2024, Retos, 55, 452-460

Learning model of basic manipulative movements of throwing and catching: A developmental study through early childhood play

Modelo de aprendizaje de los movimientos manipulativos básicos de lanzamiento y recepción: un estudio del desarrollo a través del juego en la primera infancia

*, **Endang Pratiwi, *Hernawan, *Fahmy Fachrezzy, ***Norma Anggara, *Hikmah Lestari, *Aditya Gumantan, ****Y. Touvan Juni Samodra, *****M. Adam Mappaompo, *****Juhannis, ******Albadi Sinulingga

*Universitas Negeri Jakarta, (Indonesia), ** Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin, (Indonesia), *** Universitas Lambung Mangkurat, (Indonesia), ****Universitas Tanjungpura, (Indonesia), ***** Universitas Negeri Makassar, (Indonesia), ****** Universitas Negeri Medan, (Indonesia)

Abstract. The importance of learning basic manipulative movements of throwing and catching to be owned by every early childhood because it has benefits and influences on their overall development. This study aims to develop a model of learning basic manipulative movements of throwing and catching in Early Childhood. The type of research adapted is Research and Development (R&D) adopting the Borg & Gall development model which conceptually the research and development steps of this development model include 10 steps namely: 1) research and data collection, 2) planning, 3) development, 4) initial field trial, 5) revision of trial results, 6) second field trial, 7) refinement of field test products, 8) field implementation test, 9) final product refinement, 10) dissemination and implementation. The initial design consisted of 16 game packages. The development stage involved judges, kindergarten teachers, and as samples in small and large scale trials, kindergarten students aged 5-6 years were used. The results of the study resulted in 14 series of games. Based on the effectiveness test, the Ngain value is 75.73%. So that these 14 game models are worth using to develop the throwing and catching skills of children aged 5-6 years. These findings make an important contribution to the development of early childhood education, especially in the context of developing fine motor skills. The learning model developed can be a reference for educators and parents in supporting the development of early childhood manipulative movements through an effective and fun play approach.
Keywords: Sport Science, Motor Control, Basic Manipulative Movements, Early Chillhod

Resumen. La importancia del aprendizaje de los movimientos manipulativos básicos de lanzamiento y recepción debe ser asumida por todos los niños en la primera infancia, ya que tiene beneficios e influye en su desarrollo general. Este estudio tiene como objetivo desarrollar un modelo de aprendizaje de los movimientos manipulativos básicos de lanzamiento y recepción en la Primera Infancia. El tipo de investigación adaptado es Investigación y Desarrollo (I+D) adoptando el modelo de desarrollo de Borg & Gall que conceptualmente los pasos de investigación y desarrollo de este modelo de desarrollo incluyen 10 pasos a saber: 1) investigación y recopilación de datos, 2) planificación, 3) desarrollo, 4) prueba inicial sobre el terreno, 5) revisión de los resultados de la prueba, 6) segunda prueba sobre el terreno, 7) perfeccionamiento de los productos de la prueba sobre el terreno, 8) prueba de aplicación sobre el terreno, 9) perfeccionamiento final del producto, 10) difusión y aplicación. El diseño inicial constaba de 16 paquetes de juegos. En la fase de desarrollo participaron jueces, profesores de guardería y, como muestras en los ensayos a pequeña y gran escala, se utilizaron alumnos de guardería de entre 5 y 6 años. Los resultados del estudio dieron lugar a 14 series de juegos. Según la prueba de eficacia, el valor de Ngain es del 75,73%. Por lo tanto, estos 14 modelos de juego merecen ser utilizados para desarrollar las habilidades de lanzamiento y recepción de los niños de 5 a 6 años. Estos resultados suponen una importante contribución al desarrollo de la educación infantil, especialmente en el contexto del desarrollo de la motricidad fina. El modelo de aprendizaje desarrollado puede ser una referencia para educadores y padres a la hora de apoyar el desarrollo de los movimientos manipulativos en la primera infancia mediante un enfoque lúdico eficaz y divertido.
Palabras clave: Ciencias del Deporte, Control Motor, Movimientos Manipulativos Básicos, Chillhod Temprano

Fecha recepción: 23-02-24. Fecha de aceptación: 06-03-24
Endang Pratiwi
endangPratiwi_9904921013@mhs.unj.ac.id

Introduction

Child's play, as highlighted by Suryadi et al., (2024) and Harianto et al., (2023) holds significant importance in the growth and development of children. It serves as more than mere pastime, functioning as a crucial medium for learning and personality development. Through play, children not only enjoy themselves but also acquire valuable experiences and knowledge, thereby enriching various aspects of their development (Suryadi et al., 2024). Moreover, continuous engagement in play facilitates the mastery of complex life processes, communication skills, and the establishment of fulfilling relationships with others (Pinelle et al., 2008).

Manipulative games, as emphasized by Dewi & Verawati, (2022) play a pivotal role in enhancing elementary school students' basic motor skills. These games stimulate active participation among students, making learning enjoyable and effective. Manipulative movements involve mastering external objects using body parts, fostering fundamental motor skills essential for children's physical development (Harianto et al., 2023; Juni Samodra et al., 2024; Samodra et al., 2023). Specifically, manipulative movements like throwing and catching are crucial for early childhood learners (Ulfah et al., 2021). According to Gallahue et al., (2019), fundamental movement groups including locomotor, non-locomotor, and manipulative movements are instrumental in improving students' movement endurance abilitie. To cater to the learning needs of early child-

hood learners, creative approaches are required. Ardiyansyah & Tuasikal, (2016) suggest incorporating basic manipulative movements into playful learning models to enhance children's engagement and willingness to learn. Modification of basic manipulative movements, such as throwing and catching, can be achieved through various equipment and setups tailored to children's age and abilities. Jospiah highlights that employing a play-based modification approach aligns with children's cognitive, affective, and psychomotor development stages (Jospiah, 2017).

