

Exploration of Early Childhood Literacy Ability based on Analytical Hierarchy Process (AHP)

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Abstract Strong early literacy skills will affect children's thinking skills in the future. The results of existing research indicate that learning in schools has not been able to make this happen. This research is a survey research to see the gap between children's literacy skills in the field and expected literacy abilities. So that it will be seen the components that can affect the literacy abilities of children aged 5-6 years. Currently, there are not many studies examining the influence of literacy components in developing children's literacy, because many researchers consider that all components are important. Therefore, a deeper study is needed to see the components that affect the development of children's literacy. The expected literacy ability is expert judgment which has been validated using the *Analytical Hierarchy Process (AHP)*. The data analysis technique used is descriptive analysis. The data collection techniques used were observation and questionnaires. The population in this study used simple random sampling. Respondents in this study were 150 children aged 5-6 years. The results showed that the children's ability to understand language components was 6.76%, phonological awareness reached 5.73%, basic reading skills 6.5%, basic writing skills 7.8%, and children's motivation in reading 3.37%, so it can be concluded that based on the components of children's early literacy skills, the accumulated age of 5-6 years has only reached 30.16% of the expected. The contribution of

this research is to determine the appropriate literacy stimulation for children.

Keywords Early Literacy, Children Aged 5-6 Years, Analytical Hierarchy Process (AHP)

1. Introduction

One of the determinants of the success of children's learning is optimal early literacy skills; therefore the ability to read and write in the early grades has a very important role. Reading literacy is very important to encourage ongoing reading involvement in the future. Literacy is one of the most important areas of development [1]. Reading or literacy is a strategy to get and access all the information needed in life. Reading is the foundation for learning; therefore the literacy skills must be strong and sturdy.

Literacy promotion that starts early can help build a routine literacy activity that will last throughout a children's lifetime [2]. Literacy is a routine activity that cannot be separated from modern human life styles, even more in the world of education. Literacy is an interactive process that takes place between the reader and the text, so that the reader uses knowledge, skills, and strategies to

determine what meaning is contained in the text [3].

The findings of [4] provide preliminary evidence to take advantage of class routines that normally occur, such as the Morning Greetings or Morning Meetings, in order to instill explicit teaching and writing opportunities for young children. The success of literacy is the foundation for children's education, health and welfare outcomes in the future. Thus, early identification of literacy needs is very important [5].

Early literacy experiences in early childhood are believed to form a strong foundation on the development of reading [6]. Interest and motivation in children's literacy activities are positively related to the achievement of their literacy. Early literacy skills are the knowledge, skills, and attitudes of early childhood that form the basis of reading and writing abilities [7]. Literacy experiences and activities will encourage children's literacy abilities [8]. Early childhood literacy development is a process of language development that begins at the time the child is born and continues to experience development during his lifetime.

The learning process is mediated by language; therefore literacy skill is always preceded by language development [9]. Literacy in early childhood is one component of aspects of child development, namely aspects of language development. Having strong alphabet knowledge early in life is a strong predictor of long-term reading and academic results [10].

Play activities in early childhood by utilizing Information and Communication Technology (ICT) are currently very effective, for example using an android, tablet or computer. Children are very fond and familiar with technology. Through the use of ICT, it will arouse motivation and answer children's high curiosity. Through the use of ICT, children learn a lot of knowledge which is sometimes impossible if taught in traditional ways. Based on [11] this environment and the people around children have a role in encouraging children to learn by introducing and showing objects, reading stories, accompanying children when children play with computers, talk while play, ask questions, and so forth. We can say adults become intermediaries for children to know the world around them [12].

Literacy activities should be done without coercion, without pressure, fun, and in accordance with the stages of child development. The introduction of literacy should be given in a framework for developing and optimizing all aspects of child development. Reading itself is actually a form of skill that can be trained [13]. Recommendations from the American Academy of Pediatrics and Reach Out and Read state that joint reading activities can be done from the birth of the children [2]. Interest in literacy activities, especially for children, is strongly influenced by their home literacy environment [14]. The home literacy environment is one of the important variables for developing reading comprehension [15].

