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Game-based educational media and associative skills in kindergarten students' early reading and writing development

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ABSTRACT

This study investigated whether children's association skills and engagement with literate media, toys, games, and activities influence their early reading and writing abilities in kindergarten. The study included 60 participants selected by cluster random sampling using a 2 x 2 factorial design. The results indicated that children with literate media scored higher in early reading and writing abilities than those with non-literate media. Fourth, youngsters with high association skills who play with literate media score better than youngsters with high association skills who play with nonliterate media. Children with high association skills also demonstrated better early reading and writing abilities than those with low association skills. The study found a significant interaction between association skills and media, influencing early reading and writing abilities differently. The study emphasizes the importance of incorporating literate media and activities promoting association skills in early childhood education to enhance children's reading and writing abilities. It also highlights the need for teachers and parents to consider individual differences in association skills when selecting media and activities for young children. Both literate and non-literate media have an important impact when combined with different association skills, influencing children's early reading and writing abilities.

Keywords: play media, association skills, abilities, early reading, writing, kindergarten

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INTRODUCTION

Early childhood education is an early stage in a person's life. Children experience very rapid development at this stage, especially in cognitive, social, and emotional abilities. To provide effective and efficient education for early childhood, educators must understand the factors that can affect their development (Elizabeth, 2016; Kostelnik et al., 2011). Early literacy skills are initial reading and writing skills that develop naturally spontaneously, with their strength according to early childhood development in recognizing, understanding, accepting, applying, evaluating, and re-creating the literacy information obtained (Shabani et al., 2010; Slavin, 2018; Weaver, 2014). Reading and writing allow a person to access information and learn at school. Therefore, knowing the factors that can affect early childhood reading and writing skills (Aprilia et al., 2020).

Reading-writing is called by Weaver (2014) part of the theory of visual literacy according to Considine's opinion in Hume (1965) that someone who is visually literate in communicating and an effective child needs the ability to receive, send, and process messages. The importance of visual literacy education, namely containing messages that provide experience, interpreting symbols, pictures, and verbal boards (Calfee, 2016; Cunningham, 2018; Dean & Nicholls, 2014; Heinrich, 1996).

Messages on visual literacy media are designed for children at all levels of education according to the needs of visual literacy mastery, which is also called language skills, including

listening, speaking, reading, and writing, requires thinking to focus attention on activity situations as stated by Brewer (2017) that early literacy skills are closely related to one's language development, namely listening to speaking, reading and writing. Children express themselves in various ways in response to the environment. Literacy-rich learning environments at school and home will help early literacy emerge.

According to Manzo and Manzo (1995), early childhood literacy skills can be through spoken language, pictures, scribbles, and writing, which then develops into a meaningful language. According to Slavin (2019), two main sources influence language development in young children: parental behavior and attitude in enhancing a child's spoken language, and the child's attitude, as they informally learn to read independently.

The early reading-writing process in early childhood is highly dependent on mood, environment, and playing system (Hohmann et al., 2008). A playing atmosphere that supports ideas, the power to create with scribbled pictures, and the initiative to choose their play equipment will bring out a child's intelligence. To accelerate the mastery of children's early reading and writing skills through the process of attracting interest and having language activities, communication activities with parents, family, friends, and teachers in everyday language, plus using the media of story books.

Children's literacy skills occur when the child has mastered the schemata and assimilated to accommodate information internally. Conservation occurs, and the child begins to write and read with his understanding and evaluates the information he gets starting from the picture; the next form, the child will construct an understanding of his reading and writing. Thus, early literacy skills are initial reading-writing skills that develop naturally and spontaneously. They are unique to early childhood development in remembering, understanding, applying, evaluating, and re-creating literacy information obtained through literacy and non-literacy games media (Mustadi et al., 2022).

Media that contains messages conveys information from sources to recipients, intending to add behavior or provide input to enhance information or skills. For learning to be optimally successful, the role of the media is important. The influence of the media as a technology, teacher, socializing tool, motivator in learning, and a tool to inspire mentality to think and solve problems (Tyas Handayani & Naibaho, 2020). For this reason, the influence of media-containing literacy will develop early childhood literacy. Media literacy efforts, such as media symbols that contain literacy messages, can play a role (Moyles, 1989). Meanwhile, suppose there is no educational goal for literacy knowledge. In that case, it can be provided with educational game tools or non-literacy media, namely those that do not have a specific purpose for reading and writing.