Understanding the significance of motion learning, especially in educational and coaching contexts, is crucial for designing effective training programs and strategies (Mustafa & Sugiharto, 2020). The structured development of basic manipulative movement skills, particularly throwing and catching, within a conducive learning environment, is essential for children aged 5-6 years (Baan et al., 2020). Playing games like throwing and catching not only fosters gross motor skills but also contributes to overall growth and development in children (Rosita et al., 2020).

The age of 3-5 years is an important age for the development of throwing ability (Sakurai & Miyashita, 1983), and the ability between boys and girls is different (Halverson et al., 1982; Lorson et al., 2013). The ability to throw or catch is closely related to movement skills in sports later in life. (Lola et al., 2022), throwing ability increases along with (Borukova & Mavrudiev, 2020; Gromeier et al., 2017, 2022), physiology (M.A. & J., 2001), Movement quality (Petranek & Barton, 2011). Throwing will have a negative impact if not considered, it is stated that growth and development greatly affect throwing ability (M.A. & J., 2001). Furthermore, throwing ability is very important (Liu, 2022), correlated with sports (Maselli et al., 2019) such as ability in basketball (Šumar et al., 2022), contributing to child development (Gimenez et al., 2012).

Throwing is one of the skills that contribute to the development of subsequent skills (Gimenez et al., 2012; Lola et al., 2022). Based on research conducted by Keller et al., (2011) 4-6 years of age there is an increase in throwing ability, so this age is ideal for stimulating its acceleration. And this movement skill will develop if you get the right intervention in the form of learning (Capio et al., 2013). Cross sectional studies state that mastery of basic movement skills is very significant to the development of motion in the future (Grimpampi et al., 2016). This conclusion is based on research on children from 5-10 years old. This statement is reinforced by Gimenez et al., (2012) which states that throwing is closely related to subsequent skills.

Participation in sports contributes to the improvement of children's motor skills (Djordjević, Valkova, and Petkovic 2021).This fact is evidenced by comparative studies of several countries such as Brazil, Germany, Finland, Ireland and the United States stating that one of the skills of catching is low except for children from Brazil who actively play soccer (Valentini, Nobre, and Duarte 2022). Furthermore, the outcomes of this investigation serve as an assessment to acquire the most current foundational framework for catching and throwing movements, which will be implemented for children aged 5-6 in early childhood education. The study endeavors to offer remedies for enhancing motor abilities, specifically in throwing and catching, among children at this early developmental stage. Diverse motion-based activities designed to enhance throwing proficiency have been devised and validated for their efficacy in addressing or preempting deficiencies in throwing and catching abilities.

Methods

Participants

Data collection for this research will be carried out in four places in Indonesia including: 3 schools in South Kalimantan Province which will be used as a place for initial trials until product revision and 1 school in North Sumatra Province which will be a place to test the effectiveness of a feasible product. In this study, the initial field test was a small-scale test using 15 subjects, revision of the main product using up to 30 subjects, the main field test or large-scale test with 40 subjects, and the effectiveness test with 60 subjects.

Research Design

This research on the learning model of basic manipulative movements for 5-6 years old consists of several stages with design steps that are described and harmonized with the objectives and conditions of the product by adopting the Borg & Gall development model which conceptually the research and development steps of this development model include 10 steps, namely: 1) research and data collection, 2) planning, 3) development, 4) initial field trial, 5) revision of trial results, 6) second field trial, 7) refinement of field test products, 8) field implementation test, 9) final product refinement, 10) dissemination and implementation (Suganda et al., 2023). More clearly the steps can be seen in Figure 1.

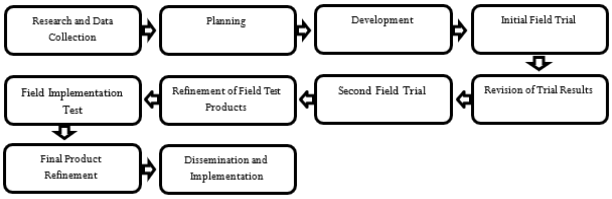

Figure 1. Steps for Using the Research and Development Method by (Sugiyono, 2017)

Design Validation

This process is actualized in the form of design validation activities carried out by experts. The product that has been designed is then reviewed by experts, with the aim of describing and or describing the shortcomings of the product being developed for later improvement. The needs of experts and or experts in question are early childhood experts, the needs of learning experts and experts in the field of sports in the scientific concentration of basic movements.

Early childhood experts will play a role in examining each learning product developed, experts in the field of sports in the scientific concentration of basic movements will play a role in examining the forms of movement contained in the product to be developed. Through the presence of experts and / or experts, it is hoped that there will be constructive and comprehensive input on the model products developed.

The validity test is carried out with the aim of knowing the extent to which the test can measure exactly the aspects to be measured. Based on this, the validity test of this test is to use the expert justification test, where the instrument that has been prepared is then consulted with experts (experts) and teachers / experts in learning physical education movements. The expert validity test can be seen in table 1.

Table 1.
List of Experts Names

No,	Name	Agency Origin
1	Prof. Dr. Novi Marlina Siregar, M.Pd	Lecturer of FIK UNJ
2	Dr. Eka Fitri Novita Sari, M.Pd	Lecturer of FIK UNJ
3	Dr. Mashud, S.Pd., M.Pd. AIFO	Lecturer of JPOK FKIP ULM
4	Rabiatul Adawiyah, S.Pd. AUD	Chairperson of Himpaudi Kalsel Province
5	Fakhrudin, S.Pd., M.Pd	Chairperson of KKG PJOK

Instrument

The instruments used in this research are using questionnaires for needs analysis, expert evaluation questionnaires and students' psychomotor assessment results (in phase I trials and phase II trials). The needs identification instrument in this study was prepared with the aim of obtaining data on teachers' opinions on teaching materials that they have used or are using, and what kind of teaching materials they want. This instrument is also based on the concept of teaching material evaluation. The initial and main field test instruments were prepared based on the concept of evaluation from students.

