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The Effect of the Ergonomics of the Reggio Emilia Approach and Mastery Motivation on Early Childhood Independence

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Abstract	This study examines the effect of the Ergonomic of Reggio Emilia Approach (EoREA) and Mastery Motivation (MM) on Early Childhood Independence (ECI). Thus, the purpose is to determine the main and interaction effects of the treatment variables on ECI. There are three variables in the study, namely: the independent variable (EoREA), the moderator variable (MM), and the dependent variable (ECI). The quasi-experimental study used a 2 x 2 factorial design, and the subjects were students from Play Group. The results showed a difference in the ECI between learning using play environment arrangements according to the EoREA and NEoREA, as indicated by a significant F value ($F = 20.441$; $p < 0.05$). There was also a difference in the ECI between students with high and low MM, as indicated by $F = 4.580$; $p < 0.05$. It is also known that there was an interaction between the EoREA model and MM on the ECI, as evidenced by $F = 9.478$, $p < 0.05$. Thus, it can be concluded that the three hypotheses in this study have been proven, so that the EoREA model assisted by MM can be applied to stimulate ECI.

1. INTRODUCTION

Looking at research results, stimulation is very important for the development of children's independence, especially that provided by parents at home or by adults around children. However, what happens is the lack of stimulation due to affection for children, resulting in over-serving the child's basic and personal needs to make the child dependent. When it is difficult to change parenting styles to stimulate children's development, the role of early childhood education (ECE) institutions is particularly important. In ECE institutions, especially kindergartens, children receive maximum stimulation, and parents gain additional knowledge through parenting activities routinely carried out at schools.

Pre-research conducted by the author on early childhood in kindergartens scattered in Imogiri, Bantul, Province of DI. In Yogyakarta (DIY), about 65% of children have low independence, 30% moderate independence, and only 5% high independence. The main factor in children's lack of independence is parents who spoil their children too much. For example, parents are worried about

leaving their children at school, so they tend to wait around the school, which can make the child "fuss" and become dependent. This phenomenon shows that the child's independence is very important to get attention.

Previous studies have stated that the need to pay attention to early childhood independence stems from several factors, namely, environmental factors, both physical and non-physical. Daud et al., (2023) stated that physical and psychological environmental factors, such as motivation, greatly influence children's independence. Baiti, (2020) also stated that the play environment influences early childhood development, especially independence. Meanwhile, Mahmudah et al., (2023) stated that the independence of early childhood is most influenced by high motivation.

The results of the research above show factors that influence independence in early childhood, but they remain general, namely, limited to the physical and non-physical environments. So it is necessary also to consider which factors in the physical and non-physical environment influence it. In this research, we will discuss the important aspects of the physical and non-physical factors. The physical factor is ergonomics based on the Reggio Emilia Approach (REA), while an important part of the non-physical factor is mastery motivation.

There is a learning model that pays close attention to ergonomic in learning, namely the REA. This is evidenced by the existence of a special teacher, known as an atelierista, who prepares and manages all matters related to ergonomics. REA with atelierista and its project methods are inseparable from ergonomic, so the term Ergonomic of Reggio Emilia Approach (EoREA) emerged. A good and correct EoREA will certainly affect the learning process, leading to the achievement of learning outcomes in the form of children's independence. Lueder & Rice (2008) explain that children's play activities are an exercise in life, and that the arrangement of the play environment greatly influences them; even the size of furniture and shelves, as well as the placement of toys and activity areas, affect children's development, including independence and responsibility. Through EoREA which focuses on structuring learning media along with the layout of furniture that is in accordance with the learning theme and children's characteristics, children's independence can be stimulated well; For example, a storage area for Educational Game Tools (In Indonesia, it is called Alat Permainan Edukatif or APE) which is not only interesting but also easy to reach for children to allow children to rearrange the APE they have used. This can indirectly foster children's independence.

EoREA is certainly not the only factor that affects the development of early childhood independence, because independence involves efforts to solve problems. Messer (2016) states that all children have a motive to 'master' the various tasks and problems they face. Without mastery motivation, it is doubtful whether children will make progress in cognitive, social, communicative, and other areas. Thus, mastery motivation can affect children's independence at this age.

Messer (2003) adds: Although all children have mastery motivation, it will, of course, vary according to inherited disposition and environmental experiences. This is almost in line with the opinion of Lueder & Rice (2008) which states that ergonomics is related to motivation, in that the correct and interesting arrangement of the playing environment will enhance motivation, making it easier to achieve learning outcomes. The statements of these two opinions show that there is a relationship between EoREA and mastery motivation, both of which are said to help improve the development of early childhood independence. For this reason, the authors aim to examine the influence of both on the development of early childhood independence through a study titled "The Effect of Ergonomics of Reggio Emilia Approach (EoREA) and Mastery Motivation on Early Childhood Independence".

2. METHODS

The design used in this research is an experimental one. Because the control of variables that affect the research subject's conditions cannot be fully implemented, and the sample used in this experimental

research is a class that cannot be randomized to meet the requirements of experimental research, this research uses a quasi-experimental design.

