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The Effectiveness of Virtual Reality Use Toward Early Childhood Understanding of Nuclear Family Roles

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ABSTRACT

Objective: This study aimed to assess the effectiveness of using virtual reality in fostering an understanding of the role of the nuclear family and to develop virtual reality-based teaching materials using educational games at TK Negeri Pembina Surian, Sumedang**. Method:** This study used a pretest-posttest quasi-experimental design and involved only one class, specifically, one experimental group. Data were collected through observations, pretests, and posttests. **Results: The** significance results were 0.002 for the pre-test scores and 0.039 for the post-test scores. The p-values from the normality tests for both sets of data were smaller than the significance level, and the Wilcoxon Signed-Rank Test revealed that the entire sample showed a significant increase. **Novelty: The** early childhood education students involved in the study demonstrated an understanding of the role of the nuclear family. This study also serves as an empirical reference for the effectiveness of using virtual reality technology to foster an understanding of the role of the nuclear family in early childhood. These findings can guide all those involved in early childhood education to develop effective and enjoyable teaching materials for early childhood.

INTRODUCTION

Recent advancements in technology and digital media over the past 20 years have markedly transformed the way children, particularly those in early childhood, experience learning. In the contemporary digital era, learning modalities are no longer exclusively dependent on traditional media, such as printed books or chalkboards. Instead, learning has broadened to encompass interactive multimedia formats, including virtual reality, which offers immersive experiences capable of engaging multiple senses (Araiza-Alba et al., 2021). Virtual reality has become a prevalent technology and a valued educational medium owing to its interactive and immersive characteristics, thereby augmenting the efficacy of early childhood education (Amprasi et al., 2022). In practical applications, virtual reality can be complemented by various integrated media such as animated videos, which serve to enrich educational content (Aminah, 2023).

In the contemporary digital era, individuals from diverse backgrounds must understand technological progress. Early childhood should have a comprehensive understanding of the roles of immediate family members, such as fathers, mothers, older siblings, and younger siblings, as they constitute the primary and closest circle in a child's life (Ramdani et al., 2023). Teaching these fundamental roles requires educational media that actively and contextually engages children in ways aligned with current technological advancements (Aslan et al., 2022).

Technologies such as virtual reality, when integrated with digital games, facilitate children's exploration of abstract concepts appropriate for their developmental stage, specifically through learning through play, thus fostering an interactive and reflective experience (Mayer, 2024). Incorporating game-based learning with technology that combines visual and verbal components can enhance children's cognitive processes

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related to information management. This approach is characterized by an instructional design suitable for early childhood development (Anis et al., 2023).

Previous research on the use of the latest technological media in early childhood education has predominantly focused on learning in the disciplines of science, literacy, or numeracy (Kusumawati & Fitri, 2024). The application of virtual reality, however, has not yet reached the most fundamental realm, one that is most immediate to children's lives, namely, understanding the role of the nuclear family. Similarly, the deployment of Scratch in early childhood education to investigate the influence of the nuclear family in shaping a child's sense of familial love remains largely reliant on traditional media and has not yet harnessed immersive digital media as a pedagogical tool (Nurunnisa et al., 2025).

Accordingly, there exists a conspicuous research gap, as few studies have specifically assessed the efficacy of employing virtual reality to integrate animated video-based learning media and scratch-based educational games for early childhood education media designed to cultivate an understanding of the function of the nuclear family. Therefore, this study is significant in addressing this void within the research domain. If these gaps or voids are left unaddressed, without the appropriate use of digital media, children's understanding of the roles and functions of family members will develop in ways that do not actively engage their sensorimotor skills, as conventional media still require significant innovation. Ultimately, this fails to help children make sense of the material presented, foster empathy, and cultivate a sense of family love, which greatly influences their social-emotional development (Rofiah & Diani, 2022).

With the widespread use of digital technology, children may develop a tendency toward dependence on gadgets or digital content if such content is not designed to be educational (Kurniastuti & Rusmariana, 2021). These effects can weaken family bonds by reducing the frequency of communication within the family. Ultimately, children may lack a strong understanding of the role of the nuclear family, which in turn affects their character and empathy, even though the family should be the primary setting for teaching children about their roles and functions in family life (Anjani, 2025).

