



Educational Applications to Improve Cognitive Development in Early Children: A Review of Educational Psychology

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ABSTRACT

Educational applications for early childhood (PAUD) are very important for growing children's cognitive abilities. Cognitive development in early childhood develops quickly and dynamically and can be influenced by many factors, such as the environment, opportunities and their own cognitive style. This research was conducted with the aim of creating educational applications that can improve the cognitive abilities of young children through various fun educational activities. Apart from that, this educational application also aims to improve creative abilities, remember and recognize the environment around them, recognize the concepts of numbers, letters, colors, and solve problems, as well as the ability to develop other cognitive abilities. The method used by researchers in researching Educational Applications to Improve Cognitive Development in Early Childhood: A Review of Educational Psychology is to use a quantitative method. The data obtained by researchers was obtained from the results of distributing questionnaires. The distribution of questionnaires carried out by researchers was carried out online using Google Form software. Then the results of the data acquisition will also be tested again using the SPSS application. The results of research on educational applications to improve the cognitive development of early childhood can show several things related to educational psychology, such as, experience-based learning methods can encourage children's creativity. From this research, researchers can conclude that educational applications to improve cognitive development in early childhood are very effective for use in the learning process. With the various educational applications used in learning, it is able to create a fun learning process and can provide new experiences to young children.

Keywords: *Applications, Cognitive, Educational*

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INTRODUCTION

Early childhood education is a coaching effort aimed at children from birth to six years of age and is carried out through stimulation to help children's physical and spiritual growth and development so that they are ready for further education (Kayiran & Sönmez, 2020). Young children are very interested in their environment. He is very interested in knowing about everything that happens around him (Sabol et al., 2018). This involvement is demonstrated in infancy by grabbing and putting into the mouth anything within reach. Children aged three to four years start to enjoy asking questions, even if in very simple language (Murtha et al., 2021). They also often disassemble everything to satisfy their curiosity. Children's questions this age usually start with the word what or why.

Early childhood children enjoy imagining and developing concepts that go far beyond the real world. Children are often thought to be lying because they cannot differentiate between reality and fantasy (Lipscomb et al., 2021). However, they can tell many things very convincingly as if they saw or experienced them themselves, despite the fact that it is just their fantasy or imagination (Ressel et al., 2022). As an educator, you must help children become curious, for example by giving them several items or models that are cheap enough to be taken apart, and every child's question must be answered with a reasonable and in-depth answer, not just a quick answer (Aylward & Neilsen-Hewett, 2021).

Early childhood experiences very rapid growth and development in various aspects, so they are often referred to as the golden age. For example, brain development occurs very quickly during a child's first two years of age. The baby's brain weight increases to ± 350 grams at birth, increases to 500 grams at the age of 3 months, and increases again to ± 1 kg at the age of 1.5 years, because nerve cells cannot divide anymore after the baby is born, the number of nerve cells does not increase anymore (Richardson & Langford, 2022). Early childhood children begin to enjoy playing and hanging out with their peers. He begins to learn to share, give in, and wait his turn when playing with his friends (Hautakangas et al., 2022). Children build their identity through social interactions with their peers. Children also learn to interact with other people and become good people in their environment (Jeong et al., 2021).

Stimulation must be given during childhood so that growth can develop optimally. PAUD is a very important institution (Rodríguez Lozano & Vicente Nicolás, 2019). The goal is to help children grow and develop well. Kindergartens offer early childhood education through formal education channels, while informal channels consist of play groups and daycares (Sumarni et al., 2019). In order for children to develop their full development, they need to communicate with other people and objects. Religious and moral values, physical motor skills (gross and fine motor skills), cognitive, linguistic, emotional, social and artistic are all aspects of development that occur in early

childhood and they experience a sensitive period to accept all the developmental possibilities available to them (Varshney et al., 2020).

The child's ability to understand logically, such as understanding differences, classification, planning, patterns, initiative, and cause and effect, is called early childhood cognitive development (Taylor et al., 2023). Stimulation and stimulation from the real world, such as playing with peers, showing affection, or seeing animals, influences this cognitive development process (Eilers, 2023). Therefore, both parents and teachers must know the stages of child development because cognitive development is an important part of the development of early childhood thinking abilities (Von Suchodoletz et al., 2022).

