7	Breadth and depth of material					
8	Accurate examples to clarify					
9	Adequacy of the examples given					
10	Suitability of images to clarify content					
11	Suitability of video to clarify content					
12	Suitability of animation to clarify content					
13	Clarity of language use					
14	Clarity of question formulation					
15	The level of difficulty of the questions is in accordance with competency					

Table 2. The Instruments for Learning Design Experts

No	Indicator	Scoring scale				
		1	2	3	4	5
1	Clarity of success indicators					
2	Consistency between basic competencies, indicators, materials and evaluation					
3	Providing motivation					
4	Systematic presentation of material					
5	Clarity of material description					
6	Clarity of study instructions					
7	Variations in how to present material					
8	Giving examples					
9	Providing exercises for understanding concepts					
10	Providing opportunities to practice alone					
11	Providing feedback for right/wrong answers					
12	Clarity of instructions for taking the test					
13	Quality of tests and assessments					
14	Balance of material with test questions					

Table 3. The Validation Instrument for Learning Media Experts

Indicator	Scoring scale				
	1	2	3	4	5
Selecting the type and size of letters					
Setting spacing, lines, paragraphs and characters					
Text readability					
Image display					
Image placement					
Video display					
Clarity of narrative					
Backgroundsmusic					
Slide design					
Layout (lay-out)					
Button options					
Consistency of button placement					
Harmony of background color with text					
Consistency of presentation					

At the individual and small group testing stages, instruments in the form of questionnaires were also used. The questionnaire instrument is presented in Table 4.

Table 4. The Assessment Instrument at the Individual and Small Group Test Stages

No	Aspect	Indicator	Amount Item
1	Effectiveness presentation and evaluation	Clarity of Material	1
		Clarity of instructions for media use	1
		Visual clarity	1
		Clarity of data collection procedures	1
		Ease of working practice and tests	1
		Amount	5

During the field test, measurements were taken of the effectiveness of multimedia on learning outcomes. This measurement uses an observation sheet instrument. Instrument Grid The observation sheet is presented in Table 5.

Table 5. The Observation Sheet Instrument Grid

Indicator	MI Development	Aspects of Child Development	Number of Items
Create works of art through coloring 3 pictures of transportation equipment. (KD 3.15-4.15/Art)	MI Logical-mathematical	Art	3
Carrying out various coordinated activities in a balanced and agile manner through the activity of moving 3 pictures of air transportation equipment (KD 3.15-4.15/Art)	MI Logical-mathematical	Physmot	1
Showing the art of singing (KD 3.15-4.15/Art)	MI Musical	Art	4
Creating various coordinated movements in a balanced and agile manner by imitating the movement of a means of transportation. (KD 3.3-4.3/FM)	MI Kinestik	Physical-motor3	3
Solve simple problems through the activity of putting together digital transportation puzzles.**(KD 3.5-4.5/Cognitive)**	Visual-spatial MI	Cognitive	2
Solve simple problems through matching numbers according to the number of pictures.**(KD 3.5-4.5/Cognitive)**	Visual-spatial MI	Cognitive	11
Solve simple problems by matching the means of transportation according to the activity**(KD 3.5-4.5/Cognitive)**	Visual-spatial MI	Cognitive	1
Re-analyze what means of transportation are through the activity of retelling videos of means of transportation. (KD 3.11-4.11/Bhs)	MI Verbal linguistics.	Language	4
Number of Items			**29**

The data that has been collected using a questionnaire is then analyzed descriptively. Guidelines used for making decisions on improvements to interactive multimedia learning are presented in Table 6. Success or product quality of at least 75-80% (good qualifications).

