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Difficulty of Visual Recognition: Identifying the Direction Confusion of Reading Letters in Young Children

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Abstract

Early literacy skills are essential for children's academic development. This research used a comprehensive approach that included observations, assessments, and interviews with children and educators from various kindergartens, which involved 1040 children and 99 teachers from 71 early childhood institutions. The comparison of difficulties in pronouncing letters was measured through observation and assessment of children's ability to recognize the shape and pronounce of letters using augmented reality digital flashcards with a companion application called KIDOPA. The results show that children have difficulty saying the letters b, d, m, w, p, q, n, u, x, and z while reading letters. These difficulties are linear with the teacher's understanding of the importance of teaching literacy to children.

Introduction

Mastery of essential reading skills is vital in shaping a child's academic journey. Reading is the foundation for further cognitive and language development, so educators and researchers must study the learning process's ins and outs (Vajs et al., 2022). The fundamental aspect of reading proficiency lies in visual recognition, where children are required to quickly identify and understand letters and their orientation. In early literacy development in children, the ability to recognize and differentiate letters plays a critical role in shaping children's future academic success (Ehri, 2022).

For young children, mastering letter recognition is an important milestone that is the basis for good reading and writing skills. However, many children face barriers in visual recognition by facing challenges in correctly distinguishing letters (Liebig et al., 2021). In recent years, there has been growing interest in investigating the challenges young children face in recognizing letters (Richmond & Taylor, 2014). The phenomenon of confusion between letters is an exciting but confusing problem that needs further research (Al-Megren & Almutairi, 2019). Visual recognition is a complex cognitive process involving the brain's ability to interpret and understand visual stimuli (Vajs et al., 2022). Unfortunately, some children experience discrimination confusion, which causes errors such as letter reversals and rotations (Carroll et al., 2022). This tendency to imitate or misinterpret certain letters can lead to potential reading and spelling difficulties (Sari et al., 2022). These difficulties can hinder a child's

reading progress and hinder the development of literacy skills.

According to Van Uittert et al. (2022), good letter and number recognition develops linearly as the child's visual perception develops. It is reasonable to assume that, along with the development of linear visual perception, children can integrate letter and number recognition skills well in reading and writing activities. This situation aligns with what Gusnita et al. (2019) stated: increasing early childhood letter recognition skills is shown by their ability to name letter sounds, combine consonants and vowels to form words, and imitate letter shapes.

Orfan and Timor (2023) compared the difficulty level of children's alphabet letter recognition and hand copying skills between two languages, English alphabet letters and Dari or hijaiyah letters. The research findings showed a significant difference in the hand-copying test, where it was seen that the children took more time to copy the letters of the Dari alphabet than the letters of the English alphabet. In other words, the letter Dari requires more concentration for children when copied by hand. The results of the study showed that the more complex the letters of the alphabet, the more difficult and time-consuming it was for children to understand and construct them in their minds.

There are several strategies that educators can use. Play activities can help achieve learning goals optimally. Children show an increase in letter recognition skills when the teacher provides a variety of activities and a fun learning atmosphere (Gusnita et al., 2019). The use of various learning media can also affect children's letter-recognition abilities. Examples are using flashcards, story books, alphabet blocks, animated videos, and technology such as AR in literacy learning activities.

Another way the teacher can do this is by comparing the picture to the objects around the child. The embedded images are images of objects that are shaped like letters and have names that start with the sound of the letter, for example, a snake drawn to form an S, a table drawn to form a T, a mountain drawn to form the letter M (Ehri, 2022).

Understanding the root causes of these learning barriers is critical in developing effective teaching strategies and intervention programs tailored to meet student needs. This study investigates the complexity of difficulty distinguishing letters in children. The aim is to identify and understand the reversal/confusion experienced by children when reading letters and the influence of the level of literacy comprehension of PAUD educators because early detection and targeted intervention can reduce the challenges faced by early childhood so that children can build a strong foundation in reading and encourage children to achieve academic success in the future (Arief et al., 2022).