The learning process in early childhood, of course, the teaching and learning process focuses on the flow of information from teacher to child (learning at the teacher center), so the lecture method is very important (Yen & Lee, 2019). Learning failure can be defined as poor learning outcomes. The causes could be children, teachers, or the learning environment used is less effective (Liu & Zou, 2023). Ineffective learning processes can be caused by teachers feeling bored or failing to design interesting learning media for early childhood education (Thorpe et al., 2022). To maintain cognitive development in early childhood, cognitive thinking and observation processes, which develop regularly from infancy to adulthood, influence the way children acquire and use knowledge (Engelmann et al., 2018).

Cognitive development in early childhood needs to be developed, because children's cognitive abilities influence their ability to process data, reason and solve problems (Massing et al., 2020). Teachers must be able to develop interesting educational applications for the cognitive development of early childhood because they can improve the cognitive abilities of early childhood (Chan et al., 2021). Educational applications for early childhood are learning media developed to help young children learn and play interactively (Pichardo Martínez et al., 2019). This application is designed to improve children's cognitive abilities, such as thinking, observing and solving problems, as well as developing language and motor skills (Nunley, 2020).

The type of method used in this research is a quantitative method. This method is used so that the final results of the processed data can be known clearly and precisely regarding educational applications to improve cognitive development in early childhood (Ansari et al., 2019). The data collection process was obtained by the researcher from the results of the respondents' answers that the researcher had carried out. Researchers created a questionnaire with 10 questions, then distributed it via Goggle from. After the data is collected, the data will be calculated into a percentage and presented in table form (Sembianti et al., 2023). In processing research data, researchers use SPSS software which aims to make it easier for researchers to process data, and the data results are more relevant. Furthermore, the researcher really hopes that the next researchers will research and study more deeply regarding educational applications to improve cognitive development in early childhood (Nolan & Molla, 2018)

RESEARCH METHOD

Research Design

This research uses a quantitative research design, which uses statistical processes to present data in the form of numbers. Researchers created twenty questions to collect information about the research to find out the results. Researchers will ask respondents to answer the questions asked, which will be presented in the form of tables and percentages (Love & Hancock, 2022). The purpose of processing this data with the SPSS application is to compare the results of respondents' answers. After this comparison, researchers can provide solutions for any information they get about educational applications to improve cognitive development in early childhood.

Research Procedure

In this research, researchers investigated educational applications to improve cognitive development in early childhood. The aim of the researcher is to investigate this matter so that the researcher can collect, analyze and provide understanding of the data that has been collected. In making questions, the researcher used good language that was easy for respondents to understand when filling out the questionnaire distributed by the researcher later (ElSayary et al., 2022). This aims to ensure that respondents who provide responses to questions asked by researchers can be answered quickly. That way, it will be easier for researchers to test the data being investigated regarding educational applications to improve cognitive development in early childhood.

Research Subject

In researching educational applications to improve cognitive development in early childhood, researchers of course determine the subjects for their research. In this research, the subject of this research was aimed at PAUD teachers from various educational institutions (Fernández-Abella et al., 2019). Before distributing the questionnaire by the researcher, the researcher asked the respondents first to be willing to spend their time filling out the questionnaire that the researcher would distribute. The questionnaire each contains 10 questions about educational applications to improve cognitive development in early childhood.

Research Ethics

After the researcher carried out several stages as previously explained, in conducting research, the researcher also paid close attention to ethics and manners in research. Researchers believe that ethics needs to be considered whenever and wherever, including in the research being conducted. This aims to gain trust and readiness from the respondents or those who are the objects of this research (Joo et al., 2020). Furthermore, in this research, the researcher also explains information related to the research, one of which is information in filling out the questionnaire. This information was explained by the researcher so that the respondents were ready and willing to voluntarily provide responses and answers to the questions asked by the researcher (Bartholdsson, 2021).

Data Collection and Analysis

Data collected by researchers in researching educational applications to improve cognitive development in early childhood will be processed into the SPSS application. Then the data that has been obtained will be presented by researchers in the form of tables and diagrams. The purpose of presenting it in table and diagram form is to be able to see a comparison of the results of research conducted by researchers regarding educational applications to improve cognitive development in early childhood. Next, the obtained data results are converted into percentages or averages. Then the data results will be tested again using the T-test.