As mentioned by Gagne (2017), to learn more effectively and achieve maximum results, the use of concrete media takes precedence over symbolic media forms that will make it easier (Julyanthry et al., 2022) to connect the experience to abstract understanding. However, in the way of early childhood learning, all messages use media activities in the form of game tools that contain concepts because playing is a vehicle for learning and playing media activities in the form of game tools that are designed with a specific purpose, namely literated media is media activities that are placed as learning resources. containing literacy (Dockett & Fleer, 2020; Hughes, 2019).

In this study, media by design is distinguished between literate media, namely media according to visual literacy that contains messages or concepts of literacy values to develop early literacy in early childhood (Lestari, 2018; Ratminingsih & Siti Syarah, 2020; Sukmayadi Halimah, 2019). While non-literate media (non-literate media) is a game tool that is usually played by children in kindergarten (Babini et al., 2021). Literated media requires a child's desire to read and write early, and both types of media are delivered using a special method for early childhood.

From the description above, it can be concluded that media literacy games are various game tools and literacy-laden activities based on educational technology studies that make it easier for children to explore meaningful literacy concepts. Media literacy games integrate meaningful spoken and written language by using the ability to see similarities and differences, visual and auditory forms, and developing understanding, application, conclusions, making decisions, and creating and collaborating between children and teachers.

Table 1. Comparison of literacy and non-literacy game media

Media literacy game	Non-literacy game media
- Complete alphabets are paired with letters and several pictures with the same initial sound	- Some letter and picture cards
- Selected and co-made library books	- Alphabet
- Picture letter lotto cards to play	- Library books, magazines
- Short poems are written together with pictures	- Some alphabet cards
- Selection of library books as needed	- Various sewing boards
- Board sewing by following the alphabet	- Traditional house image
- Puzzle with alphabets	- Word: only one sheet is matched
- Concept display tools, colors, numbers, letters, pictures	- Colored alphabets
- Domino images and letters	- Sing along
- Classification images of the same kind of equivalent	- Image prepared for coloring
- Journal book belongs to each student	
- Poetry preparation for children to master	
- Making books with teachers and children	

The non-literate game media in this study are all game tools, tasks, and activities prepared by the teacher based on his understanding and experience to be emulated and worked on by children as daily tasks without the purpose of reading and writing messages.

Several factors that can affect the ability to read and write in early childhood are the media games used and the ability to associate. Previous research has shown that the game media used can affect children's reading and writing skills (Mustadi et al., 2022). The research conducted by Weaver concerns the use of literature media or literacy game media, which is a part of the beginning or preparation of early literacy skills. In addition, the ability to associate is an important factor affecting children's reading and writing abilities. In associative theory, there is a link between ideas and thoughts in the opinion of Hume (1965), emphasizing the existence of subtle power, a gentle force that connects, associating simple ideas with complex ideas, simple reading and writing becomes difficult. Also called Flechen (2014), social skills are intellectual competencies inherent in each child, linking ideas and knowledge or classifying information obtained using reasoning. Each child has something unique, and each child has different competencies and high and low children's association abilities, which are characterized by conditions as mentioned in Table 2.

Table 2. High associate ability and low associate ability

High Associated Ability	Low Association Ability
- Be open	- Reclusive behavior is difficult to predict
- Easy to attract attention	- Does not indulge sluggish attention
- Able to quickly see visual cues	- Slow to grasp meaning
- Able to see similarities	- Hard or not to see feelings
- It's easy to say the function of objects	- Requires repeated time
- Skilled in installing pieces	- It's hard not to see the similarities
- Quickly recognize the sound of your letters	- Difficult and unable to see similarities
- Quickly get to know the word neighbourhood city	- Can't get it involved
- Expressive face	- It takes a lot of repetition
- Eyes full of attention	- Unable to hear the initial sound of letters
	- Not interested in us

The difference in high and low associative abilities in young children has characteristics as described in the table above. Some children exhibit open behavior, are attentive, quick to grasp, able to identify similarities and differences, easily name the functions of objects, quickly recognize visual and auditory shapes of letters, memorize poetry easily, and have a good vocabulary. They are categorized as children with high associative abilities.