Table 6. The Guidelines for Conversion of Achievement Levels with Scale 5

Achievement Rate (%)	Qualification	Information
90-100	Very good	No need to revise
75-89	Good	Slightly revised
65-74	Enough	Revised sufficiently
55-64	Not enough	Many things revised
0-54	Very less	Repeatedly make the product

To see effectiveness, this is done by looking at the initial safety score and the final observation score. If the average score of each meeting I with a score of 78 is in the good category, meeting II with a score of 85 is in the good category, meeting III with a score of 91 is in the very good category, and meeting IV with a score of 98 is in the very good category, Observations of meetings I, II, III, and IV have increased to the very good category, and multimedia is said to be effective.

3. RESULT AND DISCUSSION

Result

Product characteristics

Activities carried out at the development stage include: 1) the creation or production of multimedia content in the form of videos, games, and so on, in accordance with the designed LOM. 2) Develop instructions or guides for teachers and students. 3) Create a Daily Learning Implementation Plan (RPPH). The results of the development of interactive multimedia are presented in Figure 2.

Figure 1. Interactive Multimedia Display

Figure 2 is an interactive multimedia home page display. The multimedia homepage display contains text and image elements, which function to make it easier for users to understand the navigation functions on the homepage. The use of image dissertation icons is also to maximize the user experience in interpreting and understanding the information presented. Apart from that, the choice of color on the multimedia dashboard has a crucial role because it functions as more than just an aesthetic element. These colors are used to draw children's attention to certain areas or information on the dashboard. Colour can help users focus on the most important data points.

The presenter used in multimedia is a kindergarten teacher. The presenter appears at the beginning of the presentation and at the closing part. In the content presentation section, only visual images, text, and the presenter's voice are used. Interactive multimedia content predominantly uses video format in presenting its content. The choice of video is related to the usefulness of videos that can be used to explain various types of knowledge, including factual, principle, concept, and procedural knowledge. The following is one of the video media displays in interactive multimedia shown in Figure 3.
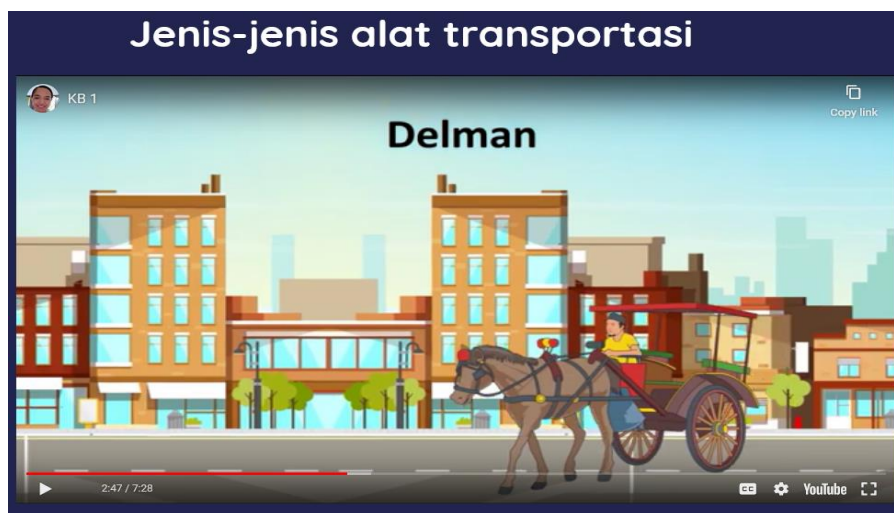

Figure 3. The Video Media Display in Interactive Multimedia

Interactive multimedia is also equipped with questions. The questions presented in multimedia are multiple choice with three types of answer choices. The questions on each question are presented using text and voice recordings. The use of sound in the questions aims to make it easier for students to understand the question in each question. Meanwhile, the answer options use images. At the development stage, not only product development is carried out, but product validation and limited trials are also carried out, which are presented in a separate sub-chapter.

Media validity test

Multimedia that has been developed is then validated by product experts, media experts, or design experts, followed by data analysis and product revision based on reviews by material experts, media experts, and design experts as presented in Table 7.