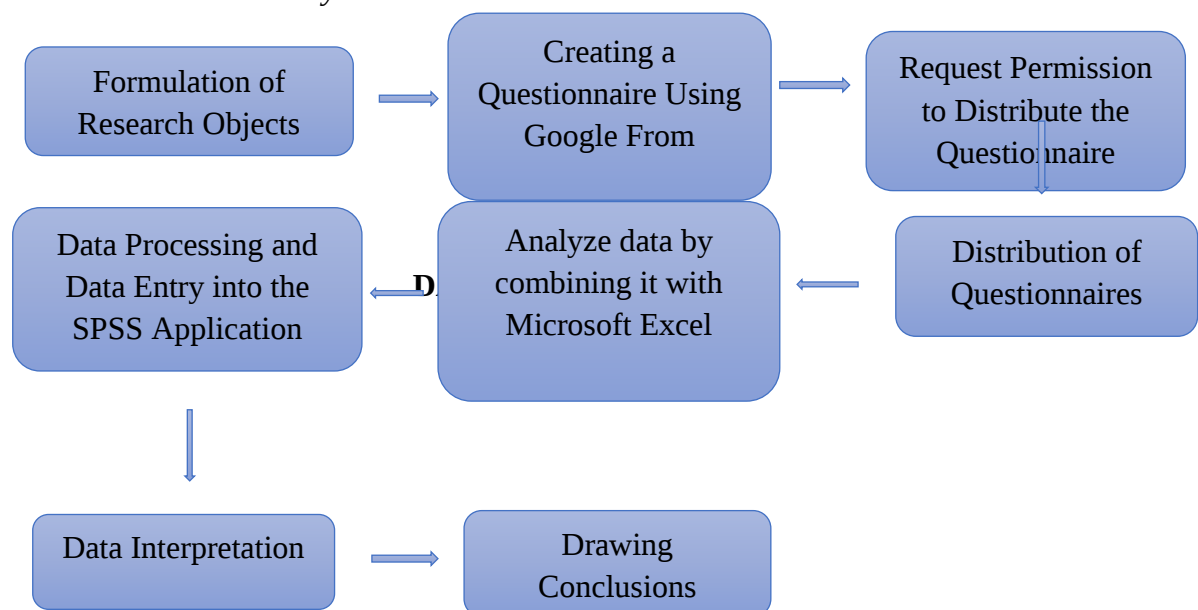
Table 1

Application Category to Improve Cognitive Development in Early Childhood

No	Earning Category	Respondent Subject	Percentage (%)
1	Earning Category	PAUD Teacher	>90%
2	Strongly agree	PAUD Teacher	35-70%
3	Agree Disagree	PAUD Teacher	15-30%
4	Disagree Don't agree	PAUD Teacher	5-15%

Figure 1

Data Collection and Analysis Flow



RESULTS

Early childhood cognitive development is critical to the general development of the child. Children's brains develop very rapidly during early childhood, especially between the golden years and six to six years of age, and they are very responsive to stimuli from their environment (Akyol & Garrison, 2019). In such a situation, educational applications can be useful to promote children's cognitive development. From an educational psychology perspective, this review will discuss various

educational methods that can be used to enhance early childhood cognitive development (Alsharhan et al., 2021). Cognitive development includes thinking, remembering, understanding and problem solving. One application that can be used and applied in an early childhood education is a game-based learning application.

Table 2

Recap of Percentage Results from Respondents' Answers

No.	Question	strongly agree	Agree	Disagree	Don't Agree
1	Interactive educational apps provide mental stimulation that is essential for early childhood cognitive development.	60%	20%	10%	10%
2	Game-based learning applications can increase children's motivation to learn in a fun way	45%	30%	15%	10%
3	Language education apps help children learn foreign languages at an early age, which can improve their critical thinking ability	30%	30%	35%	25%
4	Science and technology applications introduce basic concepts that can stimulate children's curiosity and logical thinking skills.	40%	20%	25%	15%
5	Personalised learning apps allow children to learn at their own pace and ability, increasing the effectiveness of learning.	50%	30%	20%	0%
6	Apps that involve parents in the learning process can strengthen emotional and cognitive support for children.	40%	35%	25%	5%
7	The content of educational apps should be of high quality and age-appropriate to ensure optimal benefits.	35%	55%	10%	5%
8	Screen time limits are important to prevent the negative impact of technology use on children's health.	45%	35%	20%	0%
9	Attractive app design can improve engagement and retention of information in early childhood	30%	25%	40%	5%
10	The use of educational apps can help children develop basic skills such as reading, writing and counting.	55%	30%	15%	0%

Table 2 above shows the distribution of questionnaires that have been conducted by researchers. This questionnaire contains ten questions about Educational Applications to Improve Cognitive Development in Early Childhood: A Review of Educational Psychology. In addition, during the distribution of the questionnaire, the researcher has percentageed each response result from the respondents. Therefore, respondents can choose to answer the researcher's questions by providing options such as strongly agree, agree, disagree, or disagree. And it can also be seen from the first question asked by the researcher regarding Interactive educational applications provide mental stimulation that is essential for early childhood cognitive development, getting the highest score of 60% strongly agree option.