Conversely, another group of children is more closed, shows a lack of attention, takes a long time to repeat, has difficulty identifying similarities and differences in visual and auditory shapes of letters, struggles to name the functions of objects, requires a lot of repetition, lacks interest in words, and has difficulty recognizing poetry. They are categorized as children with low associative abilities. The way kindergarten children learn by playing is very conducive because of the opportunity to explore. According to Piaget (Bybee & Sund, 1990), the development of cognitive or intellectual stages states that the intuitive stage is 2-7 years when children slowly begin to think and associate the information they get in simple ways. At the age of 4-7 years is the stage of playing symbols, and children slowly begin to think and associate the information they get in simple ways. When children play and interact with their environment, the natural strength of the child's association can be continued. The development of associative abilities occurs when children play creatively and integrate various experiences of learning activities simultaneously (Gago et al., 2023; Reiff & Fortson, 1994).

The ability to associate is an intellectual competence that is owned and attached to children, connecting new information or ideas with the knowledge they already have through remembering, understanding, applying, analyzing, evaluating, and creating. There is a class of children who are open-minded, attentive, able to see similarities and differences quickly, easily name the function of objects, quickly recognize visual and auditory forms of letters, and easily recognize vocabulary, so these children include children who have high association abilities (Di Giacomo et al., 2016). A group of introverted children do not show attention, take a long time to repeat, have difficulty seeing similarities and differences in visual and auditory forms of letters, find it difficult to name the function of objects, need repetition time, and are not interested in words. This is a child who has low association ability.

Therefore, this study aims to investigate the effect of media games and association skills on early childhood reading and writing skills at the kindergarten level. This study will study these factors using media games and measuring children's association abilities.

Maturity in a child's development plays a significant role, and it is essential to consider their intellectual development, which can involve varying abilities in processing information quickly or slowly, easily or with difficulty.

Factors that positively influence quick or slow responsiveness in capturing responses need to be considered by teachers. Children have different associative abilities; some are high, and some are low. Additionally, their ability to associate visual and auditory forms of letters is a key factor in developing early literacy skills in young children. Play materials are commonly used in preschools and kindergarten classrooms. Not all of these materials are related to literacy. However, they can be introduced to preschools if literacy activities use literate media or media promoting literacy.

In this study, media is categorized into two types: literate and non-literate media, which include various tools and games used in children's learning strategies.

The focus on associative abilities is chosen because it is one of the many signs of the emergence of intellectual development in young children, especially in terms of classification, reception, problem-solving, self-expression, and retaining information in line with the characteristics of young children.

METHOD

This study uses an experimental method with a 2 x 2 factorial design. The method used in this research is the experimental method with a group design model. The experimental design employed is a 2 x 2 factorial design (Sudjana, 2019). In this design, two types of game media usage variables are literacy media and non-literacy game media. The associative ability variable is divided into high association ability and low association ability (Table 3).

The target population in this study was 3,331 kindergarten children in TK ABA Yogyakarta City, Indonesia. The sample was 15 children; they were classified as children with high association abilities, 15 respondents for each experimental group, and a group of 15 people with high association abilities in the control group and low association was a representative sample.

Table 3. The 2 x 2 factorial design used is an expression grouping matrix

Media request Ability Socialize	Literacy (A1)	Non-Literacy (A2)	Amount
High association ability (B1)	A1 B1 = 15	A2 B1 = 15	30
Low association ability (B2)	A1 B2 = 15	A2 B2 = 15	30
	30	30	60

Note:
A1 B1: Groups of children who have high association abilities use literacy games as media
A2 B1: Groups of children who have high association skills use non-literacy game media
A1 B2: Groups of children who have low association ability use literacy game media
A2 B2: A group of children with low associative abilities using non-literacy game media

The sampling technique used was a two-stage random sampling of participants. The first stage involves randomly selecting two schools from ABA Kindergartens across Yogyakarta. Then, in the second stage, students are randomly chosen from each school selected in the first stage, with 30 students from each school. Therefore, the total research sample consists of 60 students.

To achieve the research objectives mentioned above, data collection was conducted by implementing treatments. The research and instrument testing were conducted in TK ABA Patangpuluhan, Wirobrajan, and Kauman. The treatments were administered according to the kindergartens' early childhood education program schedule. The choice of these three Kindergartens was based on similarities in infrastructure, the social status of the student population, the relatively similar number of students in each class, and the fact that they were all managed under the same ABA Kindergarten management in Yogyakarta. These three locations are all located within Yogyakarta City but are at a sufficient distance from each other.