Table 2.
Maximum score of the motion assessment instrument

No.	Indicator	Number of Sub Indicators	Maximum Scale Assessment	Maximum Value
1	Throwing	4	5	20
2	Catch	4	5	20
3	Dribble	3	5	15
4	Kick	4	5	20
5	Reflect	4	5	20
	Total	19		95

Data Analysis

One of the requirements for the results of a measuring instrument to be trusted is that the measuring instrument must have adequate reliability. The motor assessment instrument is tested with a test retest carried out by testing the same instrument 2 (two) times a series of testee trials. In this case the instrument is the same, the respondents are the same, and the time is different. The reliability of the instrument will be calculated by correlating the instrument data in the first trial and the second instrument test data. The psychomotor - far assessment instrument will use the product moment (Pearson) correlation formula. In determining the high and low of the instrument used classification can be seen in table 3.

Table 3.
Reliability testing criteria.

Testing Results	Criteria
0,00 - 0,199	Very Low
0,20 - 0,399	Low
0,40 - 0,599	Medium
0,60 - 0,799	High
0,80 - 1,000	Very High

Source: (Sugiyono, 2017)

Research results

The results of the development of a manipulative basic motion learning model for students aged 5-6 years are written in the form of a manuscript by presenting forms of manipulative basic motion learning models in the form of learning using simple tools modified with a manipulative basic motion approach, which is applied in the form of games.

Product trials were conducted to collect data used as a basis for determining the feasibility of products developed by researchers. After being validated and revised, the product was tested using subjects of 10-20 students aged 4-6 years at PAUD IT Al Ishlah in Banjar Regency, South Kalimantan, which was carried out by providing indicators of manipulative games of throwing and catching. This research was conducted by directly testing all forms of the learning model. The implementation of the Product test through the activities of determining the test design, 2) determining the test subjects 3) Large group trial.

After the initial product was tested, the researchers discussed it with experts consisting of 3 experts, 1 motoric and basic motion expert, 1 learning expert, 1 early childhood expert who aims to determine the level of effectiveness so that it was revised again by the PJOK teacher motion expert and PAUD practitioners educators (small group trials and large group trials) and devoted to children aged 5-6 years. The results can be seen in table 4.

Table 4.
Input data from experts/early childhood teachers/physical education lecturers

No.	Model	Suggestions and Feedback
1	Model 1	In the implementation, it would be good for students to be in a squat position
2	Model 2	This game model is too complicated for 5-6 year old learners, it should be evaluated again.
3	Model 3	Each learner does 3 repetitions and the distance between learners and other learners when doing is not too close.
4	Model 4	Learners must always be supervised and watched in every movement.
5	Model 5	Always use two feet to perform this movement and learners should always be supervised and watched.
6	Model 6	Always keep an eye on the tire spacing.
7	Model 7	Tire spacing should always be kept to a minimum for this game model.
8	Model 8	The increase in tire spacing is not too much and far, more gradual.
9	Model 9	The distance between the blade and the tire is always considered not to be too far.

10	Model 10	It would be nice for the crossbar to use lightweight materials and can be lifted by students.
11	Model 11	Every learner who plays this game needs to be watched and supervised.
12	Model 12	In this game, the tires should not be installed too much so that the child does not feel tired and can complete this movement.
13	Model 13	In this variation of the game, the number of tools used is not too large.
14	Model 14	To stimulate children to actively manipulate for 30 seconds, it would be better to count the number of manipulatives for each team by children waiting for their turn, the highest number of manipulatives is a good team.
15	Model 15	Every time a learner reaches the ball, the height of the ball is gradually increased.
16	Model 16	For bouncing the ball, it would be better to use a large plate ball so that it is easy to coordinate to seal it.
17	Model 17	It is better if the ball used if using a balloon the distance used is 2 meters.
18	Model 18	It is better if the ball used is a plastic ball, the distance used is more than 2 meters.
19	Model 19	It is necessary to pay attention to the floor used so that it is not slippery and dangerous. Also, whether or not shoes are used.
20	Model 20	It is important to be aware of the striking tools used so that they are not hard and dangerous. Also, whether or not shoes are used.
21	Model 21	In this variation of the game, the number of tools used is not too large.
22	Model 22	In this variation of the game, the number of tools used is not too large.
23	Model 23	The tools used are rarely found in schools
24	Model 24	Try to keep the floor that is the reflection is not soft, then the type of ball used that is made of rubber
25	Model 25	Try to make the floor that is bounced not soft, then the type of ball used is made of rubber either with the left hand.
26	Model 26	Try to make the floor that is bounced not soft, then the type of ball used is made of rubber either with the right hand.
27	Model 27	To stimulate children to actively manipulate for 30 seconds, it would be better to count the number of manipulatives for each team by children waiting for their turn, the highest number of manipulatives is a good team.
28	Model 28	It is necessary to pay attention to the floor used so that it is not slippery and dangerous. Then the use of shoes or not
29	Model 29	In this variation of the game, the number of tools used is not too large.
30	Model 30	It is better if the ball used is a plastic ball, the distance used is more than 2 meters.

The manipulative basic movement game model that the researcher made after being evaluated by experts, then underwent stage I revision. The data obtained is used as a basis for making revisions in the next first stage, namely stage II trials. The following is a summary of the first stage revision based on evaluations and suggestions from motion experts, PAUD practitioners and PJOK teachers. Researchers implemented and disseminated the revised and finalized product (dissemination) to teachers in the PAUD environment for children aged 5-6 years at TK AL Islah Banjar Regency, through discussions and interviews. Hopefully the dissemination of this product will make the gross motor learning process more interesting, children dare to do manipulative movements of throwing and catching and manipulative activities are favored by students aged 5-6 years. Teachers and educators become a lot of knowledge. Understand the suitability of visitation assessment instruments related to gross motor items which include basic manipulative movements.

Table 5.
Assessment Results of the Revision of the Manipulative Basic Movement Learning Model Using Simple Tools with Game Forms.