The second question about game-based learning apps can increase children's motivation to learn in a fun way, scored 45% strongly agree. The third question about language education apps helping children learn foreign languages at an early age, which can improve their critical thinking skills, scored 35% strongly disagree. The fourth question about science and technology apps introducing basic concepts that can stimulate children's curiosity and logical thinking skills scored 40% strongly agree. The fifth question, personalised learning apps allow children to learn at their own pace and ability, increasing the effectiveness of learning, scored 50% strongly agree.

Furthermore, the sixth question that apps that involve parents in the learning process can strengthen emotional and cognitive support for children, got a percentage of 40% who strongly agreed. The seventh question that the content of educational apps must be of high quality and age-appropriate to ensure optimal benefits, gained a percentage of 55% agreeing. In the eighth question about Screen time limits are important to prevent the negative impact of technology use on children's health, there was also a strongly agree option of 45%. The ninth question about Attractive app design can increase engagement and retention of information in early childhood, got a percentage result of 40% who disagreed. For the last question about The use of educational apps can help children develop basic skills such as reading, writing and counting, got a percentage of 55% in the strongly agree option.

Table 3

Recap of Percentage Results from Respondents' Answers

No.	Question	strongly agree	Agree	Disagree	Don't Agree
1	Apps that teach social skills can help children learn to interact with others in a safe virtual environment	50%	25%	15%	10%
2	Periodic evaluation of the education app in use is important to ensure its effectiveness	25%	50%	25%	0%

3	Adaptive education apps can adjust the level of difficulty based on child development	65%	20%	15%	0%
4	Integration of offline and online learning through apps can provide a more holistic learning experience	30%	35%	40%	25%
5	Apps that utilise augmented reality technology can offer a more interactive and immersive learning experience.	35%	45%	15%	5%
6	Apps that focus on memory development can help strengthen early childhood memory skills	55%	25%	20%	0%
7	App with progress tracking feature allows parents and teachers to monitor children's development in real-time	80%	20%	0%	0%
8	Availability of access to quality education apps must be ensured to address the digital divide	35%	40%	20%	5%
9	Cooperation between app developers and education experts is needed to create content that is useful and suited to children's developmental needs.	45%	15%	30%	10%
10	Judicious use of educational apps can be an effective tool to support and accelerate early childhood cognitive development.	60%	30%	10%	0%

In the table 3 statement above, researchers have also made ten questions. Which can be seen from the first question regarding applications that teach social skills can help children learn to interact with others in a safe virtual environment, getting a percentage result of 50% in the strongly agree option. Next, question number two about periodic evaluation of educational applications used is important to ensure their effectiveness, getting a percentage score of 50% in the agree option. The third question about adaptive educational apps that can adjust the level of difficulty based on children's development scored 65% strongly agree.

Question four, Integration of offline and online learning through applications can provide a more holistic learning experience, getting as much as 40% of the percentage score for the less agree option. The fifth question about applications that utilize augmented reality technology can offer a more interactive and immersive learning experience, received as many as 45% of the affirmative options. Question six: Applications that focus on memory development can help strengthen the memory abilities of young children, getting a percentage gain of 55% for the strongly agree option.

The seventh question about apps with progress tracking features allowing parents and teachers to monitor children's development in real-time, scored a percentage of 80% strongly agree. The eighth question about the availability of access to quality educational apps must be ensured to overcome the digital divide, received a percentage score of 40% agree. In question nine, Cooperation between app developers and education experts is needed to create content that is useful and in line with children's developmental needs, scored 45% strongly agree. The last question about The judicious use of educational apps can be an effective tool to support and accelerate early childhood cognitive development, gained 60% in the strongly agree option.