To address this issue, this study examines the development of technology-based instructional media that incorporates two primary components, 3D animated videos and Scratch-based educational games, as a means to enhance early childhood's understanding of the fundamental roles within a family context. Furthermore, this study aims to evaluate the effectiveness of this approach. This initiative aims to develop virtual reality-based instructional media that integrates 3D animated videos and Scratch-based educational games to facilitate early childhood comprehension of family roles. Additionally, based on the described issues, this study was designed to answer the question: How effective are Virtual Reality-based teaching materials in fostering early childhood understanding of the nuclear family role?

RESEARCH METHOD

Research Design

This study was conducted using a quantitative approach with a quasi-experimental design employing a pre-test–post-test experimental group design. The purpose of using this quasi-experimental method was to determine the effectiveness of using virtual reality as a learning medium in shaping early childhood's understanding of the role of

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the nuclear family through the provision of a specific intervention, as well as to compare the results from before the intervention (pre-test) and after the intervention (post-test). This study only used a one-group pretest-posttest experimental design because of the limited number of classes at TK Negeri Pembina Surian at the time the data were collected. Because there was no control group in this study, the observed improvement may have been influenced by learning processes occurring simultaneously in the classroom. However, this study is exploratory in nature and aims to examine the initial potential for the effectiveness of using virtual reality as a learning medium in early childhood education.

Table 1. Research Design

Group	Measurement (Pretest)	Treatment	Measurement (Posttest)
Experiment	O_1	X	O_2

Notes:
O_1 : Pretest Results for the Experimental Class
O_2 : Posttest Results for the Experimental Class
X : Treatment using virtual reality as a learning medium

This design allows researchers to objectively measure children's level of understanding by using technology as a teaching medium specifically designed for research in an early childhood education setting.

Participant Descriptions

The participants in this study were 24 children in Group B at TK Negeri Pembina, all of whom were in the experimental class. The subjects of this study were children aged 5–6 years. This study was conducted at TK Negeri Pembina, Surian Subdistrict, Sumedang Regency, during the odd semester of the 2026–2027 school year, specifically in July 2026. The method for assigning groups was based on the fact that the school had never previously conducted lessons using virtual reality media.

Instruments

The instruments used in this study consisted of a variety of tools, including conventional media in the form of simple interviews and interactive worksheets for the pre-test and post-test phases, as well as digital media in the form of 3D animated videos and scratch-based games integrated with virtual reality as the treatment medium. The implementation procedures are outlined in the following research plan.

Table 2. Research Plan

Day	Stage	Activity	Media	Output
1	Observation	Conducting observational familiarization during classroom instruction and making initial contact with students to build rapport and get to know them.	-	Observing students' readiness and ability levels to participate in the series of activities in this study
2	Pretest (Phase 1)	Conducting the pretest phase using the instruments that have been developed	Conventional media: simple interviews and interactive worksheets from	The results of the pretest or the second day's activities will be recorded in the assessment column of the " "
3	Pretest	Reviewing the learning	Conventional	Calculating the total

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Day	Stage	Activity	Media	Output
	(Phase 2)	activities and materials presented the previous day.	media; review and interactive worksheet	pretest score on the instrument that was created
4	Treatment	The treatment phase using the media developed for testing on participants was conducted by first showing an animated video, followed by educational games via virtual reality..	Digital Media: Animated Videos, Virtual Reality Games, Scratch	The material presented is the same as during the pretest; the only difference is the media used
5	Posttest	The final post-test was conducted by recalling the lesson.	Simple Review, Interactive Worksheet	Activities were reviewed using supportive methods to stimulate and assess the extent of the children's knowledge; the hope is that the children will be able to recount the content of the lesson

Data collection began with observations to assess the extent of children's engagement in teaching and learning activities. Next, the researcher administered a pre-test to measure the children's initial understanding of the role of the nuclear family, followed by an intervention for the sample group, and a post-test to assess the children's final understanding of the role of the nuclear family.

