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The Effect of Gardening Activities on Cooperation Skills and Skills to Recognize Size Concepts in Children Aged 5-6 Years

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ABSTRACT

The age of 5-6 years is a critical phase in the cognitive and socio-emotional development of children. This study aims to determine the effect of gardening activities on cooperation skills and skills to recognize size concepts in children aged 5-6 years. This study used a quasi-experiment model with a nonrandomized pretest-posttest control group design. The research subjects were 32 children aged 5-6 years, who were divided into 2 groups, namely 16 control group children, consisting of 11 boys and 5 girls, and 16 experimental group children, consisting of 9 boys and 7 girls. The results showed that in the t-test of cooperation ability, the value of $p < 0.001$, proving $p < 0.05$ and showing that there was a difference in gain score between the experimental group and the control group. In the t-test of skills to recognize size concepts shows a value of $p < 0.001$, proving that $p < 0.05$ and means there is a difference in gain score between the control group and the experimental group. This means that there is an effect of gardening activities on the ability to cooperate and skills to recognize size concepts in children aged 5-6 years.

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INTRODUCTION

The age of 5-6 years is a critical phase in children's cognitive and socio-emotional development, at this stage children progress in thinking, language acquisition, and interpersonal skills (Agustina et al., 2023; Murni, 2017). Early childhood education (ECE) key role in enabling holistic early childhood development. High-quality ECD programs have been shown to significantly improve cognitive capacities and social-emotional competencies of young children (Nasution et al., 2024). Social development refers to progress in establishing and maintaining relationships in social contexts (H et al., 2020). Children acquire social skills through diverse interactions and individual experiences in their environment (Mawaddati et al., 2022). Social emotional development plays a key role in this process because children learn to respond to social cues that come from the group, then develop behaviors that are in accordance with social adaptability (Bergan et al., 2024; Lubis, 2019). Cooperation is one of the social emotional aspects that involves children to communicate and interact with the social environment so as to provide collaborative experiences for children (Rohima et al., 2023). Children's collaboration is based on how communication is created between them and their peer group (Suci, 2018; Widyaning Tyas & Widyasari, 2023; Wulandari & Suparno, 2020). Collaboration can train children to prioritize the group and suppress individual personality (Nasution et al., 2024; Nishino et al., 2018; Safitri, 2023). Cooperation increases children's ability to know the role of children in groups, appreciate differences, and encourage active and creative analytical development (Ehrlich, 2019; Mawaddah et al., 2024). In line with research conducted by Dwi Nurjannah that the development of

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cooperation is an important value to be instilled and introduced to children from an early age, in accordance with the school curriculum and programs that have been prepared by the school (Nurjannah et al., 2022). Fostering cooperation requires mutual trust, openness, self-awareness, and mutual assistance (Smith & Apicella, 2020). Teachers can facilitate children's collaboration to develop their understanding with project activities, discussing, playing together, and group work with their peers (Ningsih & Rohita, 2024). Peer support and dynamic social interactions in children's environment positively influence their social development, especially in the character of cooperation (Setyaningsih et al., 2022). Through cooperation, children will have more opportunities to interact with peers, equipping them to be independent in seeking knowledge and information from various sources (Wahyuni, 2020).

Skills to recognize and understand size concepts is a fundamental cognitive milestone in early childhood development (Fatdianti, R., & Rianto, 2016). This ability is a crucial aspect of child development because it involves the ability to recognize differences between objects based on attributes such as size, dimensions, and weight (Toala et al., 2020). The concept of size goes beyond simple recognition of "big" and "small" but also includes a more complex understanding of dimensions such as length, width, height, weight, and volume (Maulana & Handayani, 2022). Engaging in activities such as pattern making, measurement, and basic arithmetic allows children to understand abstract ideas and relate them to practical real-world contexts (Latifah, et al., 2024). These activities foster children's ability to recognize differences between objects and increase their capacity to compare, categorize, and classify items according to their attributes. The integration of cognitive concepts related to size an essential key role in cognitive development in stimulating children to recognize, compare, distinguish, and remember information from visual and auditory stimuli (Khotimah et al., 2020). From an early age, children gain an understanding of size through direct interaction with their physical environment (Anisabela & Rahminawati, 2022). One of the problems in stimulating skills to recognize size concepts is the use of children's worksheets. Worksheet-based learning causes a lack of exploration and utilization of the surrounding environment as a learning resource. This is in line with Maryam's research that monotonous and non-contextual learning methods are less meaningful to children (Maryam, 2022). Therefore, interesting and fun activities are needed to deal with these problems.