Table 7. The Validation Results

No	Aspect	Average Score	Category
1	Learning Design	93.53	Very Good
2	Media	90.00	Very Good
3	Learning Content	95.00	Very Good

Test The Practicality of the Media Through Individual and Small Group Trials

Test the practicality of interactive multimedia using individual tests and small group tests. The individual test involved three students and the small group test involved 9 students with a distribution of 3 smart people, 3 people with medium abilities, and 3 people with low abilities. Below are presented the results of practical tests using the three students shown in Table 8.

Table 8. The Individual Test

Indicator	X1	X2	X3
1	4	4	4
2	4	4	4
3	4	4	4
4	4	3	3
5	4	4	4
Amount	20	19	19
Score	100	95	95
Average Score	96.67		

Based on Table 8 that the average practicality test score is 96.67 which is at the very good qualification level. Next, a practicality test was carried out on 9 students, the results of which were presented in Table 9.

Table 9. The Small Group Test

Indicator	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
1	4	4	4	2	3	4	4	4	4
2	4	4	4	4	4	4	4	4	4
3	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	3	3
5	4	4	4	3	4	4	4	4	4
Amount	20	20	20	17	19	20	20	19	19
Score	100	100	100	85	95	100	100	95	95
Average Score	96.67								

Based on Table 9 that the practicality of multimedia at the small group test stage obtained an average score of 96.67 which is at the very good qualification level. This means that interactive multimedia is very practical to use in learning, especially for 9 students.

Test the Effectiveness of Interactive Multimedia

Multimedia that has been validated by experts and tested for practicality through individual and small group tests then needs to be applied in real learning. The purpose of this application is to determine the effectiveness of interactive multimedia in improving student learning outcomes. Interactive multimedia was applied to 18 kindergarten students. By using one class. The application of multimedia will be carried out from 21, 22, 23 and 24 August 2023 with the dates for implementing multimedia, namely 1) providing initial observations, 2) the teacher providing apperception and learning instructions, 3) students accessing the media using smartphones, 3) students trying or demonstrating or demonstrating what they have watched on their smartphone. The following is documentation for the application of interactive multimedia in learning as shown in Figure 4.

Figure 4. The Application of Multimedia in the Classroom

Based on Figure 4, Interactive multimedia is applied in the classroom by means of independent learning. Every student is given the opportunity to study independently via smartphone. Students who do not bring cell phones are given the opportunity to study through the group method. The development of students' multiple intelligences was observed using observation sheets. The types of intelligence observed are mathematical logic, music, language, kinesthetic and spatial. Data showed that the results of the first meeting showed that the average Logical intelligence was 68, Music72, Kinesthetic 75, Spatial 97, and Linguistics 79. If you look for the overall average it is 78 (in the good category). Based on these results showed that the results of the fourth meeting showed that the average intelligence was 96 in Logic, Music 96, Kinesthetic 97, Spatial 100, and Linguistics 100. If you look for the overall average, it is 98 which is at a very good qualification level. Thus, there has been an increase in intelligence fromeach meeting I with an average score of 78 is in the good category, meeting II with a score of 85 with a good qualification level, meeting III with a score of 91 with a very good qualification level, meeting IV with a score of 98 with a very good qualification level.

Discussion

The interactive multimedia developed can be a stimulus for developing students' talents and types of intelligence. The development of students' multiple intelligences after implementing interactive multimedia is measured using observation.The interactive multimedia developed discusses means of transportation and includes games and simulations that require logical thinking and problem solving. It can stimulate children's cognition and help them develop logic skills (Muchtar et al., 2021; Nuraini et al., 2021). Interactive multimedia is also a stimulus in developing spatial intelligence. Multimedia is able to present or visualize means of transportation in different environmental contexts. This helps children understand spatial concepts such as distance, position, and orientation. For example, children can know the appropriate type of transportation to use for short and long distances. Interactive multimedia also makes use of images, animation, and movement, which can speed up visual perception (Diah Kurniawati et al., 2018; Peek et al., 2014). This can improve children's ability to understand spatial information. Interactive multimedia has implications for the development of language intelligence. Interactive multimedia elements, including images, videos and games, in learning contexts positively influence language learning (Hardiyana, 2016; Yaacob & Lubis, 2022). The interactive multimedia developed has become a stimulus for developing students' language skills. Students are asked to observe the video in multimedia and then students are asked to retell the impressions in the video.