Subject	Value		Total	Description	Category
	Throwing	Catch			
A	18	17	35	Used	Good
B	10	14	24	Replace	Less
C	15	15	30	Used	Good
D	14	16	30	Used	Good
E	9	10	19	Replace	Less
F	17	16	33	Used	Good
G	18	15	33	Used	Good
H	14	10	24	Replace	Less
I	15	14	29	Replace	Simply
J	14	14	28	Used	Good
K	14	16	30	Used	Good
L	16	18	34	Used	Good
M	18	12	30	Replace	Simply
N	17	11	28	Replace	Less
O	15	15	30	Used	Good
P	15	16	31	Used	Good
Q	18	17	35	Used	Good
R	16	17	33	Used	Good
S	18	16	34	Used	Good
T	14	15	29	Used	Good
U	15	14	29	Used	Good
V	15	16	31	Used	Good
W	12	18	30	Used	Good

From the data in table 5, it can be explained that the model has been revised again and tested at another school, namely at PAUD IT AL Isahlah Martapura with 30 students. It was found that the dominating value could be used as much as 76% or reached 14 manipulative learning models that could be used or a good category out of 16 total models made.

After the results of the development of manipulative basic motion learning products using simple tools with forms were tested on a small scale and revised, the next stage was to conduct a large group trial (*field group try out*). Based on the results of limited trials (small group trials) that have been evaluated by experts, then researchers revise the product and obtain 14 models that will be used in large group trials (*field group try out*). Based on the results of the large group trial conducted on 14 learning models using simple tools with the form of games by experts, a maximum score of 95 was obtained or with an average percentage of the results of using the model of 74.3%, so that the use of the entire model in this development can be categorized as **valid** and suitable for use in the development of manipulative basic motion learning models using simple tools with the form of games for students aged 5-6 years. The next step after the model undergoes stage II revision from the expert is continued by testing the product to a large *group* (*field group try out*) using research subjects as many as 40 students aged 5-6 years at TK AL Islah Martapura. Assessment data from 30 respondents / students on the effectiveness of the basic manipulative learning model of throwing and menangka using simple tools with the form of games are shown in table 6.

To calculate the average effectiveness of the learning model of the large group trial, the average effectiveness of this approach was calculated by using the ideal score.

Ideal score: 5 x 1 x 30 x 40 = 6000

Description:

5: Five highest answer scores

1: One item of assessment indicators (attitude of cour-

age, attitude of concentration (focus) and attitude of enthusiasm)

30:Thirty stages of movement

40: Forty respondents

Based on table 6, the amount of data obtained = 4290 Thus the effectiveness of the new learning model as a whole 4290 : 6000 = 0.715 or 71% of the expected criteria.

Table 6.
Assessment Results of Phase II of the Manipulative Basic Movement Learning Model Using Simple Tools with the form of Games

Subject	Indicator		Value	Description	Category
	Throwing	Catch			
A	19	18	77	Used	Good
B	14	14	71	Used	Good
C	14	15	72	Used	Good
D	15	16	75	Used	Good
E	17	17	72	Used	Good
F	17	16	70	Used	Good
G	18	15	71	Used	Good
H	14	18	81	Used	Good
I	15	14	73	Used	Good
J	14	14	70	Used	Good
K	14	16	71	Used	Good
L	16	18	75	Used	Good
M	18	12	78	Used	Good
N	17	18	75	Used	Good
O	15	15	70	Used	Good
P	15	16	74	Used	Good
Q	18	17	85	Used	Good
R	16	17	73	Used	Good
S	18	16	80	Used	Good
T	14	15	75	Used	Good
U	15	14	74	Used	Good
V	15	16	73	Used	Good
W	12	18	75	Used	Good
X	14	14	71	Used	Good
Y	16	16	78	Used	Good
Z	18	18	81	Used	Good
AA	17	17	75	Used	Good
AB	15	18	71	Used	Good
AC	18	17	73	Used	Good
AD	16	15	72	Used	Good

Table 7.
Effectiveness Level of Manipulative Basic Movement Learning Model

Value	Category	Meaning	Total
≥ 80	Very good	Used	4
60-79	Good	Used	36
40-59	Simply	Not Used	0
30-39	Less	Not Used	0
< 29	Very Less	Not Used	0

Based on table 7 psychomotor values above, it is obtained that students who get scores ≥ 80 **very good** categories are 4 students and scores 60-79 (good) are 36 students, and all of them are in the **good** category. Thus it can be concluded that the learning material for manipulative basic movements in students aged 5-6 years has been successful and can be used for students.

The results of the small group trial, product revision, and large group trial can be concluded that the development of an effective manipulative basic motion learning model is given to students aged 5-6 years. From the results of the recapitulation of the large group trial (n = 40) above it can be concluded that the overall manipulative learning model for children aged 5-6 years can be applied because they can all carry it out but are still given instructions from the teacher. Based on the results of the field test, it shows that this learning model has been tested and there is no revision anymore, all aspects are very feasible to use.

Table 8.
Descriptive Results of Manipulative Basic Movement

Testee	Group Experiment		Testee	Group Control	
	Pretest	Posttest		Pretest	Posttest
mean	60,18	76,48	X	61,27	71,10
SD	5,02	4,16	SD	3,66	4,36

The effectiveness test was conducted with an experiment with two groups and each group consisted of 15 children. The results in the table above provide information that both experimental and control groups are equally improved. The results of the assessment of the effectiveness of the manipulative basic movement model for children aged 5-6 years are as follows: Manipulative gross motor skill test results. The results can be seen in table 8.

Table 9.
N-Gain Test Results Percent

No.	Class	N-Gain Percent	Interpretation
1	Experiment	75,73	Effective
2	Control	21,48	Ineffective

Based on the *N-gain* results, it shows that the average N-gain percent value for the experimental class (manipulative learning model for children aged 5-6 years) of 75.73% is included in the "effective" category. With a minimum N-gain percent value of 21.48% and a maximum N-gain percent of 100%. Meanwhile, the average N-gain percent for the control class was 31.88%, including in the "Ineffective" category. With a minimum N-gain percent value of 10.00% and a maximum N-gain percent value of 66.67%. So with that it can be concluded that the use of manipulative learning models of throwing and catching for children aged 5-6 years is effective for improving the gross motor outcomes of students in units / institutions. The results can be seen in table 9.

