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ORIGINAL ARTICLES. PHYSICAL EDUCATION

Application of developmental games based on kinesthetic perception to improve proprioceptive sensitivity, intelligence and cooperation in primary school children

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Abstract

Aim: to produce a game learning model based on kinesthetic perception to improve kinesthetic perception, play intelligence, and collaboration among elementary school children.

Material and methods. The game learning model based on kinesthetic perception is adapted to the growth and development aspects of students which is packaged through the processing of limbs that is focused on the psychomotor domain consisting of a series of basic locomotor movements, manipulative, non-manipulative, cognitive play intelligence, and effective cooperation. The method used is research and development, namely descriptive, evaluative and experimental methods. This research method is used to produce a product, namely a game learning model based on the kinesthetic perception of children aged 7-8 years which is equivalent to lower grade elementary school students. Development procedures: (1) collecting research results and information, (2) analyzing the product to be developed, (3) developing the initial product, (4) conducting expert validation, (5) conducting small-scale trials and revisions, (6) conducting large-scale trials and revisions, (7) making final products, and (8) conducting effectiveness tests. The subjects of this study were grade 1 elementary school students. The data analysis techniques used were quantitative and qualitative descriptive analysis. The final product effectiveness test used one group pretest-posttest design experiment.

Results. The results of this study are in the form of a kinesthetic perception-based game learning model to improve kinesthetic perception, playing intelligence, primary school children's collaboration which contains four games, namely (1) Target Shooting Games, (2) Train Car Games, (3) Flag Games, and (4) Rakartugu Games. From the results of the assessment of experts and practitioners, the game learning model based on kinesthetic perception has a validity of 0.963.

Conclusions. Kinesthetic perception based game learning model is effective for developing kinesthetic perception limb processing skills, playing intelligence and cooperation.

Keywords: kinesthetic perception, play intelligence, cooperation

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Анотація

Аулія Маріс Сяхпутрі, Памуджі Сукоко. Застосування розвиваючих ігор на основі кінестетичного сприйняття для поліпшення пропріорецептивної чутливості, інтелекту і здатності до співпраці дітей початкової школи

Мета: створення ігрової моделі навчання, заснованої на кинестетическом сприйнятті, для поліпшення кінестетичного сприйняття, ігрового інтелекту і співпраці між дітьми початкової школи.

Матеріал і методи. Модель ігрового навчання, заснована на кинестетическом сприйнятті, адаптована до аспектам зростання і розвитку учнів, включає в себе роботу кінцівок, орієнтовану на психомоторну область, що складається з серії базових локомоторних рухів, маніпулятивних, неманипулятивного, когнітивних ігор, розвитку інтелекту та ефективної співпраці. Використовувані методи - це дослідження і розробки, а саме описові, оціночні та експериментальні методи. Ці методи дослідження використовувалися для створення продукту, а саме - ігрової моделі навчання, заснованої на кинестетическом сприйнятті дітей у віці 7-8 років, що еквівалентно учням молодших класів початкової школи. Процедури розробки: (1) збір результатів досліджень та інформації, (2) аналіз продукту, який буде розроблений, (3) розробка вихідного продукту, (4) проведення експертної перевірки, (5) проведення невеликих випробувань і перевірок, (6)) проведення великомасштабних випробувань і перевірок, (7) виготовлення кінцевих продуктів і (8) проведення тестів ефективності. Випробуваними були учні 1 класу початкової школи. В якості методів аналізу даних використовувалися кількісний і якісний описовий аналіз. В остаточному тесті ефективності продукту використовувався один груповий попередній і наступний проектний експеримент.

Результати. Результати цього дослідження представлені в формі ігрової моделі навчання, заснованої на кинестетичному сприйнятті, для поліпшення кінестетичного сприйняття, ігрового інтелекту, спільної роботи дітей молодшого шкільного віку, яка містить чотири гри, а саме (1) гри зі стрільби по мішенях, (2) гри в вагон-поїздах, (3) Ігри під прапором і (4) Ігри Ракартугу. За результатами оцінки експертів і практиків модель ігрового навчання, заснована на кинестетическом сприйнятті, має валідність 0,963.

Висновки. Модель ігрового навчання, заснована на кинестетическом сприйнятті, ефективна для розвитку навичок обробки кінестетичного сприйняття, ігрового інтелекту і співпраці.