Interactive multimedia is not only able to improve students' cognitive aspects but is able to stimulate students' multiple intelligences. There are five intelligences that can be developed through interactive multimedia, namely mathematical logical, musical, linguistic, kinesthetic and spatial intelligence. In the mathematical logic aspect, interactive multimedia is able to stimulate students' logical thinking when they interact with content (Budianti et al., 2021; Hengki, 2018). For example, in a math game, students are given a stimulus in the form of counting the number of cars, the number of vehicles and the like. This can stimulate the development of mathematical logic intelligence. The research results also show that games, including their intensity, influence mathematical logic intelligence (Widyastuti et al., 2020; Wulandari et al., 2020).

In the aspect of musical intelligence, interactive multimedia contains several songs that can be used to stimulate the development of musical intelligence. Students can play several songs in multimedia and then imitate or sing several of these songs in front of the class. Apart from that, some of the questions are also filled with song questions so that they can measure students' musical intelligence. Research resultpreviously showed that musical games can influence children's musical creativity. This means that the integration of music and song elements into multimedia can be a stimulus for the development of musical intelligence (Teti Sumiati & Septi Gumiandari, 2022).

In the linguistic aspect, interactive multimedia is able to develop language intelligence through presenting narrative elements in sound form. The use of explanations through sound and some dialogue can help students to improve their speaking abilities. Audio-visual elements really help students develop language intelligence. This is in line with research conducted that audio-visual media can develop verbal linguistic intelligence, namely being able to recognize new words, think and then express them using language (Fitriani, 2014; Nugroho & Surjono, 2019). Apart from that, the use of quizzes and questions with sound trains students to become good listeners and learn to understand the language better.

Interactive multimedia is considered capable of developing kinesthetic intelligence. Interactive multimedia can stimulate students' physical skills, such as following instructions, following the flow of the game. Students can follow the visual and hearing instructions in the video shown and then try to carry them out physically. It helps in the development of kinesthetic intelligence of students. This is in line with researchpreviously stated that videos can improve kinesthetic intelligence (Marchetti & Cullen, 2015). Audio visual elements help students understand a movement process or a procedural action.

Interactive multimedia is considered capable of developing spatial intelligence. The elements of matching and puzzle games usually require players to find and match two suitable objects based on existing patterns or images. This helps in developing students' understanding of spatial relationships between objects, such as how two objects relate to each other in space. This is in line with research conducted byPrevious researchers found that puzzle media can improve the visual spatial abilities of kindergarten children. Puzzle patterns stimulate and train kindergarten children's spatial intelligence (Sari, NT and Wasgito, 2020).

The results of this research can be the basis for developing an educational curriculum at the kindergarten level that places greater emphasis on the use of interactive multimedia based on Multiple Intelligences (MI) to improve students' MI development. Kindergarten teachers and educators can use these findings to design and implement more diverse and interesting learning methods that take into account students' multiple intelligences. However, this research has limitations. The use of interactive multimedia may face obstacles related to technological accessibility and dependence on electronic devices, which may not always be available or possible in every kindergarten learning environment.

4. CONCLUSION

The percentage of validity of design aspects, learning media aspects, and learning content aspects converted to PAP scale 5 is in the very good category. Several experts also provided suggestions that were used as a reference for revising interactive multimedia in aspects of design, media, and learning content. The practicality of interactive multimedia through individual tests obtains excellent qualifications. Students responded that multimedia was easy to use in learning. The effectiveness test shows that interactive multimedia is able to develop students' intelligence specifically in five aspects, namely Logical-mathematical, Musical, Kinestic MI, Visual-spatial, and Verbal Linguistics.The average multiple intelligence of students is in the very good category.

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