Method

This research uses a mixed-method approach, which includes quantitative and qualitative methodologies. A cross-sectional regression approach was used to explore difficulties in visual recognition of letters by early childhood and collect quantitative data to provide statistical support for the qualitative findings and to determine how much influence teacher literacy comprehension has on children's literacy skills.

Sample and Participants

For the sample in the study, researchers involved 99 respondents consisting of school principals and teachers from 71 early childhood education institutions in Banyuwangi Regency. As for the early childhood involved, 1040 children were selected as samples from a comparative study of difficulties pronouncing letters using digital augmented reality flash cards. The research instruments used included observation, questionnaires, and interviews. Observations in diverse early childhood will be assessed using a series of carefully designed activities using Augmented Reality flash card media. In addition, interviews and questionnaires will be conducted with educators to gather valuable insights into teachers' understanding of child literacy.

Study Design

Researchers will collect qualitative and quantitative data, then analyze them separately and integrate the results to develop a comprehensive understanding. Qualitative data was obtained through participant observation, interviews with teachers and parents, and direct observation of children interacting with letters. The results of interviews and field notes will record the children's feelings, attitudes, and subjective understanding of the direction of letters. Qualitative data will be analyzed by identifying patterns of errors and children's feelings toward several letters. The results of this analysis will lead to an in-depth understanding of the visual difficulties faced by children.

Data Analysis

Quantitative data were collected through assessment tests or letter recognition tests by recording children's success and error rates in recognizing letter directions. The number of errors and success rate will be used for statistical analysis. Quantitative data will be analyzed using descriptive statistics and comparative analysis to see how often children make mistakes and identify the most frequently identified letter direction patterns. Once both data types are analyzed separately, the qualitative and quantitative results will be integrated better to understand visual difficulties in letter recognition in young children.

Results and Discussion

This research involved 99 school principals and teachers from 71 early childhood education institutions in Banyuwangi Regency and 1040 Kindergarten B children aged 4-7 years. The distribution of demographic data for the research participants involved can be seen in Table 1.

Table 1. Demographic Data of Students, Teachers, and Principals Involved

	N	Min	Max	Mean	Std. Deviation
Student					
Gender	1040	1	2	1.68	0.467
Man	333				

	N	Min	Max	Mean	Std. Deviation
Woman	707				
Age	1040	4	7	5,37	0.913
4 years	129				
5 years	578				
6 years	150				
7 years	183				
Teachers and Principals					
Gender	99	1	2	1.68	0.467
Man	13				
Woman	86				
Last education	99	1	5	2.38	0.804
S1 non-linear	40				
S1 PG PAUD	43				
S2 PG PAUD	2				
Master of Psychology	1				
Senior High School	13				
Position	99	1	3	2.32	0.512
Admin/TU	2				
Teacher	34				
Headmaster	63				
Taught Class	99	1	3	2,29	0.704
KB	14				
Kindergarten A	42				
Kindergarten B	43				