There are three variables in this study, namely: independent variables, moderator variables, and dependent variables. The independent variable in question is the Ergonomic of Reggio Emilia Approach (EoREA) model, as the treatment applied to the experimental group, and the control group does not receive the Ergonomic of Reggio Emilia Approach model (hereinafter referred to as NEoREA). The moderator variable in this study is mastery motivation, which is thought to interact with the independent variable to influence the dependent variable, early childhood independence. The conceptual relationship between variables in this study is shown in the following figure:
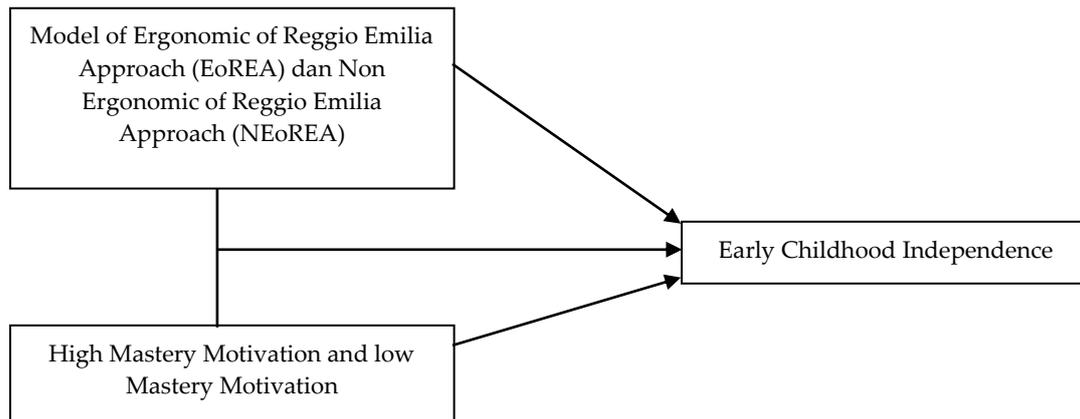

Diagram 1. Conceptual Chart of the Relationship between Research Variables

The quasi-experimental design in this study uses the 2 x 2 factorial design, which is presented in the following table:

Table 1. The 2 x 2 Factorial Quasi-Experiment Design

Treatment		Ergonomic Model	
Moderator		EoREA	NEoREA
Mastery	High	TT	RT
Motivation	Low	TR	RR

EoREA = Ergonomics of Reggio Emilia Approach

NEoREA = Non-Ergonomics of Reggio Emilia Approach

TT = High mastery motivation and high independence

RT = Low mastery motivation and high independence

TR = High mastery motivation and low independence

RR = Low mastery motivation and low independence

The subjects in this study were students of Citra Bangsa Mulia 2 Kembangsongo, Trimulyo, Jetis, Bantul, DI. Yogyakarta. The student of Citra Bangsa Mulia 2 Kembangsongo, Trimulyo, Jetis consists of 2 groups (study groups) where each group has 15 students, namely groups 1 and 2. The two student groups were assigned as research subjects; they were then randomly assigned: one class to the experimental group and the other to the control group. At the first meeting, a pretest (initial observation) was conducted for both groups.

This research was conducted in three stages, namely the experimental preparation stage, the experimental implementation stage, and the post-experimental stage.

a.   The Experimental Preparation Stage

The preparation for this research lasted quite a long time, given that the focus was on setting up the classroom according to the EoREA model and preparing research instruments. The first step the author took at this preparatory stage was to obtain the administrative prerequisites, including a research permit addressed to the Head of Citra Bangsa Mulia 2, Kembangsongo, Trimulyo, Jetis, Bantul, DI. Yogyakarta and prepare/ compile a research tool in the form of a research measuring instrument scale. After obtaining permission to conduct the research, the independence scale and mastery motivation scale were tested to determine their validity and reliability. The trial was conducted at Ay-Yumna Dukuh, Imogiri, Bantul, DI Yogyakarta, with students who were not accustomed to collecting research data. After the experimental data were collected, data analysis was conducted to assess the validity and reliability of each scale, namely by removing missing items and adjusting the item order.

Next, determine which class will serve as the experimental group and which will serve as the control group. The determination was random, and group 1 was assigned as the experimental group and group 2 as the control group. The author then discussed the preparation and application of the EoREA model with the PAMONG teacher who led group 1. Before arranging the classroom to apply the EoREA model, the materials and tools to be used during experiments related to its application are prepared. It was then agreed that the classroom arrangement would take place on Saturdays and Sundays before the new theme began. The classroom teacher also serves as an atelierista, a special teacher who addresses issues in instructional media and classroom settings.