Ключові слова: кінестетичне сприйняття, ігровий інтелект, співпраця

Аннотация

Аулия Марис Сяхпутри, Памуджи Сукоко. Применение развивающих игр на основе кинестетического восприятия для улучшения проприорецептивной чувсвительности, интеллекта и способности к сотрудничеству детей начальной школы

Цель: создание игровой модели обучения, основанной на кинестетическом восприятии, для улучшения кинестетического восприятия, игрового интеллекта и сотрудничества между детьми начальной школы.

Материал и методы. Модель игрового обучения, основанная на кинестетическом восприятии, адаптирована к аспектам роста и развития учащихся, включает в себя работу конечностей, ориентированную на психомоторную область, состоящую из серии базовых локомоторных движений, манипулятивных, неманипулятивных, когнитивных игр, развития интеллекта и эффективного сотрудничества. Используемые методы - это исследования и разработки, а именно описательные, оценочные и экспериментальные методы. Эти методы исследования использовались для создания продукта, а именно - игровой модели обучения, основанной на кинестетическом восприятии детей в возрасте 7-8 лет, что эквивалентно учащимся младших классов начальной школы. Процедуры разработки: (1) сбор результатов исследований и информации, (2) анализ продукта, который будет разработан, (3) разработка исходного продукта, (4) проведение экспертной проверки, (5) проведение небольших испытаний и проверок, (6)) проведение крупномасштабных испытаний и проверок, (7) изготовление конечных продуктов и (8) проведение тестов эффективности. Испытуемыми были ученики 1 класса начальной школы. В качестве методов анализа данных использовались количественный и качественный описательный анализ. В окончательном тесте эффективности продукта использовался один групповой предварительный и последующий проектный эксперимент.

Результаты. Результаты этого исследования представлены в форме игровой модели обучения, основанной на кинестетическом восприятии, для улучшения кинестетического восприятия, игрового интеллекта, совместной работы детей младшего школьного возраста, которая содержит четыре игры, а именно (1) игры по стрельбе по мишеням, (2) игры в вагон-поезде, (3) Игры под флагом и (4) Игры Ракартугу. По результатам оценки экспертов и практиков модель игрового обучения, основанная на кинестетическом восприятии, имеет валидность 0,963.

Выводы. Модель игрового обучения, основанная на кинестатическом восприятии, эффективна для развития навыков обработки кинестетического восприятия, игрового интеллекта и сотрудничества.

Ключевые слова: кинестатическое восприятие, игровой интеллект, сотрудничество.

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Introduction

In elementary school students, the psychomotor domain is closely related to the overall movement of the limbs related to basic technical skills of several sports [1]. Skills for processing limbs in physical activity or sports can be mastered if they have previously mastered good kinesthetic perception skills [2]. Kinesthetic is the ability to use all or part of the body to express ideas and feelings or use the hands to produce and transform something [3]. This kinesthetic intelligence skills include special physical skills such as coordination, balance, agility, strength, flexibility and speed [4]. The children with kinesthetic intelligence can respond well through sensory stimuli which then convey something with their body parts, especially the hands [5]. This kinesthetic intelligence is closely related to the motor and development of the child. The motor skills have difficulty learning more advanced skills that affect physical activity [6].

Motoric is the development of a process of growth and development of a person's mobility [7]. Every movement that a child makes is the result of a complex interaction pattern of various parts and systems in the body that are controlled by the brain [8]. Motor skills are the terminology used in various skills that lead to mastering the basic movement skills of physical fitness activities [9]. Motor skills consist of gross motor skills and fine motor skills [10]. Through motor learning in elementary schools, it will affect several aspects of the life of students such as: 1) children get entertainment and enjoyment, 2) children can move from a weak condition to an independent condition, 3) children can adapt to the environment, 4) can support children's skills in various ways, and 5) can encourage children to be independent, so they can solve all the problems they face [11].

Efforts to develop the potential for motor skills and limb processing for primary school children development as a whole require an exercise in the form of a game approach to improve limb processing with appropriate handling of the characteristics and abilities of elementary school children [12]. So that the learning model is a method or strategy carried out by a teacher so that the learning process occurs in students to achieve a goal that is systematically designed and carried out deliberately by educators which can cause students to carry out learning activities [13].

One form of activity in physical education that keeps children active is play [14]. Playing activities are expected to be able to develop students in accordance with the educational goals to be achieved [15]. Because in playing not only prioritizing physical activity, but also values that must be met and practiced in everyday life [16]. Play is something very important that can affect cognitive, physical, emotional, social development, and provide the main place for social participation [17]. Play and games have the same function and purpose [18]. All functions in the individual child will be trained both physically and spiritually while playing [19].