Discussion

From the test results above, it shows that there is a significant increase after being given rough mptprik learning with a manipulative learning model of throwing and catching, so that it can be used and applied for students aged 5-6 years. This development research was conducted considering the development of manipulative skills is important. As a discussion based on a review of motor research the more mature the better (Lorson et al., 2013), and the fact that boys are more active, it is natural that various studies of boys are better (Johnson et al., 2019), also differences in throwing ability are caused by experience and gender (Beseler et al., 2022; Borukova & Mavrudiev, 2020). Another thing that is worth noting, it turns out that mental development is also in line with the development of motion, one of which is throwing (Gromeier et al., 2022). Children who are facilitated to play the development of motoric abilities

will also be more prolific (Aris Rahmadani et al., 2018)

Throwing is important because it is a complex motion (Stodden et al., 2006), and will determine the child's sporting involvement (Johnson et al., 2019; Maselli et al., 2019), water polo, javelin throwing, (Chi, 2010) also to handball and base ball. Based on this, if throwing skills are not taught well, it is certain that children's involvement in sports and physical activity will not occur properly. If people are not physically active then it is certain that fitness levels will be low (Mashud et al., 2024; Rubiyatno et al., 2023; Septianto et al., 2024; Suryadi et al., 2023), this will affect the productivity of children to learn new things. If the child is fit, it will contribute to academic ability (Hermassi et al., 2021) Mastery of basic throwing movements will develop if learning interventions are carried out.

Likewise with the ability to catch, this ability is also an important skill, stated by (Drost et al., 2015) stated that if catching skills are mature, it will have a major role in other skills in the child's future. It is evident that both throwing and catching skills will be the most influential if the child has a visual impairment. (Wagner, Haibach, and Lieberman 2013). There is an era relationship between throwing ability and catching ability (Dirksen et al. 2016). In another study, it was stated that there is a relationship between motor skills, fitness and academic skills (Syväoja et al., 2021). Based on this, guided motor activities in schools are effective in improving children's fitness and motor competence (Huhtiniemi et al., 2023) In an experiment with 4-5 year olds on one of the boys' catching skills, the results remained higher than those of the boys (Navarro-Patón et al., 2021).

Based on the assessment outcomes, it can be deduced that the manipulative basic motion learning framework is viable and fruitful in enhancing students' capabilities. Further deliberation underscores the necessity for early childhood educators to exercise oversight and proficiency in delivering the curriculum. Teachers must possess adept supervisory skills in instructional methodologies, particularly when instructing gross motor skills that may pose risks of falls or injuries for 5-6-year-old learners. Hence, intensive teacher supervision is imperative to mitigate any potential mishaps (Suganda et al., 2023).

Teachers should exhibit mastery of the subject matter and stay abreast of the latest educational references. Teacher expertise correlates positively with the efficacy of teaching and learning endeavors (Umar et al., 2023). Emphasis is laid on the imperative to enhance educational standards and services, fostering the cultivation of proficient students and graduates (Mashud et al., 2023). Educators must augment their knowledge to enrich instructional materials, thereby averting student disengagement. Fostering student interest and cultivating enthusiasm are pivotal in the pedagogical process (Athaya et al., 2023; Dhia et al., 2023). The design of game activities should be tailored to the learners' age and aptitude levels, facilitating educators in delivering appropriate materials. Teachers should gauge the complexity of the instructional model beforehand (Aziz, Okilanda, Permadi, et al., 2023; Aziz, Okilanda, Rozi, et al., 2023; Mashud et al., 2024; Tantri et al., 2023; Umar et al., 2023). Analyzing the difficulty level involves aligning the model with the learners' capacities. The instructional process should follow a clear and sequential progression, beginning with simpler tasks before advancing to more challenging ones. This staged approach ensures comprehensive comprehension of each gross motor movement. The game-based manipulative learning model for throwing and catching was devised by researchers to enhance learning outcomes, catering specifically to the needs of early childhood learners to engender a sense of enjoyment in learning this material.

Conclusion

Based on the results of the development research conducted, 14 games were obtained that were suitable for use in efforts to develop throwing and catching skills. In the development research steps, several stages of development were carried out starting from design, expert validation, small-scale validation and testing the effectiveness of the game on improving throwing and catching skills. The results of the development of 16 games initially became 14 that were suitable for testing, and finally 16 games were fixed into a developed model. At the effectiveness test stage, it was proven that there was an increase in throwing and catching skills with Ngain 75.73%. So it can be concluded that this game is effective for developing throwing and catching skills for children aged 5-6 years. The results showed that the development of a manipulative basic motion learning model through a play approach is effective in improving the ability of early childhood in throwing and catching. This learning model includes various play activities that are creatively and interestingly designed to stimulate the development of children's movement skills. This finding makes an important contribution to the development of early childhood education, particularly in the context of fine motor skills development. The learning model developed can be a reference for educators and parents in supporting the development of early childhood manipulative movement through an effective and fun play approach.

One notable limitation of this study pertains to the educators' limited comprehension regarding the fundamental movement patterns suitable for early childhood learners. Field observations reveal that teachers predominantly emphasize facilitating gross motor skills, allowing students the freedom to engage in activities they enjoy. While this approach fosters active movement among learners, it lacks structured guidance on basic movements tailored to their developmental needs. Consequently, children's psychomotor skills may flourish, leading them to prefer physical activity over sedentary behavior. It is imperative for educators to create conducive environments and provide appropriate resources for children to explore and enhance cognitive, affective, and psychomotor skills through enjoyable play activities. By doing so, stimulation for holistic growth and development can be effectively facilitated. Engaging children

in diverse and enjoyable physical activities yields positive outcomes, particularly in fostering their overall growth and development.

Acknowledgment

The publication of this review is funded by the education financing service center (PUSLAPDIK) of the education fund management institution (LPDP) and the Indonesian education scholarship (BPI) for doctoral students with scholarship programs.

Conflict of Interest

The authors declare that this paper has no conflict of interest.

Ethics Committee

This research was approved and supervised by the departmental research committee, Institute for Research and Community Service, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin, Indonesia (Reg No 31/UNISKA-LP2M/I/2024), dated January 31, 2024).