The theme at the time of the experiment was plants, so the arrangement of the experimental group classrooms was adjusted accordingly. In contrast, the control group classroom settings remained as they were, untouched by the EoREA model. Learning activities are carried out as usual without any changes. There is no automatic change in the learning plan (in Indonesia, especially in ECE, the weekly plan is called RPPM, or the daily plan is commonly called RPPH).

b.   The Implementation Stage of Experiment

Collecting data in this study through the following steps: a) providing child observation sheets in the form of a mastery motivation scale to the teacher, b) giving a pretest, namely a child's observation sheet in the form of a self-reliance scale to the teacher, c) carrying out experimental treatment in the form of learning activities with a model EoREA, and d) provide a posttest, which is a child's observation sheet in the form of a scale of independence to the teacher. The study was conducted across 10 meetings: one for the mastery motivation test, one for the pretest measuring children's independence, seven for learning using the EoREA model, and one for the posttest measuring children's independence.

c.   The Post-Experimental Stage

The final step after treatment is to administer a final test to both groups to measure the children's independence. This test aims to determine the effects of treatment in the experimental and control groups on independence in early childhood (in this case, students), as well as the interaction between the independent and moderator variables on independence.

3.   FINDINGS AND DISCUSSIONS

Findings

It has been previously stated that this research was conducted at Citra Bangsa Mulia 2 Kembangsongo, Trimulyo, Jetis, Bantul, DI Yogyakarta, with group 1 as the experimental group and group 2 as the control group. Each group consisted of 15 children. All selected subjects met the inclusion criteria for the data analysis because their mastery motivation (MM) scores fell within the high- and low-MM groups.

Early childhood independence data show the abilities students develop after receiving treatment. The treatment for the control class was the implementation of learning using the Non-Ergonomics of Reggio Emilia Approach (NEoREA). In contrast, the treatment for the experimental class involved learning using the Ergonomics of Reggio Emilia Approach (EoREA). Early childhood independence data in this study were obtained from an assessment using an early childhood independence scale. The description of early childhood independence among groups of students whose learning uses NEoREA and those who apply EoREA without paying attention to MM is presented in the following table:

Table 2. Description of Early Childhood Independence Based on Type of Treatment in the Group

Parameter	Treatment Group	
	NEoREA	EoREA
N	15	15
Highest Score	30	45
Lowest Score	29	44
Mean	29.8	44.8
Std Deviation	0.447	1.414

The table above shows that the overall mean for early childhood independence among students (regardless of high or low MM) in the EoREA treatment group was 44.8. This value is higher than the average early childhood independence in the NEoREA treatment group, which is 29.8.

Regarding MM, the researcher classified students into 2 groups based on their MM scores: high MM and low MM. Students are classified into the high MM group if the score obtained is greater than the median ($\geq$ median). Moreover, the group of students with low MM is students who get a score smaller than or equal to the median (<median). The median in the experimental group was 51, and in the control group was 34. The description of the independence of early childhood based on MM in each group is shown in the following table:

Table 3. Description of Early Childhood Independence Based on Mastery Motivation (MM)

Descriptive Statistic				
Dependent Variable: early childhood independence				
Class	MM	Mean	Std. Deviation	N
Control	Tinggi	30	0.245	8
	Rendah	29.5	0.824	7
	Total	29.8	0.447	15
Experiment	Tinggi	45	0.245	8
	Rendah	43.5	2.807	7
	Total	44.8	1.414	15
Total	Tinggi	37.5	0.219	16
	Rendah	36.5	1.689	14
	Total	37.1	0.989	30

Based on the table above, students with high MM scores have higher independence scores than those with low MM scores, in both the experimental (EoREA) and control (NEoREA) groups.

A normality test is performed to assess the data's normality using the Kolmogorov-Smirnov test. The decision-making criterion is $\alpha = 0.05$; that is, if the probability is significant ($p > 0.05$), the data are normally distributed, and if the probability is significant ($p < 0.05$), the data are not normally distributed. Based on the research data for each variable, after conducting a normality test, the results are shown in the following table.

Table 4. Normality Test Results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
NEoREA	.130	35	.140	.949	35	.106
EoREA	.125	35	.183	.941	35	.060
a. Lilliefors Significance Correction						

Table 4 shows data that the independence value of KB students in the experimental group who received the EoREA model treatment showed a significance value of 0.183 ($p > 0.05$) and the independence value of KB students in the control group who received the NEoREA treatment showed a significance value of 0.140 ($p > 0.05$), meaning that both data on the independence value of KB students in the experimental group and the control group were normally distributed.

The next test requirement is the homogeneity test, which assesses the homogeneity of each variable or group of data. This homogeneity test aims to determine whether the research samples or respondents have the same characteristics, so that the experiment can truly compare the main research factors. The results of the homogeneity test using Levene's Test in this study are shown in Table 5.

Table 5. Homogeneity Test Results

Levene's Test of Equality of Error Variances[a,b]					
		Levene Statistic	df1	df2	Sig.
Kemandirian	Based on Mean	1.626	3	74	.191
	Based on Median	.878	3	74	.456
	Based on Median and with adjusted df	.878	3	54.421	.458
	Based on the trimmed mean	1.537	3	74	.212

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Kemandirian

b. Design: Intercept + Model + MasteryMotivation + Model * MasteryMotivation

Based on the results of the homogeneity test in Table 4.4, the data for the independence of KB students show a p-value of 0.191 ($p > 0.05$), indicating that the variances of the control and experimental groups are homogeneous.