In school, literacy learning is focused on 'printing literacy', reading, and writing [16]. The teacher plays an important role in developing and teaching literacy skills, such as the ability to read, write, and speak. Teachers need to carry out literacy strategies in their learning. Children learning ability is done through developing literacy skills in schools, for example using teaching materials or various media. Good and well-planned planning requires teachers who are expected to be able to develop children literacy skill. The teacher needs to create an attractive classroom environment for children to read and write and appreciate the use of children's language at home [17].

Learning at school is not yet able to realize this, as evidenced by the reading interest of children who are still very low [18]. In general, literacy teaching conducted by teachers has a relatively low quality [19]. The teacher has little time to plan or carry out new learning activities [20]. Teachers are relatively rarely involved in activities that actively support children's writing [21]. The research conducted by [22] motivated by the problem of the lack of consistent learning models about how to support the learning environment that can be beneficial for the development of children's literacy skills, so it is needed the effective training for teachers to facilitate and provide literacy experiences to children [23].

Children's opportunities to read make a positive contribution to their academic reading achievement; learn to read various shapes, colors, arrange puzzles, play guessing cards accompanied by the initial letters of one word according to the pictures on the card. The new ICT also brings new opportunities for children to develop literacy outside the classroom [24]. In recent ICT advancements, social robots have emerged as educational tools with the potential to improve language skills and early literacy in children. Social robots are defined as machines that can interact socially and communicate intelligently with humans. Literature review is conducted to explore current knowledge about social robots and language learning and early literacy in developing children in the age of 0 to 8 years [25]. The increasing use of smartphones and tablets sets the stage for new cellular-based education programs that seek to increase children's learning and involvement at school and at home. The phonological awareness component, word reading and early writing skills can be improved through the use of a smartphone [26].

International research results show that the literacy abilities of Indonesian students who represent Indonesian society in general are relatively low, especially in terms of language literacy [27]. Based on the data of *Organisation for Economic Co-operation and Development* [28], the level of literacy of Indonesian society based on the data of *Programme for International Student Assessment* [29] shows that Indonesia is ranked 64th out of 65 countries that followed with a score of 396 from the OECD average score of 496.

According to the PISA report, Indonesian education received a red report card (VOI, 4 December 2019) Indonesia's position was ranked 6th from the bottom, or 74th position out of 79 countries. The reduced level of literacy of Indonesian students is the cause of their critical thinking skills decline. Almost all Indonesian student competency scores declined from PISA 2015. Indonesian students' reading competency scores declined the most from 397 to 371. The 2018 PISA survey places the quality of Indonesian education below Singapore, Thailand, Malaysia, and Brunei Darussalam for all areas of competency.

Seeing these various facts, a learning approach is needed where the teacher must be able to stimulate, guide, help, and direct their students to be able to develop their literacy abilities. Strengthening literacy is one way to implement the 2013 curriculum in learning. Literacy is a means for students to recognize, understand, and apply science. Literacy is an important ability that must be possessed by every student [18].

Early language skills for early childhood primarily emphasize the elements of listening, speaking, pre-reading, and pre-writing. All elements of early language skills in early childhood can be developed through the Whole Language Approach (WLA). WLA is a learning approach that is believed to be able to stimulate children's language abilities at school or in the classroom naturally. Education in developed countries has implemented WLA a lot in its learning, because it is believed that WLA is able to have a positive impact on children's language development. The WLA approach is currently a very trendy, popular, and important approach for early childhood education [30].

In the era of disruption or millennial era, the use of technology is something that cannot be avoided [31]. This indicates that the influence of information technology is very large and it cannot be denied that we need technology in education. Many studies discuss the importance of ICT in early childhood education [32], [33]. Using ICT shows that children can be very active and independent learners [34].