Non-parametric Analytical Procedures

This study underwent a prerequisite test, namely, the normality test. Because the sample size was small, the Shapiro-Wilk test was employed. Once the data were confirmed, the Wilcoxon Signed-Ranks Test was used for a single group without a control group (Albers, 2017). Finally, the N Gain Score test was used to measure the level of effectiveness based on the difference between the pretest and posttest scores. The analysis was performed using Microsoft Excel and IBS SPSS.

RESULTS AND DISCUSSION

Results

The results of the study, which was conducted over five school days, indicate a significant improvement in early childhood students' understanding of the nuclear family's role. This is evidenced by the findings from observations and brief interviews conducted before the pre-test and post-test activities began. During the initial observation period, although the school was indeed difficult to access, it had adequate technological resources, such as internet access, electricity, and a smart TV for learning. In addition, during the observation period, children appeared confused and did not yet know who was included in the nuclear family.

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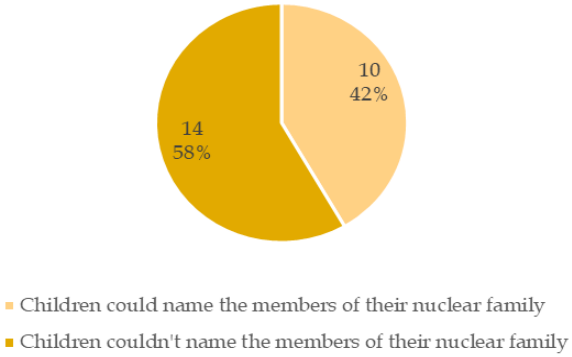

Figure 1. Children Knowledge

Based on Figure 1, only about 10 out of 24 children could name the members of their nuclear family, while the rest still needed guidance to do so. Once they knew who belonged to their nuclear family, the children were able to describe the role of each family member. The children also tended to name only the roles of the father and mother; they felt confused when asked about the roles of their older or younger siblings. After in-depth observation and interviews, it was found that this was because some children did not have older siblings, while others did not have younger siblings.

In this study, the research results were derived from pre-test and post-test data collected during the study period. The pretest data were collected during the instrument validation phase before the intervention was implemented. Conversely, the post-test refers to data collected during instrument administration after the intervention was completed. Based on these two datasets, the next step was to compare the results.

Before testing the hypotheses, it was necessary to conduct a normality test to determine whether the data for the pre-test and post-test variables were normally distributed. The normality test used in this study was the Shapiro-Wilk test because the sample size was 24 children (n < 50).

Table 3. Test of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Pretest	.213	24	.006	.846	24	.002
Posttest	.190	24	.026	.912	24	.039

Based on the data analysis, the significance values (Sig.) were 0.002 for the pretest scores and 0.039 for the posttest scores. Both values are below the significance level of 0.05 ($p < 0.05$) for the normality test; therefore, the pretest and posttest data are not normally distributed. This non-normality may be due to several factors, such as a small sample size or the instrument's limited score range (maximum score of 12). This is common and does not indicate errors in the data collection process. Because the data were not normally distributed, a hypothesis test was conducted using a nonparametric statistical test, namely the Wilcoxon Signed Ranks Test.

Table 4. Wilcoxon Signed Ranks Test

		N	**Mean Rank**	**Sum of Ranks**
Posttest - Pretest	Negative Ranks	0[a]	.00	.00
	Positive Ranks	24[b]	12.50	300.00
	Ties	0[c]		
	Total	24		

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a. Posttest < Pretest
b. Posttest > Pretest
c. Posttest = Pretest

The Wilcoxon Signed Ranks Test was conducted to determine whether there was a significant difference between the pretest and posttest scores regarding early childhood understanding of the roles of immediate family members after receiving treatment involving virtual reality-based media. The table shows that all 24 children in the study sample increased their scores from pre-test to post-test. The test results also indicated that no child experienced a decrease in scores after the intervention, and no child maintained the same score. Therefore, it can be concluded that there is a significant difference between the children's pre-test and post-test scores. This also indicates that the use of virtual reality media has proven effective in shaping early childhood understanding of the roles of the nuclear family. This was further supported by the test results, which showed an increase in scores without exception.