The game model in learning that will be developed is a kinesthetic perception-based game development model to improve kinesthetic perception, play intelligence and elementary school children's cooperation, which will be developed in accordance with the Basic Competencies of the 2013 Curriculum in sports and health physical education subjects for elementary school children aged 7-8 years. Of these various problems, a game model is needed in learning games based on kinesthetic perception that includes all cognitive aspects of playing intelligence, affective aspects in teamwork and psychomotor aspects in kinesthetic perception. So that the development of this game model is expected to be good, effective, fun learning, and make students enthusiastic in the learning process based on kinesthetic perception.

Material and methods

The method used is research and development [20]. Namely descriptive, evaluative and experimental methods . This research method is used to produce a product [21], namely a game learning model based on the kinesthetic perception of children aged 7-8 years which is equivalent to lower grade elementary school students. Development procedures: 1) collecting research results and information, 2) analyzing the product to be developed, 3) developing the initial product, 4) conducting expert validation, 5) conducting small-scale trials and revisions, 6) conducting large-scale trials and revisions, 7) making final products, and 8) conducting effectiveness tests. The subjects of this study were grade 1 elementary school students. The data analysis techniques used were quantitative and qualitative descriptive analysis. The final product effectiveness test used one group pretest-posttest design experiment.

Results

From data (Table 1, 2) it can be seen that the average score obtained from the observations of experts and practitioners of the kinesthetic perception-based game learning model is 81.88,

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which is in the valid / used category and all models are declared eligible to be tested on a small scale. This can be seen from the average score of all experts and practitioners at the upper limit of the score of suitability and acceptance of a learning model. Even

so, experts and practitioners gave some input, suggestions, and revisions for improvements before this model was piloted on a small scale.

Table 1

Grades of Value Scale Classification for Experts and Practitioners to the Kinesthetic Perception-Based Game Model

Variable	Measured Components	Indicator	Number / Item
Game Model Based on Kinesthetic Perception	Content / Material	In accordance with the curriculum	1, 2
		In accordance with KD	3, 4, 5, 6
		Degree of difficulty	7, 8
	Construction	Systematics	9
		Security	10, 11, 12, 13
		Assessment	14, 15, 16, 17, 18
	Language	The use of Indonesian language is in accordance with the EYD	19, 20
	Benefits and Purpose	In accordance with the learning objectives	21, 22, 23

Table 2

Data Recapitulation of Initial Product Draft Value from Experts and Practitioners

Number	Name of activity	A1	A2	G	Average	%
1	Target Shooting Games	89	91	93	91.00	79.13
2	Train Car Games	95	96	95	95.33	82.90
3	Flag Games	93	99	95	95.67	83.19
4	Rakartugu Games	93	94	97	94.67	82.32
	Total score	370	380	380	376.67	
	Average	92.5	95	95	94.17	
	Percentage	80.43	82.61	82.61	81.88	

Notes:
A1: Prof. Dr. Suharjana M. Kes
A2: Dr. Guntur M.Pd.
G: Prama, S.Pd

1. Expert and Practitioner Validation Results on Small Scale Trials

Small-scale trials are documented in DVD form, so that experts can observe kinesthetic perception based game learning activities in accordance with the draft guidebook that has been made. The observation guide used by the expert uses

the observation sheet that has been prepared by the researcher. This is given with the aim of experts being able to assess small-scale trials of learning models. The observations obtained from experts and teachers are presented in Table 3.

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Table 3

Data on Small Scale Trial Observation Results

Number	Name of activity	A1	A2	G	Average	%
1	Target Shooting Games	109	104	108	107.00	93.04
2	Train Car Games	103	103	105	103.67	90.14
3	Flag Games	90	101	103	98.00	85.22
4	Rakartugu Games	106	104	106	105.33	91.59
	Total score	408	412	422	414.00	
	Average	102	103	105.5	103.50	
	Percentage	88.70	89.57	91.74	90.00	

Notes:
A1: Prof. Dr. Suharjana M. Kes
A2: Dr. Guntur M.Pd.
G: Prama, S.Pd

2. Expert and Practitioner Validation Results on Large-Scale Trials

After the product of the kinesthetic perception-based game learning model to improve kinesthetic perception, play intelligence, the cooperation of elementary school children was tried out in a small-scale trial and was revised, then doing a large-scale trial. A large-scale trial was carried out on students aged 7-8 years. This large-scale trial was carried out by physical education teachers using the draft guide for a game learning model based on kinesthetic perception to improve kinesthetic perception, playing intelligence, and the cooperation of elementary school children as a reference for teaching. Experts observe large-scale trials through documentation in DVD format, so that experts can observe kinesthetic perception-based game learning models to improve kinesthetic perception, play intelligence, and elementary school children's cooperation. The results of large-scale trial observations are presented in Table 4.