Research on literacy in early childhood has been widely carried out; therefore there are many components that can be used as a basis in developing literacy skills in children. In this study the ability to read and write was measured using an initial literacy skill measure developed by [9] which contains 5 early literacy components of early childhood, namely: 1) language skills, 2) phonological awareness, 3) basic reading skills, and 4) basic writing skills and 5) reading motivation. The five components of early literacy of children mentioned above are still very common and in certain circumstances, it is not yet seen which components can make a major contribution or influence in the development of children's early literacy [35]. Currently, there are not many studies examining the influence of literacy components in developing children's literacy. Many researchers consider that all components of

literacy are important [35]. The studies above show that there is no study on the level of literacy components that can affect children's literacy development, so this study needs to be examined in depth. It is hoped that the gap between children's current literacy skills and those at the ability level needs to be further examined

In addition, to improve children's abilities, it is necessary to use a comprehensive method (WLA). This approach is used to improve children's literacy levels to be better in the future. Therefore, a deeper study is needed to see the components that affect the development of children's literacy. By knowing the influence of these components, it will become a foot hold in providing optimal literacy stimulation to children. Therefore, this study aims to see the gap between children's literacy skills in the field and the expected literacy skills so that the components that can affect the literacy skills of children aged 5-6 years will be seen.

2. Methodology

2.1. Research Design

This research is a survey research to see the gap between the literacy skills of children in the field and the expected literacy abilities so that the components that can affect the literacy abilities of children aged 5-6 years will be seen. The data analysis technique used is descriptive analysis. The data collection techniques used were observation and questionnaires. Observations were made by looking at the process of literacy learning activities during class. The questionnaire method uses a measuring instrument for early literacy skills developed by [9] which contains 5 components of early childhood literacy, namely: (1) language skills, (2) phonological awareness, (3) basic reading skills, and (4) basic skills writing and (5) reading motivation. Data analysis techniques were performed by data reduction, data presentation and data verification until drawing conclusions.

In this study, the initial questionnaire was distributed to experts to obtain valid information regarding the sequence of components that affect children's literacy skills. The experts involved in this research were 12.5% with the title of Professor, 62.5% of lecturers with Doctoral degrees with early literacy competencies for early childhood and 25% of practitioners who are competent in the field of early childhood education. The expected literacy ability is expert judgment which has been validated using the *Analytical Hierarchy Process* (AHP). AHP is a hierarchical layered structure developed for decision making [36], [37]. Using a hierarchy of AHP criteria helps us to solve complex and complex problems. Interested parties (experts) provide an assessment and conclude all considerations for developing weights or priorities. So far, the use of AHP has not been widely used in research

studies, although decision making using AHP is quite objective and rational. The evaluation results using the AHP method have been tested and proven to be more scientific, objective and take into account the elements of intuition and subjectivity [38], [39]. AHP steps can be seen in Figure 1:

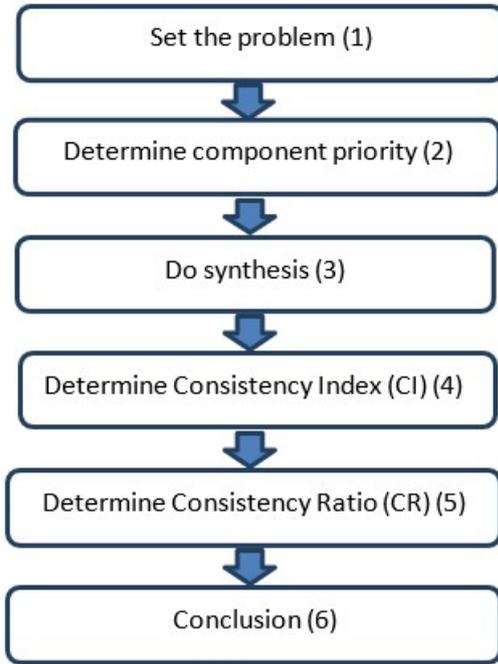


Figure 1. Stages in AHP

The stages in AHP are as follows:

- 1) Define the problem and determine the desired solutions
- 2) Create a hierarchical structure starting with a general goal, followed by criteria and choice alternatives.
- 3) Create a pairwise comparison matrix
- 4) Calculate the Consistency Index (CI) with the formula:

$$CI = \frac{\lambda_{max} - n}{(n-1)}$$

- 5) Calculate the Consistency Ratio (CR) with the formula

$$CR = \frac{CI}{RI}$$

If $CR < 0.1$ is consistent

If $CR \geq 0.1$ is inconsistent, then the paired matrix on the criterion element must be repeated.