The previous explanation illustrates that the normality and homogeneity tests have been fulfilled. The next step is to analyze the research data. The data analysis technique used is a two-way analysis of variance (2 x 2 factorial), which is essentially used to test three hypotheses in this study: (a) The independence of early childhood children differs significantly between class groups using play environment arrangements according to the EoREA model and class groups without play environment arrangements according to the EoREA model, which are then referred to as NEoREA, (b) The

independence of early childhood differs significantly between groups with high mastery motivation and groups with low mastery motivation, dan (c) There is an interaction between the Ergonomics of Reggio Emilia Approach (EoREA) model and mastery motivation on the independence of early childhood.

The results of the data analysis using two-way analysis of variance (2 x 2 factorial) to test the three hypotheses above can be seen in the following table 6:

Table 6. Two-Way Analysis of Variance Results

Tests of Between-Subjects Effects					
Dependent Variable: Independence					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9659.159a	3	3219.720	11.163	.000
Intercept	1878433.710	1	1878433.710	6512.848	.000
Model	5895.533	1	5895.533	20.441	.000
MasteryMotivation	1320.969	1	1320.969	4.580	.036
Model * MasteryMotivation	2733.612	1	2733.612	9.478	.003
Error	21343.059	74	288.420		
Total	1936393.000	78			
Corrected Total	31002.218	77			
a. R Squared = .312 (Adjusted R Squared = .284)					

Based on the results of the two-way analysis of variance test in the table above, it can be seen that there is a difference in independence in early childhood between learning using play environment arrangements according to the EoREA and NEoREA models, as indicated by a significance value of F = 20.441; p < 0.05. In addition, there is a difference in independence in early childhood between students with high and low Mastery Motivation, as indicated by the significance value, F = 4.580; p < 0.05. Furthermore, an interaction between the EoREA model and mastery motivation on independence in early childhood was found, as shown by F = 9.478; p < 0.05. Thus, the three hypotheses in this study have been supported.

Discussion

The results of a two-way analysis of variance (factorial 2 x 2) show that the F statistic is 20.441. This shows that the significance level of 0.000 is below the 0.05 threshold (p < 0.05). This means that there is a difference in the independence of early childhood between learning that uses the arrangement of the play environment according to the Ergonomic of Reggio Emilia Approach (EoREA) model and learning without using the arrangement of the play environment according to the EoREA model, which is then referred to as the NEoREA model.

The group using the EoREA learning model showed greater independence than the group using the NEoREA learning model. This is shown in Table 4.1, which summarizes the average independence value for each treatment group, namely the EoREA and NEoREA models. In Table 4.1, the average independence of children overall for PG students in the EoREA learning model group is 164.31. This value is greater than the average independence of children in the group using NEoREA learning, which is 142.47. The significant difference in average independence in early childhood between the EoREA and NEoREA groups indicates that the treatment in each group has a significant influence on independence in early childhood (PG student).

The findings of this study align with several previous studies. However, previous research on children's ergonomics has not yet focused on ergonomics aligned with the Reggio Emilia Approach (REA). Even so, previous research indicates a close relationship between ergonomics and the development of children's independence, and this study extends this line of inquiry to REA. Findings from previous studies that align with this study are presented in the following explanation.

Bennett & Tien (2003) highlighted the physical growth of early childhood when they have to carry heavy loads to school, such as backpacks, food supplies, and other items that require special attention. The results of their research illustrate that ergonomics, when designed and implemented seriously and adjusted to the child's character, will produce outcomes in accordance with expectations. It is said that creating a good, comfortable learning environment will have a positive impact on physical health, help children become more independent in completing tasks, and enable them to enjoy learning.

Other researchers who produced findings almost similar to Bennett & Tien are Syazwan et al., (2011)where they also highlighted the impact on children's muscle health from the physical burden of heavy school bags. The study found that ergonomics affects the development or restoration of children's physical health and independence in activities.

Not much different from the two research results above, Heyman & Dekel (2009) also studied children's physical health, focusing on elementary school students in the early grades. They presented the findings of their research that ergonomics adjusted to children's (elementary school students') physical growth characteristics make their movements more flexible, reduce physical injuries, and increase their independence in completing tasks.

The findings of the next research come from old research, but are still quite up to date in the development of research on ergonomics, namely, research conducted by Nixon et al., (1979). Nixon found that poor ergonomics or insufficient attention to the child's character can cause injury and trauma, leading the child to feel worried about doing something independently.

As if following up on Nixon's research, Bailey, (1988) In his was, an elementary school principal in the London Borough of Enfield in his research found that ergonomics affects children's ability and independence in handwriting. According to him, ergonomics that focus on grip performance affects children's ability to write (by hand) and independence in writing without teacher assistance.

In line with Bailey's findings, Liu et al., (2015) studied hand grasp development in children aged three to ten years. According to them, hand grasp development needs special attention because it is linked to other developmental milestones involving hand movements, such as holding, grasping, writing, and so on, which are related to the ability to care for oneself and perform tasks. In this study, they found that ergonomic factors focused on writing tools greatly influence hand grasp development, and that the arrangement of the learning environment, adjusted to the child's body contour and characteristics, has a positive impact on the child's independence in completing tasks, as hand grasp development proceeds as expected.