Reference

Ardiyansyah, W., & Tuasikal, A. R. S. (2016). Modifikasi Permainan Lari Estafet untuk Meningkatkan Gerak Dasar Manipulatif Anak Tunagrahita Ringan. *Pendidikan Olahraga Dan Kesehatan*, *4*(1), 177–184.

Aris Rahmadani, N. K., Latiana, L., & AEN, R. A. (2018). The Influence of Traditional Games on The Development of Children's Basic Motor Skills. *Revista Publicando*, *5*(15). https://doi.org/10.2991/icece-17.2018.41

Athaya, H., Dewantara, J., Husein, M., Taiar, R., Malek, N. F. A., & Shukla, M. (2023). Analysis of physical fitness in students: a comparative study based on social status. *Tanjungpura Journal of Coaching Research*, *1*(3), 71–78. https://doi.org/10.26418/tajor.v1i3.66542

Aziz, I., Okilanda, A., Permadi, A. A., Tjahyanto, T., Prabowo, T. A., Rozi, M. F., Suganda, M. A., & Suryadi, D. (2023). Correlational study: Sports Students' special test results and basic athletic training learning outcomes. *Retos*, *49*, 519–524. https://doi.org/10.47197/retos.v49.98820

Aziz, I., Okilanda, A., Rozi, M. F., Suganda, M. A., & Suryadi, D. (2023). Results of Special Tests on Sports Students: Does It Have a Relationship with Learning Outcomes of Basic Athletic Practice? *International Journal of Human Movement and Sports Sciences*, *11*(3), 676–682. https://doi.org/0.13189/saj.2023.110322

Baan, A. B., Rejeki, H. S., & Nurhayati. (2020). Perkembangan Motorik Kasar Anak Usia Dini. *Bungamputi*, *6*(1).

Beseler, B., Mesagno, C., Spittle, M., Johnson, N. F., Harvey, J., Talpey, S., & Plumb, M. S. (2022). Validation of a Follow-Through Developmental Sequence for the Overarm Throw for Force in University Students. *Journal of Motor Learning and Development*, *10*(2). https://doi.org/10.1123/jmld.2022-0010

Borukova, M., & Mavrudiev, P. (2020). Comparative Analysis Of The Characteristics Of Physical Ability Of 14-15 Years Old Students. *Trakia Journal of Sciences*, *18*(Suppl.1). https://doi.org/10.15547/tjs.2020.s.01.135

Capio, C. M., Poolton, J. M., Sit, C. H. P., Holmstrom, M., & Masters, R. S. W. (2013). Reducing errors benefits the field-based learning of a fundamental movement skill in children. *Scandinavian Journal of Medicine and Science in Sports*, *23*(2), 181–188. https://doi.org/10.1111/j.1600-0838.2011.01368.x

Chi, W.-H. (2010). Training Effects of Different Approaching Steps on Overarm Throwing Performance for Boys Aged 7-12 Years. *Sports & Exercise Research*, *12*(1). https://doi.org/10.5297/ser.1201.002

Dewi, R., & Verawati, I. (2022). The Effect of Manipulative Games to Improve Fundamental Motor Skills in Elementary School Students. *International Journal of Education in Mathematics, Science and Technology*, *10*(1), 24–37. https://doi.org/10.46328/ijemst.2163

Dhia, Z., Suryadi, D., Samodra, Y. T. J., Mashud, Mardiyyaningsih, A. N., Saputra, E., Németh, Z., Syam, A., Dewintha, R., & Fazarudin. (2023). Assessing the influence of playing method on the outcome of basketball shooting ability. *Physical Culture, Recreation and Rehabilitation*, *2*(1), :37-43. https://doi.org/10.15561/physcult.2023.0106

Dirksen, T., De Lussanet, M. H. E., Zentgraf, K., Slupinski, L., & Wagner, H. (2016). Increased throwing accuracy improves children's catching performance in a ball-catching task from the movement assessment battery (MABC-2). *Frontiers in Psychology*, *7*(JUL). https://doi.org/10.3389/fpsyg.2016.01122

Djordjević, I., Valkova, H., & Petkovic, E. (2021). Differences of Motor Proficiency in Preschool Girls Related To Organized Physical Activity. *Physical Education Theory and Methodology*, *21*(4), 357–364. https://doi.org/10.17309/tmfv.2021.4.11

Drost, D. K., Brown, K., Wirth, C. K., & Greska, E. K. (2015). Teaching Elementary-age Youth Catching Skills Using Theoretically Based Motor-development Strategies. *Journal of Physical Education, Recreation & Dance*, *86*(1), 30–35. https://doi.org/10.1080/07303084.2014.978420

Gallahue, D. L., Ozmun, J. C., & Godway, J. D. (2019). *Understanding motor dovelopment : Infants, Children, Adolescents, Adults, Seventh Edition*. Americas, New York : The McGraw-Hill Companies.

Gimenez, R., Manoel, E. de J., de Oliveira, D. L., Dantas, L., & Marques, I. (2012). Integrating fundamental movement skills in late childhood. *Perceptual and Motor Skills*, *114*(2). https://doi.org/10.2466/10.11.25.PMS.114.2.563-583

Grimpampi, E., Masci, I., Pesce, C., & Vannozzi, G. (2016). Quantitative assessment of developmental levels in overarm throwing using wearable inertial sensing technology. *Journal of Sports Sciences*, *34*(18). https://doi.org/10.1080/02640414.2015.1137341

Gromeier, M., Koester, D., & Schack, T. (2017). Gender differences in motor skills of the overarm throw. *Frontiers in Psychology*, *8*(FEB). https://doi.org/10.3389/fpsyg.2017.00212

Gromeier, M., Schack, T., & Koester, D. (2022). Effects of Age and Expertise on Mental Representation of the Throwing Movement Among 6- to 16-Year-Olds. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.799316

Halverson, L. E., Roberton, M. A., & Langendorfer, S. (1982).