- 6) Conclusion

The first step is to determine the problem

The AHP approach is carried out by conducting a pair wise comparative analysis of each component. Based on the data above, it is necessary to look for the components that have the most important influence on children's literacy skills.

The second step determines the priority of the component

- Intensity of Interest
 - 1 = The two components are equally important
 - 3 = One component is slightly more important than the other components
 - 5 = One component is more important than the other
 - 7 = One component is absolutely more important than the other components
 - 9 = One component is absolutely essential from the other components
 - 2,4,6,8 = Values between two adjacent balances

The third step: compiling a comparison matrix, namely:

The next step is to pool the opinions of several experts using the geometric mean equation:

$$GM = \sqrt[n]{(X1)(X2) \dots \dots (Xn)}$$

Where:

GM = Geometric Mean X1 = 1st Expert

X2 = 2nd Expert Xn = nth Expert

Table 1. Comparison Matrix

Components	Ability to understand language	Phonological awareness	Basic reading skill	Basic writing skill	Reading motivation
Ability to understand language	1	2.43	1.29	1.57	3
Phonological awareness	0.412	1	2.326	1.71	3.14
Basic reading skill	0.775	0.43	1	0.280	2.29
Basic writing skill	0.637	0.584	3.57	1	3.57
Reading motivation	0.333	0.318	0.437	0.280	1
Total	3.157	4.763	8.622	4.840	13

Table 2. Normalization

Components	Eigen values/ Normalized					Total	Mean
	Ability to understand language	Phonological awareness	Basic reading skill	Basic writing skill	Reading motivation		
Ability to understand language	0.317	0.510	0.149	0.324	0.231	1.532	0.306
Phonological awareness	0.130	0.209	0.269	0.353	0.242	1.205	0.241
Basic reading skill	0.246	0.090	0.116	0.058	0.176	0.686	0.137
Basic writing skill	0.202	0.123	0.414	0.207	0.275	1.219	0.243
Reading motivation	0.106	0.067	0.051	0.058	0.077	0.358	0.072
Total							1

The fourth step is to calculate the normalized Eigen factor by calculating the value of each row divided by the final number in the column

Column 1 row 1 = 1 / 3.157 = 0.317

Column 1 row 2 = 0.142 / 3.157 = 0.130

Column 1 row 3 = 0.775 / 3.157 = 0.246

Column 1 row 4 = 0.637 / 3.157 = 0.202

Column 1 row 5 = 0.333 / 3.157 = 0.106 and so on, so the Eigen values/ Normalization table can be seen in table 2.

In the mean column, the number must be 1 otherwise the calculation is wrong and must be repeated. In the table above the calculation is 1 so the calculation is correct. Furthermore, it is necessary to calculate to find the Consistency Ratio (CR) to determine the consistency of existing data. To calculate the Consistency Ratio, we must first find the Consistency Index (CI).

The fourth step is to calculate the CI (Consistency Index).

$$CI = (\lambda_{max} - n) / (n - 1)$$

$$\lambda_{max} = (3.157 \times 0.306) + (4.763 \times 0.241) + (8.622 \times 0.137) + (4.840 \times 0.243) + (13 \times 0.072) = 5.409$$

$$CI = (5.409 - 5) / (5 - 1) = 0.102$$

Consistency Ratio CR (CR)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	5,8	0,9	1,12	1,24	1,32	1,41	1,45	1,49

Figure 2. Consistency Ratio (CR) Test

Where n = 5, the RI is at 1.12

The fifth step is to calculate the CR (Consistency Ratio).