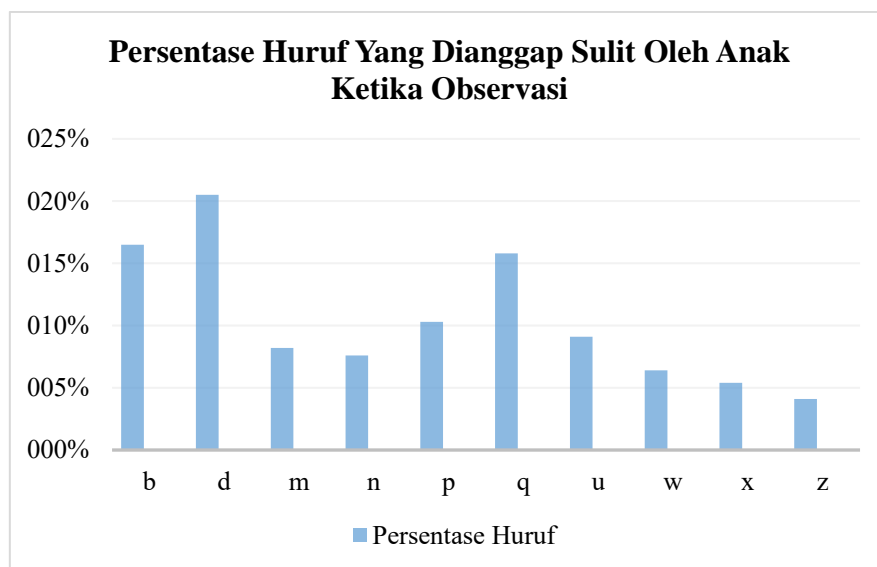
Observation

Observations were conducted on 1040 children (girls n=707; boys n=333) from 71 PAUD institutions in Banyuwangi Regency. It can be seen in Table 1 that the ages of the children sampled in this study are in the range of 4-7 years, with details of 129 children aged 4 years, 578 children aged 5 years, 150 children aged 6 years, and 7 years old as many as 183 children. 99 teachers and school principals observed the 1040 children through reading experiments using augmented reality digital flash cards. Based on these activities, it is known that several letters still need to be made more accessible for children to understand and differentiate. The percentage comparison of difficulty between letters can be seen in Graph 1.

Of the 26 letters a to z, it was found that the letters b, d, m, w, p, q, n, u, x, and z were identified as letters that were considered challenging in the learning process. The letter "d" is the letter with the highest difficulty level in pronunciation, namely 20.5%, and the letter "b" is the letter with the second highest level of difficulty after that, namely 16.5%, because the letter "d" and the letter "b" have almost the same shape, so children often remember

and pronounce them backward. Another pair of letters that have the same case as the letters "d" and "b" are the letters "p" and "q". The letter "q" is the third most challenging letter, with a percentage of 15.8%, and the letter "p" is 10.3%. Other letters that are also considered difficult for children include the letter "u" as much as 9.1%, the letter "m" as much as 8.2%, the letter "n" as much as 7.6%, the letter "w" 6.4%, the letter "x" was 5.4%, and the letter "z" was 4.1%. The teachers believe that the difficulties experienced by children in differentiating speech (phonemes) are because children still often write the alphabet upside down, and the alphabet has almost the same shape between the letters "b" and "d"; the letters "m" with "w"; letters "p" with "q"; and the letters "n" with "u." PAUD teachers need to pay attention to the formation of letters, such as lines, circles, curves, and the shape of the letters themselves (Wright et al., 2019). As an instructor and role model, the teacher needs to clearly demonstrate how a letter can be formed and the purpose of writing itself (Gerde et al., 2015). That way, children will understand that writing is a meaningful activity because by writing, children can communicate what they want to convey.

Another thing that causes children to need help understanding the alphabet or letters properly is the lack of learning media available in the school environment and the difficulty in finding objects around children that start with the alphabet, such as x and z. It means that these letters need to be implemented in the learning process for children in a meaningful and fun way.



Graph 1. Results Comparison of Difficulties in Pronouncing Letters by Children

Reliability Test

A teacher also needs to understand how important it is to instill literacy in children from an early age and understand what and how to teach literacy to children. Teachers' knowledge of children's early literacy development and age-related developmental expectations is crucial for their instructional decisions (Gerde et al., 2018). To find out other factors in children's difficulties in recognizing letters from the perspective of PAUD educators, researchers also collected data related to children's understanding of literacy by the teachers who participated in this research. The reliability test result of the questionnaire instrument using Cronbach's Alpha was .958, with 11 questions using the scale. The data can be seen in Table 2.

Table 2. Descriptive Statistics Results of Teacher and Principal Literacy Understanding Questionnaires

	N	Min	Max	Mean	Std. Deviation
Questionnaire Results					
Understanding Literacy of Teachers and School Principals	99	21	44	32.56	4,638

From the table, it can be seen that the average teacher's understanding related to literacy reaches 32.56 out of a maximum value of 44, which means that the teachers involved in the research entirely understand the importance of literacy in early childhood and how to design exciting literacy activities for children.

Regression Test

To see whether there is a relationship between gender, last level of education, position, and class level taught by teachers, and their understanding of the importance of literacy, a series of tests between variables and regression tests were carried out, which can be seen in Table 3 and 4.