Development of the Overarm throw: Movement and Ball Velocity Changes by Seventh Grade. *Research Quarterly for Exercise and Sport*, *53*(3). https://doi.org/10.1080/02701367.1982.10609340

Harianto, E., Gustian, U., Supriatna, E., Shalaby, M. N., & Taiar, R. (2023). Stimulating game performance skills in students: experimental studies using net games. *Tanjungpura Journal of Coaching Research*, *1*(2), 63–70. https://doi.org/10.26418/tajor.v1i2.65009

Hermassi, S., Chelly, M. S., Michalsik, L. B., Sanal, N. E. M., Hayes, L. D., & Cadenas-Sanchez, C. (2021). Relationship between fatness, physical fitness, and academic performance in normal weight and overweight schoolchild handball players in Qatar State. *PLoS ONE*, *16*(2 February 2021). https://doi.org/10.1371/journal.pone.0246476

Huhtiniemi, M., Sääkslahti, A., Tolvanen, A., Lubans, D. R., & Jaakkola, T. (2023). A scalable school-based intervention to increase early adolescents' motor competence and health-related fitness. *Scandinavian Journal of Medicine and Science in Sports*, *33*(10), 2046–2057. https://doi.org/10.1111/sms.14410

Johnson, J. L., Rudisill, M. E., Hastie, P. A., & Sassi, J. (2019). The influence of guided practice on overhand throwing competence in preschool children in a mastery motivational climate. *Journal of Motor Learning and Development*, *7*(1). https://doi.org/10.1123/JMLD.2018-0005

Jospiah, J. (2017). Peningkatan Pembelajaran Lompat Jauh Melalui Pendekatan Bermain Pada Siswa Kelas V Sd Negeri 025 Koto Sentajo. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, *6*(2), 563. https://doi.org/10.33578/jpfkip.v6i2.5521

Juni Samodra, Y. T., Yosika, G. F., Gustian, U., Mashud, M., Arifin, S., Suryadi, D., Wati, I. D. P., Syam, A., Candra, A. R. D., Wati, M. G., & Candra, A. T. (2024). Are boys and girls in rural areas equal in terms of gross motor skills? *Retos*, *54*, 94–99. https://doi.org/10.47197/retos.v54.103005

Keller, J., Lamenoise, J. M., Testa, M., Golomer, E., & Rosey, F. (2011). Discontinuity and variability in the development of the overarm throwing skill in 3- To 18-year-old children. *International Journal of Sport Psychology*, *42*(3).

Liu, L. (2022). Analysis on Performance Development Trend of Track-and-Field Throwing Events Based on Blockchain and Mobile Big Data. *Security and Communication Networks*, *2022*. https://doi.org/10.1155/2022/7559268

Lola, A., Tzetzis, G., Manou, V., & Alexandropoulou, S. (2022). Attentional focus on learning fundamental movement skills in children. *Physical Activity Review*, *10*(1), 60–67. https://doi.org/10.16926/PAR.2022.10.07

Lorson, K. M., Stodden, D. F., Langendorfer, S. J., & Goodway, J. D. (2013). Age and gender differences in adolescent and adult overarm throwing. *Research Quarterly for Exercise and Sport*, *84*(2). https://doi.org/10.1080/02701367.2013.784841

M.A., R., & J., K. (2001). Predicting children's overarm throw ball velocities from their developmental levels in throwing. In *Research quarterly for exercise and sport* (Vol. 72, Issue 2).

Maselli, A., Dhawan, A., Russo, M., Cesqui, B., Lacquaniti, F., & d'Avella, A. (2019). A whole body characterization of individual strategies, gender differences, and common styles in overarm throwing. *Journal of Neurophysiology*, *122*(6). https://doi.org/10.1152/JN.00011.2019

Mashud, M., Arifin, S., Warni, H., Samodra, Y. T. J., Yosika, G. F., Basuki, S., Suryadi, D., & Suyudi, I. (2024). Physical Fitness: Effects of active lifestyle internalization through physical literacy awarenes based project. *Retos*, *51*, 1299–1308. https://doi.org/10.47197/retos.v51.101662

Mashud, Warni, H., Putra, M. F. P., Haris, M. Al, Samodra, Y. T. J., Tantri, A., Kristiyandaru, A., & Suryadi, D. (2023). Integrating the Project-Based Learning and the Inclusive Teaching Style: An Innovation to Improve Freestyle Swimming Skills. *International Journal of Human Movement and Sports Sciences*, *11*(5), 956–964. https://doi.org/10.13189/saj.2023.110503

Mustafa, P. S., & Sugiharto, S. (2020). Keterampilan motorik pada pendidikan jasmani meningkatkan pembelajaran gerak seumur hidup. *Sporta Saintika*, *5*(2), 199–218. https://doi.org/10.24036/sporta.v5i2.133

Navarro-Patón, R., Brito-Ballester, J., Villa, S. P., Anaya, V., & Mecías-Calvo, M. (2021). Changes in motor competence after a brief physical education intervention program in 4 and 5-year-old preschool children. *International Journal of Environmental Research and Public Health*, *18*(9). https://doi.org/10.3390/ijerph18094988

Petranek, L. J., & Barton, G. V. (2011). The overarm-throwing pattern among u-14 asa female softball players: A comparative study of gender, culture, and experience. *Research Quarterly for Exercise and Sport*, *82*(2), 220–228. https://doi.org/10.1080/02701367.2011.10599749

Pinelle, D., Wong, N., & Stach, T. (2008). Using genres to customize usability evaluations of video games. *ACM Future Play 2008 International Academic Conference on the Future of Game Design and Technology, Future Play: Research, Play, Share*, 129–136. https://doi.org/10.1145/1496984.1497006

Rosita, T., Nurhayati, S., Jumiatin, D., Rosmiati, A., & Abdu, W. J. (2020). Using traditional role-play games by adults to nurture a culture of cooperation among children amidst widespread engagement in online games within today's technological society. In *Journal of Critical Reviews* (Vol. 7, Issue 7, pp. 183–186). https://doi.org/10.31838/jcr.07.07.29

Rubiyatno, Perdana, R. P., Fallo, I. S., Arifin, Z., Nusri, A., Suryadi, D., Suganda, M. A., & Fauziah, E. (2023). Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. *Pedagogy of Physical Culture and Sports*, *27*(3), 208–214. https://doi.org/10.15561/26649837.2023.0304