If the CR is less than 0.1, the result is consistent. If CR is greater than or equal to 0.1, then the results are inconsistent and the paired matrix must be repeated to create. Consistency Ratio (CR) Test can be seen in Figure 2

- Acceptable assessment results are those with CR < 10% (0.1) Then: CR = CI / IR

$$= 0.102 / 1.12 = 0.091$$

CR = **0.091 consistent** (because it is less than 0.1)

So based on the analysis above, the priority of children's literacy skills can be presented in the table as follows:

The sixth step is Conclusion

Table 3. Components of Child Literacy Ability based on Priorities

No.	Components	Score	Rating
1.	Ability to understand language	0.306	Main priority
2.	Basic writing skill	0.243	Second priority
3.	Phonological awareness	0.241	Third priority
4.	Basic reading skill	0.137	Fourth priority
5.	Reading interest/ motivation	0.072	Fifth priority

2.2. Research Subject

The subjects in this study were 170 respondents. A total of 150 early childhood children participated in this study and 20 teachers/ principals were involved in this study. The research subjects were 150 early childhood students who attended 10 Kindergartens in the Solo Raya area. Of the 10 Kindergartens used in the study were class B groups (ages 5-6 years). This study only involved children in group B class because group B was a preparatory class for elementary school, so there were 10 class B groups involved in this study.

2.3. Data Collection

Data about the early literacy activities of children aged 5-6 years were collected by means of observation and questionnaires. Sources of data were also obtained in the form of oral data and written data. Observations were made by looking at the process of literacy learning activities during class. The questionnaire method uses a

measuring instrument for early literacy skills developed by [9] which contains 5 components of early literacy in early childhood. Researchers conducted observations/ observations of 150 early childhood using instruments that have been prepared so that the child's early literacy skills can be seen. The questionnaire was given to 20 teachers/ principals for the sampling technique used by Simple Random Sampling, namely random sampling so that each child has the same opportunity to participate.

2.4. Data Analysis

This activity was carried out by spreading the initial literacy questionnaire that was developed by [9] to ten kindergartens in the Solo region. The results of the questionnaire were analyzed to produce data on the literacy abilities of children aged 5-6 years based on the

conditions in the field. The data were compared with the expected data i.e. data from experts that have been validated using AHP. Comparison of the two children's literacy abilities data will show the existing gap.

3. Results

The results showed that children's ability to understand language was 6.76%, children's phonological awareness reached 5.73%, basic reading ability was 6.5%, basic writing ability was 7.8%, and children's motivation in reading was 3.37%. Thus, it can be concluded that based on the component of children's early literacy skill, age of 5-6 years in the Solo region accumulated to only 30.16% of the expected. The results of the field study of children's early literacy skills can be seen in Figure 3 below:

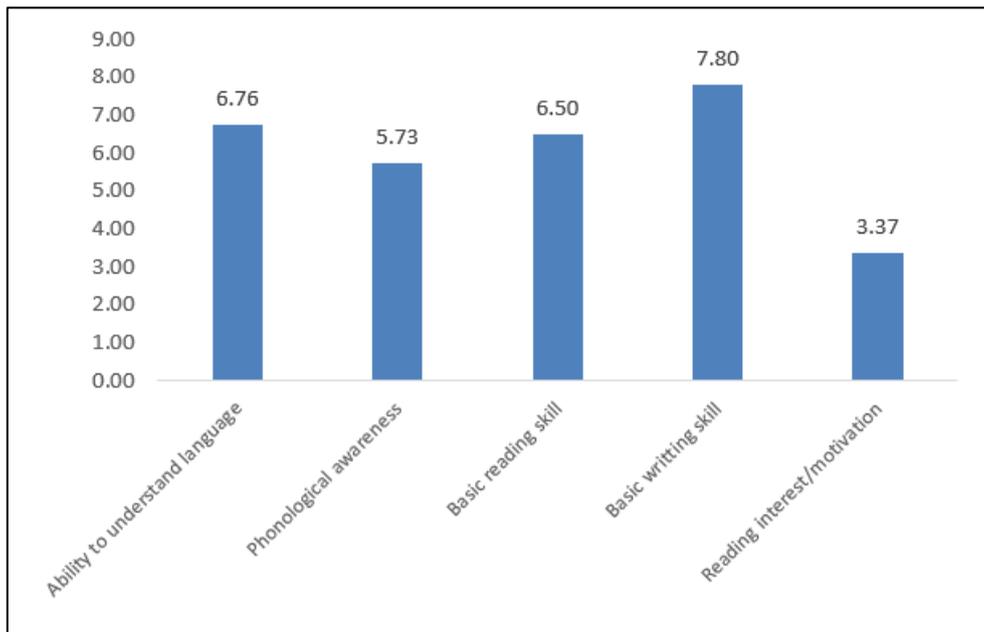


Figure 6. The components of early literacy skill of children in Solo region

To find out the effect of each component, an appropriate calculation was needed. Assuming all components had the same value (had the same effect), the percentage obtained for each component was 20%.

Table 4. The Early Literacy Skill of Children throughout Solo

Literacy Components	Initial Score
Ability to understand language	20%
Phonological awareness	20%
Basic reading skill	20%
Basic writing skill	20%
Reading interest/ motivation	20%
Total	100%

The results of the component scores of children’s early literacy skill can be seen in table 5

Table 5. The Score Table of Children Literacy Skill

Literacy Components	Average	Percentage based on initial score (%)
Ability to understand language	2.01	6.76
Phonological awareness	1.86	5.73
Basic reading skill	1.97	6.50
Basic writing skill	2.18	7.80
Reading interest / motivation	1.51	3.37
Total Score		30.16

Based on the research conducted by [35] then the components that affect the ability of children’s literacy based on expert judgment that has been validated using AHP results can be seen in table 6.

Table 6. Children Literacy Skill based on Expert

No	Components	Value	%
1.	Ability to understand language	0.306	30.60
2.	Basic writing skill	0.243	24.30
3.	Phonological awareness	0.241	24.10
4.	Basic reading skill	0.137	13.70
5.	Reading interest / motivation	0.073	7.30

Table 7. The Score of Early Literacy Skill based on AHP

No	Literacy Component	Average	Percentage based on AHP (%)
1.	Ability to understand language	2.01	10,30
2.	Basic writing skill	2.18	9,56
3.	Phonological awareness	1.86	6,91
4.	Basic reading skill	1.97	4,48
5.	Reading interest / motivation	1.51	1,24

From table 6 (30.60%), basic writing skills (24.30) and phonological awareness (24.10) were components that had a high percentage, thus those components influence children’s literacy skills at the age of 5-6 years old.

Therefore, the component to understand language, basic writing skills, and phonological awareness will get greater literacy stimulation compared to the components of basic reading skill (9.22%) and reading motivation (6.06%). Then the percentage of initial component was calculated based on AHP, so table 5 was changed to table 7.

After an expert score was obtained, it could be seen the gap between the initial literacy skill data in the field and the expected literacy skill conditions. The gap between the initial literacy skill data (in the field) and the expected literacy skill data can be seen in table 8.

Table 8. The Gap on Children Literacy Skill Data (Field Study) with Expected Data

Literacy Component	Initial Score After AHP(%)	Gap (%)	Expert Score (%)
Ability to understand language	10.30	20.30	30.60
Basic writing skill	9.56	14.74	24.30
Phonological awareness	6.91	17.19	24.10
Basic reading skill	4.48	9.22	13.70
Reading interest / motivation	1.24	6.06	7.30
Total	32.49	67.51	100

From table 8, it can be seen the gap between children’s literacy skill in the field and the expected data. The conclusion is that the children’s literacy skill in the field has only reached 32.49% of 100%. This means that there was a gap of 67.51%. A large gap existed in the components of the ability to understand language (20.3%), basic writing skills (14.74%), and phonological awareness (17.19%). This means that the three components have a great influence on children’s literacy skill. It means that the components of understanding language, the basic ability of writing and phonological awareness were stimulated greater than the components of basic reading skill (9.22) and reading motivation (6.06).