Table 4

Data on Large Scale Trial Observation Results

Number	Name of activity	A1	A2	G	Average	%
1	Target Shooting Games	109	108	110	109.00	94.78
2	Train Car Games	111	109	112	110.67	96.23
3	Flag Games	101	104	103	102.67	89.28
4	Rakartugu Games	105	106	106	105.67	91.88
	Total score	426	427	431	428.00	
	Average	106.5	106.75	107.75	107.00	
	Percentage	92.61	92.83	93.70	93.04	

Notes:
A1: Prof. Dr. Suharjana M. Kes
A2: Dr. Guntur M.Pd.
G: Prama, S.Pd

The results of the assessment of observations in large-scale trials can be seen that the model that has been revised from the results of small-scale trials is increasingly showing conformity with expectations, namely agreement between experts and practitioners as well as the appropriateness and accuracy of the results of observations on the kinesthetic perception based game learning model to improve kinesthetic perception intelligence at play, cooperation of elementary school children which is very suitable This can be seen from the average score of the observation assessment and the percentage of game model suitability.

3. Normality test

The normality test in this study used the Kolmogrov Smirnov / Shapiro Wilk method. The results of the normality test in each group were analyzed with SPSS version 23.0 for windows with a significance level of 5% or 0.05. The results of the normality test are as follows (Table 5).

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Table 5

Normality Test Results

Game titles	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	p
Target Shooting Games	Pretest	0,209	10	0,200*	0,927	10	0,423
	Posttest	0,164	10	0,200*	0,915	10	0,319
Train Car Games	Pretest	0,129	10	0,200*	0,981	10	0,971
	Posttest	0,146	10	0,200*	0,947	10	0,633
Flag Games	Pretest	0,240	10	0,108	0,901	10	0,226
	Posttest	0,207	10	0,200*	0,860	10	0,076
Rakartugu Games	Pretest	0,199	10	0,200*	0,905	10	0,248
	Posttest	0,233	10	0,132	0,886	10	0,155

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the statistical analysis of the normality test using the Kolmogorov Smirnov test. Pretest and posttest data on learning the target shooting game, train carriages, flags and rakartugu obtained the results of data with a significance value of p> 0.05. So, it can be concluded that the data is normally distributed.

4. Homogeneity Test

Homogeneity test is carried out to determine whether the data in the study are homogeneous or not. The homogeneity test in this study used the Levene Test as follows (Table 6).

Table 6

Homogeneity Test Results

Game titles		Levene Statistic	df1	df2	p
Target Shooting Games	Based on Mean	0.956	1	18	0.341
	Based on Median	0.661	1	18	0.427
	Based on Median and with adjusted df	0.661	1	17.992	0.427
	Based on trimmed mean	0.872	1	18	0.363
Train Car Games	Based on Mean	6.688	1	18	0.019
	Based on Median	6.646	1	18	0.019
	Based on Median and with adjusted df	6.646	1	12.175	0.024
	Based on trimmed mean	6.681	1	18	0.019
Flag Games	Based on Mean	0.004	1	18	0.953
	Based on Median	0.001	1	18	0.980
	Based on Median and with adjusted df	0.001	1	17.841	0.980
	Based on trimmed mean	0.000	1	18	0.990
Rakartugu Games	Based on Mean	2.991	1	18	0.101
	Based on Median	1.703	1	18	0.208
	Based on Median and with adjusted df	1.703	1	14.915	0.212
	Based on trimmed mean	2.789	1	18	0.112

Based on the results of the statistical analysis of the homogeneity test using the Levene Test. It can

be seen in the posttest of target shooting games obtained a significance value of 0.341> 0.05, the

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train carriage game obtained a significance value of 0.019> 0.05, the flag game obtained a significance value of 0.953> 0.05 and the rakartugu game obtained a significance value of 0.101> 0.05. So, it can be concluded that the study population has the same variant or homogeneous.

5. Effectiveness Test

The following are the results of the effectiveness test for each game as shown in table 7.