Table 5. Table N Gain Score

Nu.	Child's Code	Pretest	Posttest	Gain	N-Gain	Category
1	Gh	8	12	4	1,000	High
2	Bm	7	10	3	0,600	Middle
3	Ab	8	11	3	0,750	High
4	An	8	11	3	0,750	High
5	Dm	6	9	3	0,500	Middle
6	Rk	6	9	3	0,500	Middle
7	As	5	8	3	0,429	Middle
8	Ph	6	9	3	0,500	Middle
9	Ys	8	11	3	0,750	High
10	Hn	8	11	3	0,750	High
11	Al	8	12	4	1,000	High
12	Fl	8	12	4	1,000	High
13	Rr	7	11	4	0,800	High
14	Ds	7	10	3	0,600	Middle
15	Bn	6	10	4	0,666	Middle
16	Nz	8	11	3	0,750	High
17	Nh	7	10	3	0,600	Middle
18	Is	6	11	5	0,833	High
19	Kh	7	10	3	0,600	Middle
20	Qi	6	10	4	0,667	Middle
21	Az	7	11	4	0,800	High
22	Zs	7	10	3	0,600	Middle
23	Ay	6	10	4	0,667	Middle
24	Sp	6	10	4	0,667	Middle
		Total			**0,699**	**Middle**

$g \geq 0.70 \rightarrow$ High; $0.30 \leq g < 0.70 \rightarrow$ Middle; $g < 0.30 \rightarrow$ Low

According to the table above, the average N-Gain value of 0.699 falls within the middle-to-high category. This indicates that the use of virtual reality in this study fostered early childhood understanding of family members' roles with middle-to-high effectiveness.

Discussion

The results of this study show that the use of virtual reality has a highly significant impact. The first indicator requires children to identify the roles of family members. During implementation, children were enthusiastic about the learning media that

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offered real-life experiences (Haryono et al., 2024). Piaget said that between the ages of five and six, children are still in the pre-operational stage, during which they learn more easily through concrete and visual examples (Lay et al., 2026). Virtual Reality as a learning medium combines visuals, audio, text, and instructions, requiring children to coordinate their five senses to complete integrated scratch-based games (Zaini & Wulandari, 2020). This virtual reality-based teaching medium provides what children need during the pre-operational stage (Dharma et al., 2018). Therefore, at the beginning of the sessions or during the observation period, some children were unable to identify the roles of certain immediate family members. Upon further investigation, this was found to be because those family members were present at home.

This study was also conducted in hard-to-access areas, where in-person interaction is highly likely to be limited, which in turn affects the transmission of knowledge (Yasmin et al., 2023). When family members are far from home, their roles within the nuclear family are crucial for introducing them and how members should behave in accordance with their gender roles (Sholeha & Baqi, 2023). This is where virtual reality plays a role by providing an immersive visual simulation that encourages children to interact, allowing them to experience firsthand roles within the nuclear family (Sukmawati et al., 2022). This direct experience is concrete, not merely an imaginary scenario, and closely resembles real-life situations, which aligns with the characteristics of early childhood (Nofianti, 2021).



Figure 2. 3D Animation Video for Early Childhood Understanding of Nuclear Family Roles



Figure 3. Game for Virtual Reality Use

The 3D animated video delineates the roles of immediate family members, commencing with the father, mother, older sibling, and younger sibling. This facilitates children's comprehension of the functions performed by family members. Within the interactive component, children are required to utilize motor skills to manipulate a virtual reality controller in order to locate lost objects associated with the functions of family members in fulfilling their responsibilities. Additionally, the video and game incorporate narratives reflective of children's real-world experiences, such as "Dad works," "Mom

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cooks," "the older sibling studies," "the younger sibling plays," and "at home." This exemplifies the necessity for educational content for young children to be tailored to their developmental stage using instruments that have been validated by experts. Moreover, it must be suitably adapted to their capabilities and congruent with their real-life experiences.

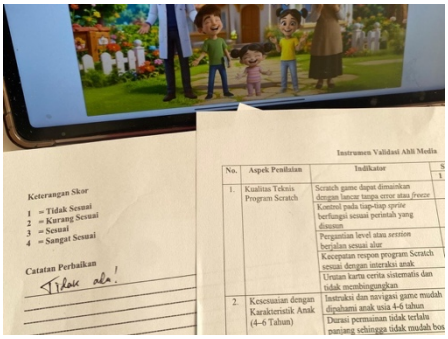

Figure 4. Expert Validation Media and Subject

Early childhood is often called the "golden age," a period when growth and development can proceed at a very rapid pace (Nurhayati, 2026). The sample in this study consists of children aged 5–6 years, who are still in their prime developmental phase. This is the ideal time to introduce them to contemporary developments (Susanti et al., 2024). To align learning media with the characteristics of early childhood while keeping pace with modern developments, digital educational games make learning more enjoyable (Magfira, 2025).