Research conducted by Marschall et al. (1995) is similar to that of Bailey and Liu et al., who focus on children's physical growth. However, they tend to discuss posture when sitting, so the ergonomics discussed focuses on the child's activity environment in that position. They found that the design of the environment in which children complete tasks affects their ability and independence in doing so.

Roderick (2004) Conducted a study that not only highlighted child growth and development, but also focused on child safety in activities both at home and at school, which will eventually lead to maximum child growth and development and the achievement of expected learning goals at school. Roderick found that a safe, child-friendly environment (ergonomics) will make parents and teachers less worried about child safety, especially physical injury. Thus, children will be free and independent in their activities even though they remain under the supervision of parents or teachers.

Jayaratne (2012) also found something not much different from Roderick. For him, children's ergonomics is a modern approach that previously focused only on the adult work environment. Children are not mini adults who must receive serious attention. The safety of the child's environment during activities is the focus of his research. Jayaratne found that a spacious, safe environment will make children feel freer and more independent when carrying out activities and completing their tasks.

Garcia et al., (2014) studied ergonomics in Kindergarten (TK), which focused on the environment (area) of children's activities, starting from the playroom, dining room, and toilet. They found that the size of the area where children are active and the accessibility of the objects they need affect children's ability and independence to complete tasks without teacher assistance.

The findings of several studies above indicate that the EoREA model is very effective for supporting early childhood learning compared to using only the NEoREA model, especially in developing early childhood independence. In addition to the results of previous research, the findings in this study are supported by several theories, including psychological theories of early childhood and learning theories in early childhood education, as explained below.

Psychological studies highlight the relationship between ergonomics and the characteristics of early childhood. Essa (2003) stated that the environment is an important factor, namely, something related to where early childhood and teachers play and do activities, and what elements must be remembered when considering an appropriate environment for early childhood learning to achieve the expected goals. In line with what was conveyed by Essa, Santrock (2011) stated that learning performance can increase due to a strong relationship between students and the learning environment. In relation to this study, the learning environment aligns with the Reggio Emilia Approach (REA).

REA aligns with the philosophies of John Dewey, Piaget, and Vygotsky, emphasizing that learning uses the project method (Roopnarine & Johnson, 2013). According to the theory he created, John Dewey stated that students (children) must be independent, able to solve the difficulties or problems they face, and determine how to solve them through the experience they have gained (Dewey, 2001). Furthermore, Piaget (1971) argued that children construct knowledge through the stimulation provided by their surroundings; in other words, they learn independently by looking around them. Moreover, REA is also supported by the theory that children can develop as expected when supported by social interaction (Vygotsky, 1978).

A learning environment designed to facilitate social interaction between children or between teachers and children, and to support children in solving the problems they face, can support children's development in line with expectations (in this case, children's independence). Looking at these theories, it can be said that the EoREA model is very effective for supporting the learning process in early childhood, especially in developing children's independence, compared to using only the NEoREA model.

In addition to the EoREA model, children's independence can also be influenced by mastery motivation (MM). Regarding MM, the results of the study showed that the average posttest score of independence of KB students with learning using the EoREA model who had high MM was greater than the average posttest score of independence of KB students who had low MM, which was 174.8 for those with high MM and 151.8 for those with low MM. Learning without the EoREA model (NEoREA) was the same; the average posttest score of independence of KB students who had high MM was greater than the average posttest score of KB students who had low MM, which was 155.2 for those with high MM and 126.4 for those with low MM.

Based on the results of the hypothesis test, it can be seen that, in learning using the EoREA or NEoREA model, there is a difference in the independence of early childhood (KB students) between the high- and low-MM groups. KB students with high MM scores had higher average posttest independence scores than KB students with low MM scores, both those who used the EoREA model

and those who did not.

The findings of this study are consistent with those of previous studies. The results of the study are described below. Ozbey & Daglioglu, (2017) found that children aged two to four years begin to express a desire for social recognition, and those who have the drive or motivation to achieve it show greater independence, which is an important part of internal motivation. Regarding this internal motivation, Chapter II explains that some experts argue that mastery motivation (MM) is part of internal motivation, and some even claim that internal motivation is the same as MM.

Jozsa, K & Morgan, (2015) Conducted a study with research subjects of children aged three to four years. They found that the expressive aspect of MM elicits affective reactions, including a sense of independence. Almost in line with the results of Jozsa & Morgan's study, Kelley et al., (2000) found that MM facilitates the development of children's abilities and independence, with higher MM associated with greater abilities and independence.

Old research by Carlton & Winsler (1998) found that a strong MM pattern in early childhood development affects a child's subsequent development. Furthermore, Gilmore et al. (2003) also explained that MM is very important for a child's future academic function. This is in line with the findings of (2017), who explained that MM is an important characteristic in early childhood, such that high and low MM can predict all aspects of the child's subsequent development. Huang & Lay (2017) also reported findings similar to those of Huang & Lay (2017), namely that the consistency and variation of high and low MM in early childhood can predict the child's general abilities. These findings were also confirmed by Rahmawati et al. (2021), who found that MM affects the social-emotional development of kindergarten children across several domains of child development, including independence.