Gardening is an activity that incorporates farming and gardening activities into project-based learning, which inspires a love of nature and builds a strong foundation for various developmental skills in early childhood (Khosiah, 2017). Gardening activities stimulate children's scientific curiosity through the process of asking questions, making observations, and experimenting with various techniques (Sofiyana et al., 2023). Gardening activities are more than just scientific exploration, children will engage in collaborative tasks, share tasks, and foster relationships with peers (Kusumawardhany et al., 2023a). Caring for plants fosters a bond with nature while improving children's emotional regulation and resilience in the face of challenges. This is in line with Albert Bandura's social learning theory which asserts that children acquire knowledge by observing and imitating others (Lesilolo, 2019). Research conducted by Rika Puspita that gardening positively influences the cognitive and social-emotional skills of children aged 5-6 years (Puspita et al., 2024). Gardening activities offer a unique and knowledge-enriching approach to early childhood education. Through gardening activities, children will be actively involved with the surrounding environment. This is supported by Piaget's theory which highlights that children learn actively through active engagement with their environment (Ibda, 2015). Gardening activities offer interesting, meaningful learning opportunities, encouraging optimal growth and development. Through knowledge of the benefits of gardening for children, educators can develop more comprehensive learning strategies that support all aspects of child development, laying a strong foundation for future success (Ilham, 2018).

Several studies have consistently highlighted the positive effects of gardening activities on social-emotional abilities and cognitive abilities in children aged 5-6 years. Research conducted by Diana showed significant differences in cognitive development between children involved in

gardening activities and children who were not involved. Children involved in gardening activities had significantly improved cognitive abilities (Diana & Putri, 2018). Gardening activities foster social skills, emotional regulation, a sense of responsibility, and a deeper appreciation of nature (Bachrudin, 2019). Through gardening, children learn to recognize various sizes of plants, soil, and gardening tools, helping children to understand the concept of size concretely (Musyarofah et al., 2023; Zulaiha et al., 2024). The activity involves direct measurement which strengthens children's understanding of the concept of size (Imron Rosyadi, 2020). Many previous studies have examined gardening activities. Each researcher has characteristics that characterize them. There are many variations of gardening activities in learning. The application of gardening activities with this hydroponic model is based on gardening activities and also contains indicators of cooperation skills and skills to recognize size concepts that helps learning and the use of media that has not been widely used by previous researchers. Therefore, the application of gardening activities is expected to stimulate cooperation skills and skills to recognize size concepts in children aged 5-6 years optimally. Based on the background above, the author is motivated to conduct research with the title "The Effect of Gardening Activities on Cooperation Skills and Ability to Recognize Size Concepts in Children 5-6 Years of Age". This study aimed to: 1) to examine the influence of gardening-based intervensions on the development of cooperative behavior in children aged 5 to 6 years; 2) to analyze their impact on the acquisition of size-related cognitive concepst within the same age group.

RESEARCH METHOD

This study was undertaken during the first semester of the 2024-2025 academic year, with data acquisition occuring in December 2024. The research site was two kindergartens in Kediri, East Java. The research subjects were 16 childrens as control groups and 16 childrens as experiment groups.