Diagram 1

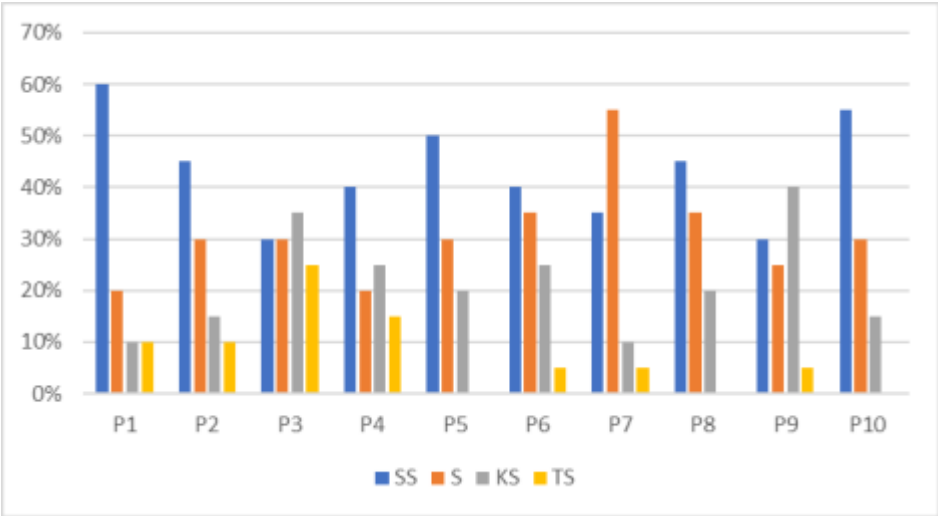


Diagram 2

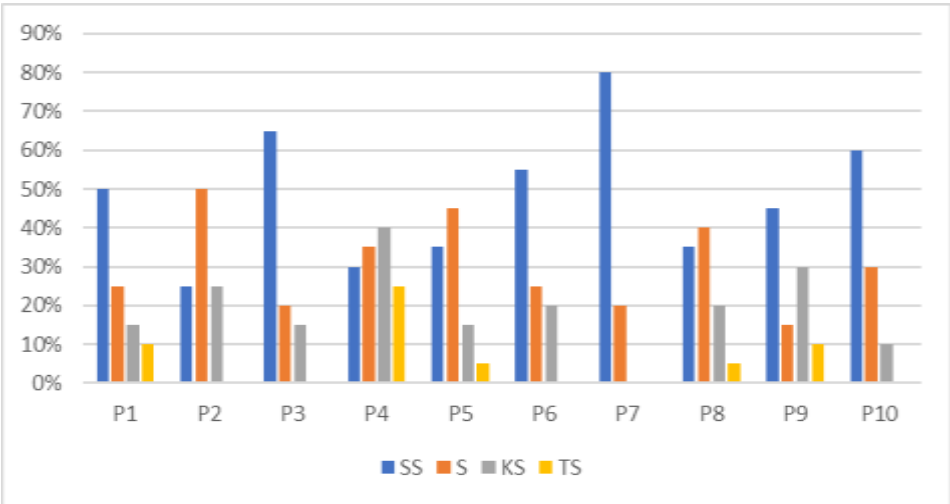


Table 3

T-test of Educational Applications for Improving Cognitive Development in Early Childhood: A Review of Educational Psychology
Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE TEST	45.5000	20	14.03942	3.13931
	POST TEST	28.7500	20	12.34110	2.75955

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE TEST & POST TEST	20	-.649	.002

Paired Samples Test

		Paired Differences			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval Difference
					Lower Upper
Pair 1	PRE TEST - POST TEST	16.75000	23.96681	5.35914	5.53319 27.96681

Based on the results of table 3 above, it is a T-test using the SPSS application. From the results of the study, researchers can conclude that the T-test test in the first output section explains Mean as an average. In the Pre Test, the resulting average amount is 45.5000, while in the Post Test it is 28.7500. Based on these results it can be formulated that there is a difference from the results of the respondents' answers. Furthermore, in the Paired Samples Correlations section, obtaining Correlations of -.649, as well as a large sig of .002. Furthermore, in the Paired Samples Test section, the results obtained are 23.96681 in the Std. Deviation section, while in the Std. Error Mean section obtained a result of 5.35914. Based on these results, Educational Applications to Improve Cognitive Development in Early Childhood: A Review of Educational Psychology.