Table 7

Effectiveness Test Results

Game titles			Paired Differences					t	df	p (2-tailed)
			$\bar{x}$	S	m	95% Confidence Interval of the Difference				
						Lower	Upper			
Target Shooting Games	Pair 1	Pretest - Posttest	-5.11	3.03	0.96	-7.28	-2.93	-5.31	9	0.000
Train Car Games	Pair 1	Pretest - Posttest	-5.80	3.11	0.98	-8.03	-3.57	-5.89	9	0.000
Flag Games	Pair 1	Pretest - Posttest	-3.21	2.31	0.73	-4.87	-1.55	-4.39	9	0.002
Rakartugu Games	Pair 1	Pretest - Posttest	-4.23	2.21	0.70	-5.82	-2.64	-6.03	9	0.000

Based on the results of the statistical analysis of the effectiveness test, it shows that the significance (2-tailed) of the target shooting game is 0.00 <0.05, the train car game is 0.00 <0.05, the flag game is 0.02 <0.05, and the rakartugu game. 0.00 <0.05. So that after seeing this data it can be said that learning games based on kinesthetic perception after learning there is a significant increase.

Discussion

Based on the research results, the product of a kinesthetic perception-based game learning model is produced to improve kinesthetic perception, play intelligence, and the collaboration of elementary school children in the form of a learning model that contains learning steps consisting of four games. Each game contains cognitive, affective, and psychomotor elements that are integrated into the game with the overall criteria in learning being valid or very effective to be applied to students aged 7-8 in the lower grades of elementary school. The results of this study answered the problems in the research question, namely:

1) Kinesthetic perception-based game learning model can improve limb movement processing skills.

2) The game learning model based on kinesthetic perception can increase the cooperation of students which is characterized by

an attitude of cooperation with one group friends and an attitude in participating in learning.

3) The kinesthetic perception based game learning model can improve playing intelligence.

4) The game learning model based on kinesthetic perception is in accordance with the characteristics of the development of elementary school students and makes it easier for students to make the right decisions in the game.

5) The game learning model based on kinesthetic perception is able to make students easy to understand kinesthetic perception which is characterized by students being more active and happy to move because learning games based on kinesthetic perception can facilitate and explore students towards increasing kinesthetic perception, with the activities that exist in a game by showing the existence of physical activities regarding limb processing skills that apply a series of locomotor, manipulative, non-manipulative movements.

Thus, the hypothesis formulated in this study regarding the effectiveness of the use of games based on kinestatic sensitivity for primary schoolchildren was fully confirmed. It should also be noted that this study obtained data that confirm the results of studies by other authors. So, in the work of Kozina et. al. [22] obtained results that testify to the effectiveness of the use of games that activate the imaginative perception of 6-7 years old children in combination with the

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development of kinestatic sensitivity during rock climbing. The use of special games for children of primary school age, which are aimed at developing imaginative thinking, is the most effective. Children think in images, and therefore the use of plot games that activate imaginative thinking is most effective for their motor development. However, the mentioned work [22] does not consider the influence of plot games on the kinesthetic sensitivity of primary school children. Therefore, from the point of view of revealing the influence of plot games on the proprioceptive and kinestatic sensitivity of primary school children, our study is new knowledge.

Kozina et. al. [23] showed the positive influence of the use of the Go game in combination with special game exercises (which are performed with verses) on the indicators of motor development and psychophysiological capabilities of children aged 6 years. From the point of view of the positive influence of plot games on the psychophysiological indicators of primary school children, our work is an extension of the data presented in the work of Kozina et. al. [23]. Psychophysiological capabilities are the basis for the development of intelligence and communication skills, therefore our work also confirms the data obtained by Kozina et. al. [23]. However, in terms of data influencing the development of proprioceptive sensitivity in story games, our work is new knowledge.

Conclusion

From the effectiveness test, the results of the kinesthetic perception-based game learning model are valid and very effective for improving kinesthetic perception, playing intelligence, and elementary school children's cooperation. The product of this development research is a kinesthetic perception-based game learning model packaged in the form of a practical guidebook for the kinesthetic perception learning model entitled "Kinesthetic Perception-Based Games for Lower Grade Children". The playbook for practitioners based on kinesthetic perception to improve kinesthetic perception, playing intelligence, collaboration between elementary school children, there are four games, namely: (1) Target Shooting Games, (2) Train Car Games, (3) My Flag Games, and (4) Games Rakartugu.

Conflict of interest

The authors declare that there is no conflict of interest.

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2020
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