This study employs a quantitative approach with an experimental research design. Quantitative research is grounded in the positivist (empirical) paradigm and is employed to investigate systematically defined populations or samples. Samples are selected through probabilistic sampling methods, and data are subjected to analysis using standardized, objective instruments and statistical procedures to empirically test preformulated hypotheses (Sudaryana & Agusiady, 2022; Purwanto, (2019). Specifically, a quasi-experimental model was utilized, adopting a nonrandomized pretest-posttest control group design due to the non-random selection of subjects (Jannah, 2016). Quasi-experiments are experiments that have treatment, measurement of the dependent variable or the impact of the treatment and experimental units, but do not use randomization in forming research groups (Jannah, 2016). This study involves a comparison of two groups, an experimental group and a control group. The experimental group receiving an consisting of gardening activities, while the control group will follow a conventional class format. In this study, data collection employed a rating scale to obtain primary quantitative data, which was subsequently interpreted through qualitative analysis (Reza & Khotimah, 2022; Sugiyono, 2019). The research tools were systematically constructed according to defined indicators associated with each variable. An observation protocol served as the primary instrument for data acquisition.

Before the treatment, both classes will be given a pretest to determine the initial ability of cooperation skills and skills to recognize size concepts. After the pretest, the experimental group will receive treatment through gardening activities, while the control group does not receive treatment. After the treatment is completed, both groups will take a posttest to evaluate changes in children's abilities between the experimental and control groups. The pretest and posttest on the ability to cooperate in the form of observations on playing and tidying up Leggo toys together with all friends, while the pretest and posttest on skills to recognize size concepts in the form of activities measuring leaves and twigs using a ruler and mentioning the numbers listed on the ruler, mentioning short-sized leaves, mentioning long-sized leaves, comparing the size of leaves

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(short and tall), measuring stones, tissues, flannel cloth, and rockwool with artificial scales, mentioning light-sized objects, mentioning heavy-sized objects, and comparing objects between heavy and light objects.

Table 1. Experimental research design

Group	Pretest	Treatment	Posttest
E	O_1	X	O_2
K	O_3	–	O_4

(Jannah, 2016; Miller et al., 2020)

Description:
O1 : Experimental group pretest
O2 : Experimental group posttest
O3 : Control group pretest
O4 : Control group posttest
X : Treatment (treatment) gardening activities in the experimental group
E : Experimental group
K : Control group
- : Conventional learning

The independent variable in this study is gardening activities, while the dependent variable is the ability to cooperate and skills to recognize size concepts. In this study, the gardening activities carried out were planting hydroponic kale with the group for 4 days. The instrument used in this study is an observation sheet. Before making an instrument, researchers need to make an outline of the instrument called a grid. This grid serves as the main structure for organizing research instruments. Researchers use instruments to observe cooperation skills and skills to recognize size concepts based on the Standard Level of Achievement of Child Development (STPPA) aged 5-6 years as well as research (Hadaina & Astawan, 2021) and (Maulana & Handayani, 2022).

Data collection techniques are tools for measuring data in an experiment, this can be in the form of observations and scales tailored to the needs of researchers (Jannah, 2016). Data collection techniques are carried out by observation and documentation. Data analysis in this study was carried out by comparing the gain score. Gain score is obtained through comparison of participants' pretest and posttest (Jannah, 2016). The stages of data analysis in this study are by conducting assumption tests consisting of normality tests and homogeneity tests. The normality assessment was conducted through the Shapiro-Wilk test, whereas the homogeneity test was performed utilizing the Lavene test. After the normality test and homogeneity test were carried out, hypothesis testing was carried out. In this study, T-testing was carried out with the Mann-Whitney U test because the data was not normal and not homogeneous.

The stages of this research activity consist of the preparation stage and the implementation stage. The following are the details of the stages in this study.

Preparation stage
Selecting the research location
Create research instruments
Prepare administration
prepare pretest, treatment, and posttest



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Implementation stage
Pretetst implementation
Treatment implementation
Posttest implementation
Data analysis
Writing results and conclusions

Figure 1. Research stage

RESULTS AND DISCUSSION

Gardening activities are project-based learning carried out in groups that utilize the school environment to be processed (Siti Khosiah, 2018). Gardening-based activities harness children's innate inquisitiveness by engaging them in hands-on experiences such as sowing seeds, nurturing plant growth, and participating in the harvest. This immersive involvement in the biological life cycle encourages active inquiry, critical observation, and the application of exploratory methods, thereby fostering experiential learning and scientific thinking (Sofiyana et al., 2023). Gardening activities extend beyond mere scientific inquiry; they serve as a medium for fostering cooperative engagement among children. Through joint undertakings such as soil preparation, seed sowing, and plant irrigation, these experiences cultivate interpersonal competencies, including collaboration, effective communication, and a sense of communal responsibility (Kusumawardhany et al., 2023b). Engagement in gardening activities can enhance children's cognitive development by promoting structured reasoning, facilitating the understanding of scientific principles, and introducing foundational concepts related to measurement and quantification (Jolly & Krogh, 2021).