Table 4

T-test of Educational Applications for Improving Cognitive Development in Early Childhood: A Review of Educational Psychology.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE TEST	20.2500	20	10.32052	2.30774

POST TEST	6.5000	20	7.79676	1.74341
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Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 PRE TEST & POST TEST	20	.567	.009

Paired Samples Test

Paired Differences

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval Difference
Pair 1 PRE TEST - POST TEST	13.75000	8.71704	1.94919	Lower 9.67030 Upper 17.82969

Furthermore, in the 4th table section, it is also the result of research using the T-test. It can be seen in the first output section from the acquisition of the Pre Test results of 20.2500, and the Post Test of 6.5000. In the Paired Samples Correlations section, obtaining Correlations of .567, with the acquisition of Sig results of .009. While in the Paired Samples Test section, obtained results of 8.71704 in the Std. Deviation, and Std. Error Mean as much as 1.94919. Based on the results of this study, it can be seen between each question posed by researchers regarding Educational Applications to Improve Cognitive Development in Early Childhood: A Review of Educational Psychology.

DISCUSSION

Educational apps have become an important tool to support teaching and learning, especially for early childhood (Hincapie et al., 2021). With today's technological advances, children can access a variety of engaging and interactive learning resources (Pozo Sánchez et al., 2019). From an educational psychology perspective, this article discusses how educational apps can help early childhood cognitive development. Early childhood is a child who is quick to imitate, capture material and has high curiosity (Mackes et al., 2020). Early childhood is in the golden age phase which is the golden age of the child in learning and capturing new things. So that children can be directed with various games and that can improve their abilities. With various supporting applications (Lindberg et al., 2020).

Early childhood cognitive development includes various aspects, such as the ability to think, solve problems, and understand basic concepts (Orri et al., 2019). According to Piaget's cognitive development theory, this development is divided into four stages: sensorimotor, preoperational, concrete and formal. In the sensorimotor and preoperational stages, children usually begin to develop basic skills such as recognising

objects, speaking, and understanding basic concepts (Martini Meilanie et al., 2023). So that the use of supporting applications can make children's cognitive development rapid (Nurhasanah et al., 2022). And children will also easily understand when learning if they use the application because it is unique in its use. Especially in the digital era, children are more interested in using gadgets than reading books (Choy et al., 2024).

Educational apps are made to make learning more interactive and fun (Cheung & Ng, 2021). There are several key advantages of using apps in early childhood learning (Delaney & Devereux, 2020). The first is interactivity, interactive games and activities are often used in educational apps to increase children's engagement in learning (Avola et al., 2019). This makes children's understanding of new ideas easier and more fun (Grenot, 2023). Secondly, personalisation, many educational apps can be tailored to children's learning abilities and needs, allowing children to learn at their own pace, which reduces frustration and increases their desire to learn (Tyrväinen et al., 2020).

Furthermore, the feedback provided, using the application can provide immediate feedback capabilities on children's performance, which is very important for the learning process because it allows children to immediately identify their mistakes and learn from their mistakes (Wang et al., 2022). The educational application that is often used for early childhood is ABCmouse. This application offers a variety of learning activities for children aged two to eight years, including reading, maths, art and music (Chen et al., 2021). As well as the Kids Khan Academy application which can provide various activities that help children learn maths, reading and social-emotional skills (Mat Nashir et al., 2022). Using these applications can help improve children's cognitive abilities and increase their interest in new things. It also makes learning interactive (Aylward & Neilsen-Hewett, 2021b).

From an educational psychology perspective, the use of educational apps can be linked to constructivist learning theory, which states that children acquire knowledge through interaction with direct experience and interaction with their environment (Xu et al., 2019). Educational apps can also help children deal with the challenges they will face in a safe and supportive way. Educational psychology provides an important understanding of how children develop and learn to improve their cognitive abilities (Albritton & Stein, 2022). Educational apps can be tailored to the child's developmental stage and help learn well by understanding Educational psychology (Jaszczur-Nowicki et al., 2020).

CONCLUSION

Educational apps are helpful for early childhood cognitive development. They are able to provide an engaging and effective learning experience through an interactive and personalised approach. Educational apps allow children to learn according to constructivist learning theory and Vygotsky's Zone of Proximal Development independently and at their own pace as they have features such as immediate feedback and are easily accessible. However, parents and educators should choose apps with

high-quality educational content and limit children's screen time to achieve maximum benefits. Active parental involvement is also important to ensure effective use and support the child's overall development. Educational apps can be a very effective tool to support early childhood cognitive development and build a strong foundation for future learning. This can be achieved with the right approach and the right selection of apps.

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