The research conducted by Redding et al., (1988) It is quite old, but it can still be used as a reference for subsequent research, including this research. Redding et al presented findings that infants and young children who have MM will persist in doing difficult things independently. The results of this study are in line with the results of the study by Vlachou & Farrell, (2000) which revealed that MM is considered a psychological strength that can encourage individuals to try tasks independently, regardless of whether the task is successful.

The research results above show a strong relationship between MM and early childhood independence: MM that meets expectations is associated with greater independence in children. This is consistent with the results of this study, which found that MM affects independence in early childhood (KB students). Based on the results of the two-way analysis of variance test, there is an interaction between the EoREA model and mastery motivation on independence in early childhood (KB students), as indicated by F = 9.478, p < 0.05. The results of this study are consistent with those of previous studies.

Smith (2012) presented the results of his research in the form of (1) changes in behavior and variations in student learning outcomes are influenced by ergonomics, and (2) the learning environment needed to support and motivate students in learning is based on education integrated with ergonomics. These findings show a close relationship among ergonomics, motivation, and learning outcomes.

Szalma (2014) found that applying motivation theory, both external and internal (mastery motivation is part of internal motivation), in ergonomic design will affect human progress in work. Although Szalma's study involved adults (office employees), the essence is the same: there is an interaction between ergonomics and mastery motivation on human performance. The results of Azadeh & Zarrin, (2016) Studies are not much different from Szalma's, namely, research with adult human research subjects. They found a relationship among self-resilience, motivation, ergonomics, and the quality of human resources.

Stevenson (2017) studied children in Finland and found that both physical and psychological environments influence the development of children's independence. The physical environment in

question is the arrangement of the learning or play environment that is appropriate to the child's size and characteristics. The psychological environment in question is everything related to affection, motivation (including mastery motivation), and interest. This study clearly shows a close relationship among ergonomics, motivation, and independence.

The results of further research conducted by MacPhee et al., (2018) found that ergonomics and the childcare environment, along with mastery motivation, affect children's school readiness, including academic, social, and independence skills. MacPhee et al. highlighted the school readiness of early childhood, which is usually a concern for parents, and found that ergonomics and mastery motivation influence it. The research by MacPhee et al. aligns with Stevenson's previous year's research and with the current researcher's research.

A relatively recent study was conducted by Soltaninejad et al., (2021) Moreover, found that ergonomics interacting with interest and motivation can affect the goals of the learning process and cognition (abilities) of preschool students during the COVID-19 pandemic. Of course, the results of the study by Soltaninejad et al. are largely in line with research by other researchers that focuses on the development of early childhood independence rather than children's abilities in general, and on mastery motivation rather than motivation in general.

It can be said that there is an interaction between the EoREA model and mastery motivation regarding independence in early childhood. Learning activities that use the arrangement of the play environment according to the EoREA model increase early childhood independence development. Related to mastery motivation, it is shown that children with high mastery motivation also have high independence, and vice versa: children with low mastery motivation also have low independence.

The independence of early childhood is part of a broader slice of social-emotional development, as well as of religious and moral values. Early childhood independence can be briefly defined as the independence that exists in early childhood. Referring to the previous definition of independence, early childhood independence is a behavior in which the child directs his own activities, based on self-confidence, without any influence from others, so that he can overcome his own difficulties, take his own initiatives, and act. Which is good for him, in this case, doing things that meet his personal needs without depending on adults. It turns out that independence in early childhood can be developed by arranging the surrounding space or environment (physical environment) so that they can carry out all their own activities easily and comfortably without the help of adults.

(2016) stated that the ergonomic learning environment is a place where the relationship between humans, work, and the environment occurs as a place for mental and physical activity to take place. It is through this environment that humans can develop their abilities. The opinion that the physical environment in the early childhood learning process can develop all aspects of children's development and intelligence (including independence) was also conveyed by Santin & Torruella (2017), who explained that the environment is part of the third teacher (atelierista) in Reggio. Emilia Approach (REA), which carries the project method in learning, where Hakim (2016) argues that project-based learning strategies can improve learning outcomes (in this case, improving children's abilities and development). Mou (2019) added that students who learn using the project method tend to be more independent in solving problems during their learning.

Ergonomics, which is an art or science in structuring a learning environment, is also an important part of REA. The relationship between ergonomics and atelierista is discussed in detail by Lella et al., (2005) In a chapter on The Role of The Atelierista, which contains assignments along with examples of atelierista work as a teacher in REA. EoREA can be developed by combining Lueder & Rice's five key principles of ergonomics in ECE with the atelierista's role in REA.

4. CONCLUSION

Referring to the explanation above, it can be concluded that: (1) there are differences in early childhood independence between class groups using the arrangement of the play environment according to the EoREA model and class groups without the arrangement of the play environment according to the EoREA model (NEoREA), (2) there are differences in early childhood independence between groups that have high MM and groups that have low MM, and (3) there is an interaction between the EoREA and MM models on early childhood independence.