Numerous scholarly investigations have explored the educational implications of gardening. For instance, Danang Hardiansyah conducted developmental research aimed at enhancing prosocial competencies among young children, with a particular emphasis on fostering cooperative behaviors (Hardiansyah et al., 2021). Similarly, Rohmatin Agustina employed a mixed-methods approach to assess the impact of gardening interventions on early childhood developmental outcomes (Agustina et al., 2023). In another qualitative inquiry, Musyarofah integrated hydroponic gardening activities to harness children's latent potential and elevate pedagogical quality. Gardening has also served as a micro-level evaluative framework for monitoring developmental progress at Wijaya Kusuma Kindergarten (Puspita et al., 2024). Additionally, Husna's empirical study substantiated the role of gardening in cultivating cooperative values in children aged 5–6 years (Husna et al., 2024). Distinct from these prior investigations, the present study positions gardening as an experimental intervention designed to simultaneously stimulate cooperative abilities and enhance early numeracy—specifically, the conceptual understanding of measurement and size in young learners.

In this research, the gardening activities carried out were planting hydroponic kale together with the group for four days. Activities on the first day were planting kale seeds using rockwool planting media moistened with mineral water and given a flannel cloth base. In addition, children are also invited to recognize the tools and materials used in gardening activities. Children are invited to compare tools from the lightest to the heaviest. On the second day to the fourth day, children will be invited to measure the height of the kale plants that have been planted using a ruler and write the results obtained on the growth card with the group. In addition, children are also invited to take care of the kale plants they have planted by spraying water to keep the planting media (rockwool) moist together with the group.

In this study, the data to be taken are the ability to cooperate and skills to recognize size concepts in children aged 5-6 years. Data collection will be carried out through observations that

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refer to the instrument grids that have been prepared. The following is a lattice of cooperation skills and ability to recognize the concept of size.

Table 2. Instrument Grids of cooperation skills

Variable	Dimension	Indicator	Items
Collaboration Skills	Interaction	1. Children are able to communicate with friends when playing	1
		2. The child is able to respond to friends when invited to communicate	2
	Build relationship	3. The child is able to follow the agreed rules of play	3
		4. The child is able to play with all friends	4
	Helps each other	5. The child is able to share toys with friends when playing	5
		6. The child is able to help friends who experience problems while playing	6
	Responsibilities	7. The child is able to do the agreed tasks with friends when tidying up toys	7
		8. The child is able to tidy up toys together with friend after playing	8

(Hadaina & Astawan, 2021; Kementrian Pendidikan Nasional RI, 2014)

Table 3. Instrument Grid for Ability to Recognize Size Concepts

Variable	Dimension	Indicators	Items
Recognize Size Concepts Ability	Measuring	1. Children are able to measure the length and shortness of objects (leaves, twigs) using a ruler	1
		2. The child is able tp mention objects that are short	2
		3. The child is able to mention objects that are long	3
		4. Children are able to measure the weight and lightness of objects (stone, tissue, rockwool, flannel) using artificial scales	4
		5. The child is able to name objects that are light in size	5
		6. The child is able to name objects that are heavy	6
	Comparing	7. Children are able to compare short and long objects	7
		8. Children are able to compare light and heavy objects	8

(Kementrian Pendidikan Nasional RI, 2014; Maulana & Handayani, 2022)

In cooperation skills, the gain score between the experimental group and the control group appears different. The experimental group's gain score was 8.63 and the control group's was 1.19. The pre-test score data of the experimental group had an average of 21.25 and the average post-test data was 29.88. In the control group, the average pre-test score was 18.63 and the average post-test score was 19.61. This already shows that there is an increase in cooperation skills in the experimental group after being given gardening treatment. The following is the data presentation:

Table 4. Description of data on cooperation skills of experimental and control groups

No	Subject	Experiment group	No	Subject	Control group

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		Pre	Post	Gain			Pre	Post	Gain
1	ND	19	28	9	17	BR	16	19	3
2	HA	21	30	9	18	BQ	20	22	2
3	RF	22	30	8	19	NS	23	22	-1
4	KR	23	30	7	20	AS	19	18	-1
5	KB	22	31	9	21	BA	24	22	-2
6	AF	21	29	8	22	RS	16	20	4
7	AZ	15	30	15	23	HA	17	17	0
8	RV	26	31	5	24	AZ	16	17	1
9	NF	22	31	9	25	AR	16	16	0
10	KY	26	32	6	26	AM	19	19	0
11	NB	20	28	8	27	SF	19	22	3
12	AM	20	29	9	28	IL	24	22	-2
13	MK	24	31	7	29	AL	15	19	4
14	FI	20	30	10	30	AT	16	19	3
15	AL	20	29	9	31	ER	18	20	2
16	TL	19	29	10	32	DD	20	23	3
Mean		**21,25**	**29,88**	**8,63**	**Mean**		**18,63**	**19,61**	**1,19**

In skills to recognize size concepts, gain score between the experimental group and the control group also appears different. The gain score of the experimental group was 9.00 and the control group was 1.69. The experimental group's pre-test score data had an average of 21.63 and the average post-test data was 30.63. In the control group, the average pre-test score was 18.31 and the average post-test score was 20.00. The following is the data presentation.

Table 5. Description of skills to recognize size concepts in experimental and control groups

No	Subject	Experiment group			No	Subject	Control group		
		Pre	Post	Gain			Pre	Post	Gain
1	ND	21	29	8	17	BR	19	21	2
2	HA	21	30	9	18	BQ	20	19	-1
3	RF	24	31	7	19	NS	22	22	0
4	KR	21	30	9	20	AS	18	16	-2
5	KB	20	31	11	21	BA	17	20	3
6	AF	23	30	7	22	RS	16	20	4
7	AZ	23	31	8	23	HA	15	19	4
8	RV	22	31	9	24	AZ	20	22	2
9	NF	20	31	11	25	AR	18	23	5
10	KY	22	32	10	26	AM	19	21	2
11	NB	22	31	9	27	SF	17	19	2
12	AM	23	31	8	28	IL	20	20	0
13	MK	22	31	9	29	AL	19	19	0
14	FI	22	30	8	30	AT	16	19	3
15	AL	21	31	10	31	ER	20	20	0
16	TL	19	30	11	32	DD	17	20	3
Mean		**21,63**	**30,63**	**9,00**	**Mean**		**18,31**	**20,00**	**1,69**

The mean value on the pre-test results of cooperation skills is 19.938, the minimum value is 15 and the maximum is 26, and the standard deviation is 3.11. The post-test data on cooperation skills had a mean of 24.844, a minimum value of 16 and a maximum of 32, and a standard deviation of 5.389. The mean gain score was 4.906, with a minimum score of -2 and a maximum score of 15, with a standard deviation of 4.321. Data on skills to recognize size concepts has a pre-test mean of 19.969, a minimum score of 15 and a maximum of 24, and a standard deviation of 2.321. The post-test data on skills to recognize size concepts has a mean of 25.313, a minimum

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value of 16 and a maximum of 32, and a standard deviation of 5.389. The mean gain score is 5.344, with a minimum score of -2 and a maximum score of 11, with a standard deviation of 4.069.