Table 3. Test Results between Four Variables with Teacher's Literacy Understanding Level

	Dependent Variable	Type III Sum of Squares	df	MeanSquare	F	Sig.
Intercepts	Literacy	22754,996	1	22754,996	1168,494	0.000
Gender	Literacy	13,777	1	13,777	0.707	0.403
Education	Literacy	195,242	4	48,810	2,506	0.049
Position	Literacy	85,223	2	42,612	2,188	0.119
Taught Class	Literacy	19,695	2	9,848	0.506	0.605

Table 4. Regression Test Results between Four Variables with Teacher's Literacy Understanding Level

Hypothesis	R	R Square	Adjusted R Square	Std. Error of the Estimate	t	Sig.
Gender → Literacy	0.027	0.001	-0.010	4,661	0.270	0.788
Recent Education → Literacy	0.074	0.005	-0.005	4,650	0.726	0.469
Position → Literacy	0.005	0.000	-0.010	4,662	0.052	0.959
Classes Taught → Literacy	0.125	0.016	0.005	4,626	1,238	0.219

Based on the results of regression tests that have been carried out on the four variables, the R-value in Table 4 tends to be very low, namely in the range of 0.00-0.125, which means there is almost no relationship between

these four variables and the results of the literacy understanding questionnaire. Likewise, the significance value in Table 4 is also in the range of 0.219-0.788. This result shows no relationship or influence on teachers' understanding of the importance of literacy because the significance value is more significant than > 0.05 . In this way, it can be concluded that gender, highest level of education, position, and class taught by PAUD educators have no effect on teachers' understanding of the importance of literacy for early childhood.

However, if studied further, the variables of class taught and last education can have a higher influence than other variables because the direct experience of teaching staff in teaching literacy from an early age will shape their understanding regarding the importance of literacy for children. It is also essential to evaluate application-based learning and shape student motor perception assessment norms (Suhartini et al., 2023). Besides that, recent education influences the mindset and knowledge of teaching staff regarding literacy for early childhood. Teachers with a more vital understanding of spoken and written language structure demonstrate higher quality early literacy pedagogical practices (Park et al., 2020). This finding also aligns with Bingham et al. (2022), where teachers who demonstrate knowledge of the various components of writing and use a variety of higher-quality instructional supports will provide more opportunities for children to engage in writing activities. Meanwhile, teachers with limited writing knowledge can develop negative attitudes toward children's writing and literacy skills because they teach children less often how to write and are less open to trying new strategies in teaching writing to children (Hall, 2016).

A literate environment can also influence a child's ability to recognize letters because children begin to familiarize themselves with letter forms early when they grow up in a literate society and are exposed to continuous letter patterns (Orfan & Timor, 2023). training using different cultures develops knowledge for students (Sujarwo et al., 2023). Another study said that the speed with which teachers introduce or teach letters to children in class affects their ability to recognize and their accuracy in comparing letters. School conditions implementing numeracy literacy improve students' reading and writing abilities (Rosnelli & Ristiana, 2023). Teachers who use a faster rate, or more than one letter per week, will have higher letter knowledge at the end of preschool (Sunde et al., 2019). It is imperative to increase the speed of introducing letters so children can see the alphabet and compare letters, such as discriminating between letter names, sounds, and shapes (Gerde et al., 2018). The development of time brings several changes to humans, including in a physiological context (Akhmad et al., 2023). looking at this can explain that time influences several things, including the development of cognitive abilities for children. Instructions for forming letters that are differentiated from each other will help children to differentiate letters easily and be better prepared for the next level of education (Piasta, 2014).

KIDOPA

Letter recognition activities using the KIDOPA application media were quite effective and exciting in increasing children's enthusiasm for learning letters. The KIDOPA application is a companion application that children can use to learn letters through interactive flashcards based on AR or augmented reality. This application is also the application used when collecting data in this study. Flashcards contain uppercase letters and lowercase letters, pictures of children doing an activity, and writing related to the activities the child is currently doing. For example,

on the flashcard letter "Bb," the activity carried out by the child is kicking a ball. So the writing written on the card is "I Kicked the Ball." When the card is scanned using the KIDOPA application, the child in the image moving and carrying out activities in the form of 3D animation will be seen on the device screen. An example of the application display can be seen in Figure 1.