Sakurai, S., & Miyashita, M. (1983). Developmental aspects of overarm throwing related to age and sex. *Human Movement Science*, *2*(1–2). https://doi.org/10.1016/0167-9457(83)90007-6

Samodra, Y. T. J., Suryadi, D., Wati, I. D. P., Supriatna, E., Santika, I. G. P. N. A., Suganda, M. A., & Dewi, P. C. P. (2023). Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. *Pedagogy of Physical Culture and Sports*, *27*(2), 139–145. https://doi.org/0.15561/26649837.2023.0206

Septianto, I., Sumaryanti, S., Nasrulloh, A., Sulistiyono, S., Nugraha, H., Ali, M., Ramadhani, A. M., Dewantara, J., Haniyyah, N., Fauzi, F., Suryadi, D., Ardian, R., & Subarjo, S. (2024). Traditional games for physical fitness: an experimental study on elementary school students. *Retos*, *54*, 122–128. https://doi.org/10.47197/retos.v54.104177

Stodden, D. F., Langendorfer, S. J., Fleisig, G. S., & Andrews, J. R. (2006). Kinematic constraints associated with the acquisition of overarm throwing part I: Step and trunk actions. *Research Quarterly for Exercise and Sport*, *77*(4). https://doi.org/10.1080/02701367.2006.10599377

Suganda, M. A., Soegiyanto, Setyawati, H., Rahayu, S., & Rustiadi, T. (2023). Development of physical fitness tests for early childhood 4–6 years. *Fizjoterapia Polska*, *23*(1), 40–49. https://doi.org/10.56984/8ZG07B6FF

Sugiyono. (2017). *Metode penelitian kuantitatif, kualitatif dan R&D*. Bandung: Alfabeta.

Šumar, D., Ćeleš, N., & Mededović, B. (2022). Relations Between Motor Abilities And Basketball Skills Of 13-14 Year Old Students. *Sportske Nauke i Zdravlje*, *12*(2). https://doi.org/10.7251/SSH2202189S

Suryadi, D., Nasrulloh, A., Yanti, N., Ramli, R., Fauzan, L. A., Kushartanti, B. W., Sumaryanti, S., Suhartini, B., Budayati, E. S., Arovah, N. I., Mashud, M., Suganda, M. A., Sumaryanto, S., Sutapa, P., Abdullah, N. M. bin, & Fauziah, E. (2024). Stimulation of motor skills through game models in early childhood and elementary school students: systematic review in Indonesia. *Retos*, *51*, 1255–1261. https://doi.org/10.47197/retos.v51.101743

Suryadi, D., Suganda, M. A., Sacko, M., Samodra, Y. T. J., Rubiyatno, R., Supriatna, E., Wati, I. D. P., & Okilanda, A. (2023). Comparative Analysis of Soccer and Futsal Extracurriculars: A Survey Study of Physical Fitness Profiles. *Physical Education and Sports: Studies and Research*, *2*(1), 59–71. https://doi.org/10.56003/pessr.v2i1.182

Syväoja, H. J., Kankaanpää, A., Hakonen, H., Inkinen, V., Kulmala, J., Joensuu, L., Räsänen, P., Hillman, C. H., & Tammelin, T. H. (2021). How physical activity, fitness, and motor skills contribute to math performance: Working memory as a mediating factor. *Scandinavian Journal of Medicine and Science in Sports*, *31*(12), 2310–2321. https://doi.org/10.1111/sms.14049

Tantri, A., Aprial, B., Mashud, M., Kristyandaru, A., Basuki, S., Samodra, Y. T. J., Warni, H., Arifin, S., Wati, I. D. P., Thamrin, L., & Suryadi, D. (2023). Modification of interactive multimedia with the ARA MODEL: study of development of football learning models in pandemic times. *Retos*, *50*, 1289–1298. https://doi.org/10.47197/retos.v50.100587

Ulfah, A. A., Dimyati, D., & Putra, A. J. A. (2021). Analisis Penerapan Senam Irama dalam Meningkatkan Kemampuan Motorik Kasar Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*. https://doi.org/10.31004/obsesi.v5i2.993

Umar, U., Okilanda, A., Suganda, M. A., Mardesia, P., Suryadi, D., Wahyuni, D., Widyastuti, S. R., Samodra, Y. T. J., & Kurniawan, F. (2023). Blended learning and online learning with project-based learning: Do they affect cognition and psycho-motor learning achievement in physical conditions? *Retos*, *50*(556–565). https://doi.org/10.47197/retos.v50.99965

Valentini, N. C., Nobre, G. C., & Duarte, M. G. (2022). Gross motor skills trajectory variation between WEIRD and LMIC countries: A cross-cultural study. *PLoS ONE*, *17*(5 May). https://doi.org/10.1371/journal.pone.0267665

Wagner, M. O., Haibach, P. S., & Lieberman, L. J. (2013). Gross motor skill performance in children with and without visual impairments-Research to practice. *Research in Developmental Disabilities*, *34*(10), 3246–3252. https://doi.org/10.1016/j.ridd.2013.06.030

Datos de los autores/as y traductor/a:

Endang Pratiwi	endangPratiwi_9904921013@mhs.unj.ac.id	Autor/a- Traductor/a
Hernawan	hernawan@unj.ac.id	Autor/a
Fahmy Fachrezzy	fahmyfachrezzy@unj.ac.id	Autor/a
Norma Anggara	norma.anggara@ulm.ac.id	Autor/a
Hikmah Lestari	hikmahlestari_9904921021@mhs.unj.ac.id	Autor/a
Aditya Gumantan	adityagumantan_9904921001@mhs.unj.ac.id	Autor/a
Y.Touvan Juni Samodra	tovan@fkip.untan.ac.id	Autor/a
M. Adam Mappaompo	m.adam.mappaompo@unm.ac.id	Autor/a
Juhannis	juhanis@unm.ac.id	Autor/a
Albadi Sinulingga	baldisling@hotmail.com	Autor/a