Table 6. Descriptive statistics of cooperation ability and skills to recognize the concept of size

	Pre cooperation	Post cooperation	Gain cooperation	Pre size	Post size	Gain size
Valid	32	32	32	32	32	32
Missing	0	0	0	0	0	0
Mean	19.938	24.844	4.906	19.969	25.313	5.344
Std. Deviation	3.110	5.389	4.321	2.321	5.538	4.069
Minimum	15.000	16.000	-2.000	15.000	16.000	-2.000
Maximum	26.000	32.000	15.000	24.000	32.000	11.000

The results of the observation of pretest activities, the observer stated that the ability of cooperation in children was still not well stimulated. When playing, children tend to prefer to play alone and are reluctant to interact with their peers. Children often fight over toys and are less able to socialize. When finished playing, children lack the responsibility to tidy up the toys that have been used and do not want to help friends to tidy up the toys. Gardening activities are provided as stimulation for children in an interesting and fun way to train cooperation in children. In the activity of preparing planting media, children will communicate in determining the division of tasks, such as who will be in charge of arranging the rockwool media, taking water to wet the rockwool, and putting rockwool in a basket that has been given a flannel cloth. This is in line with Vygotsky's theory, which states that collaboration among children is shaped by the dynamics of communication within their peer group, children's capacity to engage and interact with their social environment is an important process that facilitates the construction of various forms of knowledge (Suci, 2018).

During the activity of planting kale seeds in rockwool media, children will learn to help each other between friends in one group. Children will communicate with each other and invite each other to plant kale seeds together so that the work is lighter and completed soon. These activities will also stimulate children who do not want to do activities, one of which is when there are children who feel disgusted to hold kale seeds, children will feel interested because they see all their friends doing this, so that children will be curious and want to try to imitate the activities carried out by their friends. This is in accordance with Bandura's modeling theory, which states that children adjust their behavior by observing and symbolically coding the actions of others, retaining this information to be applied in future contexts (Lesilolo, 2019).

In skills to recognize size concepts, the pretest results show that children still do not understand the size of objects measured using a ruler. Children do not understand units and often call the size not in accordance with the numbers shown. Through gardening activities, skills to recognize size concepts is stimulated through the activity of measuring the height of the kale plants that have been planted together with the group and recording the results on the growth card from the second to the fourth day. During gardening activities, children are not only asked to measure, but also asked to compare the height of kale plants from the second to the fourth day. Measurement and comparison activities are carried out through concrete objects so that children are easier to understand and construct new experiences gained. This finding is in line with the characteristics of early childhood, namely learning through concrete objects around them (Lestariningrum, 2017). Piaget also stated that children acquire knowledge through active engagement with their environment (McClain & Vandermaas-Peeler, 2015).

Gardening activities are an excellent method to stimulate the ability to recognize number concepts compared to conventional methods. Through gardening activities, process skills allow children to process new information through experimentation (Siti Khosiah, 2018). Engaging in

gardening activities provides children with a direct learning process where they grow knowledge, develop skills, and internalize values derived from the interaction of children's experiences (Hardiansyah et al., 2021; Puspita et al., 2024).

CONCLUSION

The results of the implementation of gardening activities on the ability to cooperate and skills to recognize size concepts were carried out with a t-test value of cooperation skills with a value of $p < 0.001$, proving that $p < 0.05$ and indicating that there was a difference in gain score between the experimental group and the control group. In the t-test skills to recognize size concepts shows a value of $p < 0.001$, proving that $p < 0.05$ and means there is a difference in gain score between the control group and the experimental group. This means that there is an effect of gardening activities on the ability to cooperate and skills to recognize size concepts in children aged 5-6 years. The implication of this study underscores: (a) The necessity of thoughtfully considering relevant theoretical frameworks, pedagogical concepts, instructional strategies, and educational media to be employed throughout the research. Such deliberation aims to foster innovation and originality within the study, while also ensuring coherence between theoretical underpinnings and practical implementation; (b) The selection of plant species should prioritize those that are feasible for children to cultivate and later process into nutritious food. This approach not only provides experiential learning opportunities during the cultivation phase but also enables children to appreciate and benefit from the tangible outcomes of their involvement; (c) It is essential to assess the contextual conditions of the research setting in order to identify suitable planting materials and tools that align with the environmental characteristics of the institution; (d) Effective time management must be emphasized to ensure that gardening activities—from sowing seeds to harvesting crops—are completed within a feasible timeframe. This allows children to gain a comprehensive understanding of the entire agricultural cycle, from initial planting to the final yield.

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