Figure 1. Display of the KIDOPA Application

In addition to showing a high level of enthusiasm in learning the shapes of letters and their pronunciation, children also show their curiosity. It is known from their attitude and behavior when the observation activities are carried out. Children actively imitate the sound from the application when the AR image moves. Children also continue to repeat the activity of scanning flashcards to see the animated movements displayed in the application. That way, learning to recognize letters using KIDOPA digital augmented reality flashcards is included in meaningful learning activities for children. The teacher's opinion regarding using this application in learning activities is that teachers or teaching staff find it helpful to provide descriptions of the letters in the names of objects and animals around the child that are known to the child. Teachers also feel that this application is an interactive learning media innovation that is interesting and accessible for teachers, children, and parents at home.

Conclusion

The fundamental aspect of reading proficiency lies in visual recognition, where children are required to quickly identify and understand letters and their orientation. Of the 26 letters of the alphabet from a to z, it was found that the letters b, d, m, w, p, q, n, u, x, and z were considered letters that were difficult for children to identify during the learning process because the letters have similar shapes and are a reflection of their partner letters. For this reason, PAUD educators need to pay attention to their way of introducing or teaching the formation of a letter to children, starting from lines, circles, curves, and the shape of the letters. Teachers need to demonstrate how a letter can be formed and the purpose of writing so that children can understand the importance of mastering the ability to write letters and compare letters, such as discriminating between letter names, sounds, and shapes. Teachers also need to present varied and meaningful activities so that children feel happy and enthusiastic about receiving learning. One alternative activity teachers can carry out is using the KIDOPA companion application to teach children letter recognition and pronunciation in a meaningful way. Teachers also need to present varied and

meaningful activities so that children feel happy and enthusiastic about receiving learning. One of the alternative activities that the teacher can carry out is to use the KIDOPA companion application to teach letter recognition and its meaningful pronunciation to children. Teachers also need to present varied and meaningful activities so that children feel happy and enthusiastic about receiving learning. One alternative activity teachers can carry out is using the KIDOPA companion application to teach children letter recognition and pronunciation in a meaningful way.

Recommendation

The instruments used in this research are still not focused on how teachers understand the importance of strategies for introducing letters to children, so it can be a recommendation for subsequent research to further deepen the influencing factors of educators' literacy understanding on the ability to compare letters in early childhood.

Implications

The findings of this study have several implications for various stakeholders:

- The results highlight the importance of promoting alternative exercise options, home-based workouts, and virtual sports to maintain physical fitness during restricted movement. Healthcare professionals and educators can provide guidance and resources to individuals, emphasizing the significance of a well-rounded approach to physical fitness that addresses various components.
- The study findings suggest the need for fitness professionals and trainers to develop innovative and adaptable exercise programs that cater to individuals' preferences and limitations during the pandemic. They can leverage technology and virtual platforms to provide guidance, motivation, and support to individuals seeking to maintain or improve their physical fitness levels.
- Policymakers can utilize the insights from this study to inform public health strategies and interventions aimed at promoting physical fitness during pandemic situations. The findings emphasize the importance of accessible and convenient exercise options and the need to provide resources that cater to individuals' preferences and limitations.
- The study provides valuable insights into college students' physical fitness behaviors and needs during the pandemic. College and university administrators can use these findings to develop and enhance resources, facilities, and support systems that promote physical fitness and well-being among their student population.
- The study findings encourage individuals to embrace alternative physical activity and exercise methods, such as home-based workouts, virtual sports, and recreational activities, to maintain their physical fitness levels during the pandemic. It highlights the importance of adapting to new circumstances and seeking accessible and convenient options to prioritize health and well-being.
- Overall, this study contributes to the understanding of maintaining and improving physical fitness during a pandemic. Exploring the adaptations made by college students and developing an adaptable fitness test procedure offers valuable insights and practical tools to promote physical fitness and well-being during challenging times.

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