Based on the research results, it can be said that the EoREA model and mastery motivation influence the independence of early childhood children, namely, the increasing independence of children by applying the EoREA model, and the higher the mastery motivation, the higher the independence of children, so this EoREA model needs to be implemented in early childhood education institutions. For the heads of PAUD institutions, they can develop policies in the form of materials and moral guidance for classroom settings that align with the EoREA model, so that teachers in their institutions can implement the EoREA model as expected and strive to make teachers competent in fostering students' high mastery motivation. Teachers can develop the EoREA model to align with their institutions' characteristics and foster high mastery motivation among their students. Furthermore, together with the school, we can help parents foster high mastery motivation and support the implementation of the EoREA model in preschool institutions, which serve as places for their sons and daughters to develop in all aspects through play and learning activities.

These findings also indicate that the EoREA and mastery motivation models can influence other aspects of early childhood development, so further research is needed to examine these areas, including cognitive, motor (gross and fine motor skills), language, and other domains. In addition to preschool institutions, the EoREA and mastery motivation models can be applied in other educational institutions (e.g., elementary schools) with a focus on areas beyond independence; therefore, further research is needed to examine this. Because this research has a limited number of subjects, it is recommended that further research be conducted to achieve more accurate results.

REFERENCES

Azadeh, A., & Zarrin, M. (2016). An intelligent framework for productivity assessment and analysis of human resources from resilience engineering, motivational factors, HSE, and ergonomics perspectives. *Safety Science*, *89*, 55–71.

Bailey, C. (1988). Handwriting: Ergonomics, Assessment and Instruction. *British Journal of Special Education*, *15*(2), 65–71.

Baiti, N. (2020). Desain Pengelolaan Lingkungan Bermain dalam Meningkatkan Kemampuan Berbahasa Anak. *Jurnal Pendidikan Islam Anak Usia Dini*, *3*(2).

Bennett, C., & Tien, D. (2003). Ergonomics for Children and Educational Environments Around The World. *International Ergonomics Association, Seoul, South Korea*.

Carlton, M. P., & Winsler, A. (1998). Fostering Intrinsic Motivation in Early Childhood Classrooms. *Early Childhood Education Journal*, *25*(3).

Daud, F., Isa, A., Napu, Y., & Setiyowati, E. (2023). Faktor-Faktor yang Mempengaruhi Kemandirian Anak Usia Dini di PAUD Aulia Indah Desa Bongo di Kabupaten Boalemo. *Student Journal of Community Education*, *3*(1).

Dewey, J. (2001). *Democracy and Education*. The Pennsylvania State University.

Essa, E. (2003). *Early Childhood Education*. Thomson Delmar Learning.

García, A., Waldron, J., Bedoya, C., Cuervo, L., Marín, L., Morales, C., Sánchez, C., & Sierra, A. (2014). Evaluation of the Occupied Area of Children Aged between 3 and 5 Years Old in Different Kindergarten Spaces—Proceedings of the 5th International Conference on Applied Human

Factors and Ergonomics, *AHFE 2014*.

Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery Motivation: Stability and Predictive Validity from Ages Two to Eight. *Early Education & Development*, 14(4).

Hakim, A. (2016). Pengaruh Strategi Pembelajaran (Pembelajaran Berbasis Proyek vs Pembelajaran Langsung) dan Motivasi Belajar Terhadap Pemahaman Konsep dan Keterampilan Motorik. *INOTEP*, 3(1).

Heyman, E., & Dekel, H. (2009). Ergonomics for children: An educational program for elementary school. *IOS Press*, 1051–9815. https://doi.org/10.3233/WOR-2009-0824.

Huang, S.-Y., & Lay, K.-L. (2017). Mastery Motivation in Infancy and Early Childhood: The Consistency and Variation of Its Stability and Predictability of General Competence. *Hungarian Educational Research Journal*, 7(2), 15–31. https://doi.org/10.14413/HERJ/7/2/2

Jayaratne, K. (2012). Ergonomic Considerations in School Environments – The Need to Broaden the Scope. *IOS Press*. https://doi.org/10.3233/WOR-2012-0877-5543

Jozsa, K, & Morgan, G. (2015). An Improved Measure of Mastery Motivation: Reliability and Validity of the Dimensions of Mastery Questionnaire (DMQ 18) for Preschool Children. *Hungarian Educational Research Journal*, 5(4), 87–103. https://doi.org/10.14413/herj.2015.04.08

Jozsa, K., Barret, K. ., Jozsa, G., Kis, N., & Morgan, G. . (2017). Development and Initial Evaluation of an Individualized Moderately Challenging Computer-tablet Mastery Motivation Measure for 3–8 year-olds. *Hungarian Educational Research Journal*, 7(2), 106–126. https://doi.org/10.14413/HERJ/7/2/7

Kelley, S., Brownell, C., & Campbell, S. (2000). Mastery Motivation and Self-Evaluative Affect in Toddlers: Longitudinal Relations with Maternal Behavior. *Child Development*, 71(4), 1061–1071.

Lella, G., Hill, L., Cadwell, L., & Schwall, C. (2005). *In The Spirit of The Studio (Learning From The Atelier of Reggio Emilia)*. Teacher College Press, Columbia University.