The research instrument used was an observation sheet prepared by the researcher to observe the associated skills of the children before the instrument was used for trials. Instrument validation was carried out through expert validation and trials. Early childhood education experts carry out expert validation. The experts evaluate the instrument based on predefined criteria. They provide feedback on the instrument, including suggestions for improvement if necessary. If the experts provide relevant suggestions, revise your research instrument. This may include changes to questions, removal or addition of items, or other adjustments. The researcher conducted a pilot study and consistently accompanied the teacher. Before the instruments were used for research or data collection, they were tested first. The pilot test was conducted with TK-B children in a TK that was not chosen as the research site, specifically at TK ABA Kauman, over a period of 4 days. The pilot test results in 16 valid items with an instrument reliability coefficient of 0.860 for initial literacy and association skills, and 24 valid items were obtained with a reliability coefficient value of 0.854.

For the hypothesis test to be carried out, it must first be carried out to test the requirements for hypothesis testing, including the normality test and data homogeneity test. The Lillefors test carried out the data normality test, and the Bartlet test carried out the data homogeneity test.

This study was experimental with a 2 x 2 factorial group design. The experiment was divided into two groups: the experimental group with literacy game media and the control group with non-literacy game media. Then, based on the observation results, the groups were categorized into high and low-associative ability groups. Therefore, data analysis used a two-way ANOVA and continued with the Tukey test. This is to determine which group has higher initial literacy skills.

FINDINGS AND DISCUSSION

Findings

Data description

Calculation of the central measure includes the mean, mode, and median and the data distribution, namely the standard deviation for initial read-write ability, which gives results as shown in Table 4.

Table 4. Calculation of the central measure includes the mean, mode, and median, as well as the distribution of data

Media Game / Ability Associate	Literacy (A1)		Non-Literacy (A2)	Amount
High Association Ability (B1)	n	15	15	30
	$\overline{x}$	74.07	64,53	69.30
	S	4.03	3.72	6,17
Low Association Ability (B2)	n	15	15	30
	$\overline{x}$	64.07	67,87	65,97
	S	4,25	5,24	5.07
Amount	n	30	30	
	$\overline{x}$	69.07	66,30	
	S	6,51	4.77	

Table 4 shows that students with literacy game media and high associative ability have an average score of 74.07. Meanwhile, students with non-literacy game media and high associative ability have an average score of 64.53. Students with literacy game media and low associative ability obtained an average score of 64.07, while students with non-literacy game media and low associative ability had an average score of 67.87. Thus, the use of literacy game media can enhance associative ability.

Requirements analysis test

The analysis requirements test consists of a normality test and a homogeneity test. Normality testing uses the Liliefors method, the conclusion is that the normality requirements are met. Homogeneity testing was carried out using the Bartlett test. The conclusion of the homogeneity test is fulfilled. Table 5 shows that each group has Lhitung < L table values, meaning the data is normally distributed.

Table 5. Summary of normality test results

Group	L_O	L_t for $\alpha = 0,05$	L_t for $\alpha = 0,01$	Conclusion
A1	0,0855	0,161	0,187	Normally distributed
A2	0,1154	0,161	0,187	Normally distributed
B1	0,0881	0,161	0,187	Normally distributed
B2	0,0876	0,161	0,187	Normally distributed
A1B1	0,1105	0,22	0,257	Normally distributed
A2B1	0,1118	0,22	0,257	Normally distributed
A1B2	0,0853	0,22	0,257	Normally distributed
A2B2	0,1571	0,22	0,257	Normally distributed

Note: N = 30

Table 6. The summary of the homogeneity test results

Group Variances	χ^2_h	$\chi^2_{t\,\alpha=0,05}$	Conclusion
A1 and A2	2,754	3,84	Homogeneous Group Variances
B1 and B2	1,106	3,84	Homogeneous Group Variances
A1B1, A2B1, A1B2 and A2B2	1,885	7,81	Homogeneous Group Variances

Based on the test results in Table 6, it can be concluded that the variances in these groups are homogeneous.

Hypothesis testing

The results of the hypothesis requirements test showed that all data came from normally distributed populations and data from all groups had a homogeneous population variance. Therefore, it is possible to conduct hypothesis testing using a two-way ANOVA. The results of data analysis

with two-way ANAVA from the results of observations of reading-writing can be presented in Table 7.