Figure 5. Virtual Reality Use with Children



Figure 6. Virtual Reality Use with Children

During the treatment phase, the children appeared enthusiastic about taking turns playing, indicating that this medium can foster their enthusiasm for learning and curiosity (Barovih et al., 2020). In this study, the teacher's role is crucial in guiding children on how to operate virtual reality without diverting the focus of learning in a child-centered approach (Faizatunisa & Kuniati, 2024). Consistent with the Zone of Proximal Development (ZPD) theory, the researcher acts as a facilitator and provides

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scaffolding through a demonstration (Musthaffiroh et al., 2025). However, children still fundamentally require supervision from a teacher or a parent to ensure that the content presented is appropriate for their age and needs (Handayani, 2022).

The implementation of this study also encourages children to express their feelings, particularly toward family members. This indicator aligns with psychosocial theory in early childhood during the "initiative vs guilt" stage, in which children actively explore their environment, including the one closest to them (Sit, 2017). Integrating learning with technology also fosters a sense of initiative and encourages children to creatively express their feelings to immediate family members (Rea et al., 2025). This is because, fundamentally, young children are unique individuals, including in the ways they express their feelings (Munir & Subaeri, 2025).

Media use is highly relevant to the nature of young children. Animated videos are used to boost children's motivation to understand the material presented in lessons (Nugroho et al., 2025). The animated videos created are also AI-based, representing a creative application of technological media tailored to the growth and developmental stages of young children, which demonstrates the benefits of such teaching materials for teachers' instructional activities (Suryani et al., 2024). The duration of digital media use itself needs to be limited, especially when applied to young children; excessive screen time can disrupt children's focus and concentration, making it difficult for them to empathize with their closest environment later on (Chandra et al., 2026). The significant increase in scores on this indicator shows that visualizing the role of the family through virtual reality helps children form more concrete and memorable mental representations (Suryana, 2016).

The theories cited as the basis for this study complement one another, providing a comprehensive explanation of how technological media foster understanding of the role of the nuclear family. The use of 3D animated videos and VR games is designed to provide a richer visual and interactive experience than the conventional media used in the pre-test phase (Fadlillah, 2019). Virtual reality, as the primary medium, can facilitate the development of cognitive abilities related to new knowledge through concrete visualization (Flavell, 2020). Children can also develop their capacity for empathy through the exploration of simple social roles; the narratives used in this implementation must engage children's emotions (Pattipeiluhu, 2024). Collaboration between teachers and students in developing learning media is crucial for making learning meaningful through the use of technology (Sutiawan & Hamdarida, n.d.). Despite the success of this study, it remains necessary to include a control group for comparison. Therefore, a recommendation for future research is to employ a design with both a control group and an experimental group to strengthen the findings regarding the effectiveness of virtual reality.

CONCLUSION

Fundamental Finding: The use of virtual reality (VR) media was proven effective, as demonstrated by the Wilcoxon signed-rank test with an asymptotic significance (two-tailed) of 0.000, based on a total sample of 24 children (100%). This study was conducted in a relatively difficult-to-access location, which makes the research findings even more significant because the study could still be conducted. **Implication:** In this discussion, it was found that the application of virtual reality technology had a positive impact and effectively shaped young children's understanding of the role of the nuclear family.

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This technology also helped children learn about family roles they were previously unaware of because those family members were not present. **Limitation:** This study is limited because it involved only one experimental class and did not include a control group to test the effectiveness of virtual reality technology; however, despite some challenges in its implementation, virtual reality technology significantly enhanced children's understanding of the roles of the nuclear family. **Future Research:** However, this medium needs to be tested using two classes: a control class and an experimental class**,** and it is necessary to first provide children with an understanding of the technologies available in this digital age.

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