Liu, L., Cui, X., & Dong, H. (2015). Ergonomics design research on writing tools for children. *Procedia Manufacturing*. https://doi.org/10.1016/j.promfg.2015.07.890.

Lueder, R., & Rice, V. J. B. (2008). *Ergonomics for Children, Designing Products and Places for Toddlers to Teens.* Taylor & Francis Group.

MacPhee, D., Prendergast, S., Albrecht, E., Walker, A., & Miller-Heyl, J. (2018). The Child-Rearing Environment and Children's Mastery Motivation as Contributors to School Readiness. *Journal of Applied Developmental Psychology*, 56. https://doi.org/https://doi.org/10.1016/j.appdev.2018.01.002

Mahmudah, N., Elan, E., & Mulyana, E. . (2023). Analisis Kemandirian Anak Usia Dini. *Journal Paud Agapedia*, 7(2), 146–151.

Marschall, M., Harrington, A., & Steele, J. R. (1995). Effect of workstation design on sitting posture in young children. *Ergonomics Journal*, 38(9), 1932–1940.

Messer, D. (2003). *Mastery Motivation in Early Childhood (Development, Measurement, and Social Processes)*. Routledge - Taylor & Francis e-Library.

Messer, D. (2016). *Mastery Motivation in Early Childhood (Development, Measurement, and Social Processes)*. Routledge - Taylor & Francis Group.

Mou, T. (2019). Students' Evaluation of Their Experiences with Project-Based Learning in a 3D Design Class. *Asia-Pacific Edu Res*, 159–170. https://doi.org/https://doi.org/10.1007/s40299-019-00462-4.

Nixon, J., Pearn, J., & Petrie, G. (1979). Childproof Safety Barriers (An ergonomic study to reduce child trauma due to environmental hazards). *Australian Paedeatric Journal*, 260–262.

Ozbey, S., & Daglioglu, H. E. (2017). Adaptation Study of The Motivation Scale for The Preschool Children (DMQ18). *International Journal of Academic Research*, 4(2).

Piaget, J. (1971). *The Child's Conception of The World. Translated by Joan & Andrew Tomlinson*. Routledge & Kegan Paul, Ltd.

Praherdhiono, H., & Dkk. (2016). Instrumen Kenyamanan Lingkungan Belajar Berbasis Ergonomi. *Jurnal Pendidikan Dan Pembelajaran (JPP)*, *23*(1).

Rahmawati, A., Tairas, M. M., & Nawangsari, N. A. (2021). The Influence of Mastery Motivation Towards Social Emotional Competence in Early Childhood. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *5*(2), 1837–1843.

Redding, C., Morgan, G., & Harmon, R. (1988). Mastery Motivation in Infants and Toddlers: Is It Greatest When Tasks are Moderately Challenging? *Infant Behavior and Development*, 419–430.

Roderick, L. (2004). The ergonomics of children in playground equipment safety. *Journal of Safety Research 35*, 249 – 254.

Roopnarine, J., & Johnson, J. (2013). *Approaches to Early Childhood Education (Sixth Edition)*. Pearson Education, Inc.

Santin, M., & Torruella, M. (2017). Reggio Emilia: An Essential Tool to Develop Critical Thinking in Early Childhood. *Journal of New Approaches in Educational Research*, *6*(1), 50–56. https://doi.org/10.7821/naer.2017.1.207

Santrock, J. (2011). *Educational Psychology (Fifth Edition)*. McGraw-Hill Companies.

Smith, T. (2012). Integrating community ergonomics with educational ergonomics - designing community systems to support classroom learning. *IOS Press*, *41*, 3676–3684. https://doi.org/10.3233/WOR-2012-0009-3676

Soltaninejad, M., Babaei-Pouya, A., Poursadeqiyan, M., & Feiz, A. (2021). Ergonomics Factors Influencing School Education During The COVID-19 Pandemic: A Literature Review. *IOS Press*, *68*(1), 69–75. https://doi.org/10.3233/WOR-203355

Stevenson, B. (2017). Children's independence: a conceptual argument for connecting the conduct of everyday life and learning in Finland. *CHILDREN'S GEOGRAPHIES*, *15*(4), 439–451. https://doi.org/http://dx.doi.org/10.1080/14733285.2016.1271942

Syazwan, A., Azhar, M. N., Anita, A., Azizan, H., Shaharuddin, M., Hanafiah, J., Muhaimin, A., Nizar, A., Rafee, B., Ibthisham, A., & Kasani, A. (2011). Poor sitting posture and a heavy schoolbag as contributors to musculoskeletal pain in children: an ergonomic school education intervention program. *Journal of Pain Research 2011*, 287–296.

Szalma, J. . (2014). On the Application of Motivation Theory to Human Factors/Ergonomics: Motivational Design Principles for Human–Technology Interaction. *Human Factors and Ergonomics Society*, *56*(8), 1453–1471. https://doi.org/10.1177/0018720814553471

Vlachou, M., & Farrell, P. (2000). Object Mastery Motivation in Pre-school Children with and without Disabilities. *Educational Psychology*, *20*(2).

Vygotsky, L. . (1978). *Mind in Society (The Development of Higher Psychological Processes)*. Harvard University Press.