Table 7. Summary of two-way ANOVA results

Source of Variation (SV)	The Sum of Squares (JK)	Degree of Error (dk)	Average Squared (RK)	F count	F table	
					0.05	0.01
A	123,27	1	123,27	6,579*	4,016	7,112
B	166,67	1	166,67	8,827**	4,016	7,112
A x B	666,67	1	666,67	35,309**	4,016	7,112
Ex	1057,33	56	18.88	-	-	-
TTL	2013,93	59	-	-	-	-

Note: A=Between columns (game media); B=Between lines (association ability); A x B= Interaction.
Ex = Error (in groups); ttl =Total; * = Significant at 0.05; ** =Significant at 0.01

The first hypothesis test of early literacy among kindergarten children who play using game media is higher literacy than children who use non-literacy game media. The results of the ANOVA calculation obtained an F count of 6.529 and F table at a significance level of 0.05 and 0.01 with one-time interpolation obtained: F table 0.05.56 = 4.016 and these results show that F count 6.529 > 4.016 = F table so HO was rejected and H1 was accepted. It can be concluded that the early reading and writing abilities of children who play with literacy game media are higher than those of children who play with non-literacy game media.

The second hypothesis test reads, "The early literacy skills of children with high association abilities are higher than children with low association abilities".

Based on the results of ANOVA calculations, the calculated F value = 8.827. These results indicate that F count = 8.827 > 7.112 F table. So Ho is rejected, and H1 is accepted, meaning that children with high association abilities have higher early literacy abilities than those with low association abilities.

The third hypothesis tests, that there is an interaction between game media and the ability to associate with children's early reading and writing abilities. Based on the results of calculations using ANOVA, the calculated F value = 35.309. These results indicate that F count = 35.309. This shows that the F count is 35.309 > 7.112: F table, so Ho is rejected, and H1 is accepted. It can be concluded that there is a very significant interaction between game media and children's early reading and writing skills. The form of this interaction can be presented in Figure 1.

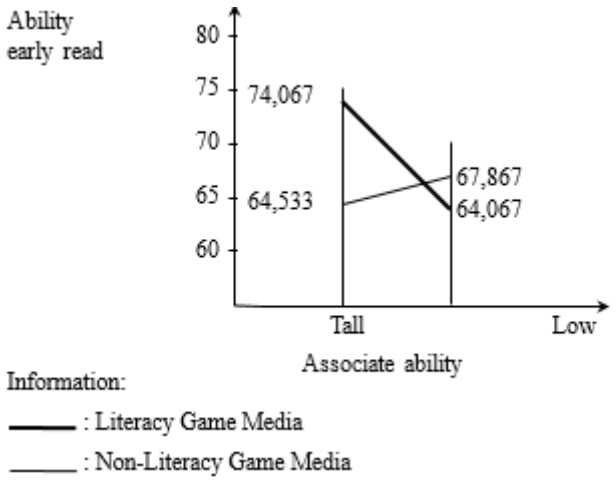

Figure 1. Interaction between game media and association ability on children's early reading and writing skills

Figure of interaction between game media and association ability on children's early reading and writing skills In Figure 1, the interaction between game media and association ability on children's early reading and writing ability is depicted.

In Figure 1, the average scores of early reading and writing ability for children with high association ability playing literacy-based games are compared with the average scores of early reading and writing ability for children with low association ability playing literacy-based games. On the other hand, the average scores of early reading and writing ability for children with high association ability playing non-literacy-based games are compared with the average scores of early reading and writing ability for children with low association ability playing non-literacy-based games.

In Figure 1, it is evident that the two lines intersect, indicating the presence of an interaction between game media and association ability on children's early reading and writing ability. Because the third hypothesis is accepted, meaning there is a very significant interaction, testing the hypothesis can be continued using the Tukey test. A summary of the test results for the Tukey test is in Table 8.

Table 8. The test results with the Tukey test

Groups being compared	Q count	Q table		Information
		0.05	0.01	
A1B1 and A2B1	8,494	0.521	0.654	Very significant
A1B2 and A2B2	3,387	0.521	0.654	Very significant

The fourth hypothesis test reads: "Early reading and writing abilities of children who have a high ability to associate playing with literacy game media are higher than those who play using non-literacy game media. Based on the calculation results of the Tukey test, Q count = 8.498 and Q table at a significant level $\alpha = 0.05$ and $\alpha = 0.01$ with n = 15 obtained Q table (0.05:15) = 0.521 and Q table (0, 01:15) = 0.654. These results indicate that Q count = 8.498 > 0.654 = Q table. This means that Ho is rejected, and H1 is accepted. The Tukey test results conclude that the early reading and writing ability of children with a high ability to associate playing with media literacy games is higher than that of children with a high ability to associate playing with non-literacy media.