4. Discussion

This study aims to look at the gap between the literacy abilities of children in the field and the expected conditions. Furthermore, it can be seen from the gap the components that can affect the literacy skill of children aged 5-6 years.

The results of the research showed that the children’s ability to understand language was 6.76%, the children’s phonological awareness reached 5.73%, basic reading ability was 6.5%, basic writing skill was 7.8%, and children’s motivation in reading 3.37%. Based on these results, it can be concluded that based on the criteria of the initial literacy skill of kindergarten B children throughout Solo Raya, the accumulation has only reached 30.16% of what was expected.

The gap between the preliminary study in the field and the expected data showed that the data on children’s

literacy skill in the field only reached 32.49% of the 100% expected (table 8). This meant that there was a gap of 67.51%. A large gap existed in the components of understanding language (20.3%), basic writing skills (14.74%), and phonological awareness (17.19%). This can be interpreted that the components of the ability to understand language, basic writing skills, and phonological awareness are influential components in the stimulation of children's literacy development. Since these three components have a large influence on the stimulation of children, they will get greater stimulation compared to the components of basic reading skills (9.22%) and reading motivation (6.06%).

Language is a very important communication tool that is important for children, as children are able to express all their want and need through language. This is in accordance with the research [9] which states that children's learning processes are mediated by language, therefore literacy skill is always preceded by language development. Good phonological awareness will have a positive impact on children's literacy skill, whereas weak phonological awareness results in children experiencing reading disabilities. This is consistent with the statement [36] states that phonological awareness is the degree of children's sensitivity towards the sound structure in oral language.

The basic ability to read in early childhood is the ability to name letters and write them, spell simple words, recognize letters and signs around, identify books and titles, and carry out activities related to books. The earliest form of writing produced by early childhood is in the form of scribbles and drawings, so the teacher needs to stimulate activities related to the children's fine motor skills such as drawing, cutting, squeezing, and so forth. This opinion is in accordance with research [38], [40] that writing ability is facilitated by the teacher with fine motor activities using various materials in the class including markers, stamps, chalks, scissors, papers, pencils, pens, paints, crayons, blackboard chalks, drawing dictionaries, sticks, and others. Children's interest and motivation to read can be stimulated well with the support of reading environment. In addition to reading books, technology advancement is currently very possible for children to read through e-books. This is consistent with the statement [41], [42] that there are more and more young children who use tablets in their literacy experiences. The increasing use of smartphones and tablets sets the stage for new cellular-based education programs that seek to increase children's learning and involvement at school and at home. The phonological awareness component, word reading, and early childhood writing skills can be improved through the use of a smartphone [26].

5. Conclusions

The teacher plays an important role in developing

children's stimulation. Stimulation must be fun, enjoyable, not make children feel burdened, able to form habits, interests, and positive motivation for children. In the era of disruption or millennial era, the use of ICT is something that cannot be avoided. This indicates that the influence of technology is huge and unavoidable.

The results of this study imply that teachers and principals must be adaptive in the use of a variety of innovative learning approaches. The availability of ICT-based learning infrastructure is very helpful in facilitating children's learning based on their needs. Children are very adaptive in using ICT so that this will motivate children to learn. Play activities in early childhood by utilizing ICT media is very effective to use. The use of ICT is believed to increase children's competence. The use of the WLA integrated ICT model will be able to arouse motivation and answer children's high curiosity so that the children's early literacy skill will develop optimally.

Early literacy in early childhood is a very important component and is able to encourage on going reading involvement in the future. Literacy is a routine activity that cannot be separated from modern human life styles, even more in the world of education. This study only looks at the early literacy skill of children aged 5-6 years based on the existing components in schools, namely teachers and school principals. Exploration of parental involvement in stimulating children's literacy is an important part but has not been discussed in this study.

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