The fifth hypothesis test reads that children with low association ability to play with media literacy games are lower than those who use non-literacy game media. Based on the results of Tukey's calculations, Q count = 3.387. These results indicate that Q count is 3.387 > 0.654 = Q table, this means that Ho is rejected and H1 is accepted. The Tukey test results conclude that the early reading and writing ability of children with a low ability to associate playing with literacy game media is lower than that of children with a low ability to associate playing with non-literacy game media.

Discussion

The results of the first hypothesis testing prove that the early reading and writing abilities of children who play with literacy game media are higher than those of children who play with non-literacy game media. This is indicated by $F_{calculation} = 6.529 > 4.016 = F_{table}$. This means that the early reading and writing abilities of children who play with literacy game media differ from those of children who play with non-literacy game media. In other words, game media used in the learning process for TK-B children impact early reading and writing abilities. In short, literacy game media are very effective in improving children's reading and writing abilities, indicating that game media influence early reading and writing abilities (Ahsan & Faletehan, 2021).

The results of the second hypothesis testing demonstrate that the early reading and writing abilities of children with high associative abilities are higher than those of children with low associative abilities. This is indicated by Fcalculation = 8.827 > 7.112 = Ftable at the significance level $\alpha = 0.01$. This means that the early reading and writing abilities of children with high associative abilities differ from those of children with low associative abilities. This suggests that associative ability affects early reading and writing abilities, indicating that associative ability influences early reading and writing abilities.

The results of the third hypothesis testing show a highly significant interaction between game media and associative ability on early reading and writing abilities. This is indicated by

Fcalculation = 35.309 > 7.112 = Ftable at the significance level α = 0.01. This indicates that the game media used in the learning process for TK-B children interact with the associative abilities of the children, and both factors can influence early reading and writing abilities.

Hypothesis testing using the Tukey test conducted for the fourth hypothesis shows that Qcalculation = 8.498 > 0.654 = Qtable at the significance level α = 0.01. This means that the early reading and writing abilities of children with high associative abilities who play with literacy game media are higher than those of children with high associative abilities who play with non-literacy game media.

Hypothesis testing for the fifth hypothesis using the Tukey test shows that Qcalculation = 3.387 > 0.654 = Qtable at the significance level α = 0.01. This means that the early reading and writing abilities of children with low associative abilities who play with literacy game media are lower than those of children with low associative abilities who play with non-literacy game media.

Literacy and non-literacy game media for young children are not different. All children enjoy playing, regardless of the type of game media, but the difference lies in a deeper examination of the mental functions used during play. The distinction is in the literacy content. Here, the higher mental functions come into play in terms of ease or difficulty in grasping meaning or concepts. The ease or difficulty of understanding literacy concepts depends on the child's associative abilities. For some children, content in literacy game media with high literacy value or high literacy culture may be difficult to grasp, and they may require more time to comprehend, master, and internalise it. The use of literacy game media may not achieve its goals if used as therapy in the emotional, social, or intellectual development of children who have difficulties dealing with aggressive behavior, regression, or ADD (attention deficit disorder) or have associative difficulties.

According to Learner & Levine, in such situations, a child's ability to associate may be low, leading to difficulties in reading and writing. Forms of game media for emotional development, in this case, should be chosen to stimulate motivation and provide adequate language development at the same time.

CONCLUSION

The following writing and referencing rules are to be taken into consideration. Based on the analysis results, there are several things: (1) There is a difference in early reading and writing abilities between children who play with literacy game media and children who play with non-literacy game media. Children who play literacy games have higher literacy skills than those who use non-literacy game media. (2) There is a difference in the early literacy skills of children with high and low association abilities. Children with high association abilities have higher initial literacy than those with low association abilities. (3) There is a very significant interaction between the ability to associate and the use of media games that influence and show differences in early reading and writing skills in kindergarten children. (4) Early literacy skills of kindergarten children with a high association ability to play using literacy game media are higher than children with a high association ability to play using non-literacy game media. (5) Early literacy skills of kindergarten children with low association ability to play with literacy game media are lower than children with low association abilities and play with non-literacy game media.

Based on these findings, it can be concluded that to improve early reading and writing skills in kindergarten children, it is necessary to work on things that influence them, namely the ability to associate and use media literacy games.

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