

## Development of gross motor skills exercise models and physical activities to enhance physical fitness of elementary school students

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### Abstract:

The development of exercise model and physical activities for the children's gross motor skills is expected to have short-term and long-term physiological effects, e.g., on their growth hormone, muscle mass growth and development, physical health, and physical fitness. The development of these models and activities was expected to enhance student participation to improve their fitness, health, and motor skills development. The research was performed in three stages. In the first stage, a needs analysis was performed on exercise models and physical activity. Then, the gross motor skills exercise model and physical activities were developed in the second stage and tested in the third stage. The small scale and large scale tests involved 15 and 45 respondents, respectively, from Batu City, Malang Regency, and Malang City, and the scores of 90.62% and 93.75% were obtained, respectively. Therefore, the developed models were proven to improve children's gross motor skills and enhance their physical fitness. The gross motor skills exercise model and physical activity were developed to improve elementary school students' physical fitness. These products were confirmed to be accepted by most physical education teachers during the testing process. These gross motor skills, exercise models, and physical activities are important because physical activities are essential for physical fitness and increase children's maximum oxygen consumption (VO<sub>2</sub>max), body composition, muscle power and durability, and flexibility. Various physical activities should be performed regularly to improve physical fitness. Additionally, education should be provided to the teachers and society to avoid failures in the implementation of gross motor skill exercise models and physical activities for elementary school students. In addition, we provided numerous suggestions related to our findings. The gross motor skills exercise models and physical activities, which were developed to enhance students' physical fitness, went through a series of stages, from expert testing to group testing. The obtained results show that the developed products can be used for elementary school students. In addition, the developed product can be used as a reference by the physical education teachers for the physical education courses.

**Key Words:** exercise model, physical activity, elementary school

### Introduction

The data published by the Indonesian Pediatric Association (IDAI) in 2013 showed a small increase of 5–10% in Indonesian children's gross motor skills. By 2014, the increase was 12.4%. The development of children's gross motor skills should be considered when children become five years old (Dewi & Verawati, 2022; Jones et al., 2020; Webster et al., 2019). Children's gross motor skills are essential for their development until they are adults (Martins et al., 2020; Melvin Chung et al., 2021; Suherman et al., 2019).

Children's exceptional gross motor skills can be observed in their physical, social, and psychological growth (Cederborg, 2021; Gümüşdağ, 2019). Besides, improvement in gross motor skills growth is also correlated with physical activities relevant to children's health, fitness, and cardiometabolic health (Sgrò et al., 2017). Children with motor movement issues mostly avoid physical activities, resulting in obesity, social communication problems, low self-esteem, and poor academic performance (Kueper et al., 2017; Nishizawa & Nakamura, 2021). Additionally, these problems are induced by the lack of exercise and physical activity; thus, these children have low gross motor skills, which influences their physical fitness and health.

Gross motor skills are defined as children's fundamental ability to perform a series of organized movements that involve parts of their bodies to attain high competence and maintain health (He et al., 2021). These gross motor skills are important elements during the early childhood period (Altınkök, 2017; Huseyin, 2019). Thus, gross motor skills development is the base for each individual to gain maturity in other developmental aspects (Kusumawardani et al., 2020; Roslan & Abdullah, 2020; Rukanah, 2021; Zulkarnaen, 2019). Gross motor skills involve big muscles and the central nervous system (Costa, Abelairas-Gomez, et al., 2015; Costa, Barcala-Furelos, et al., 2015).

Gross motor skills consist of three stages, i.e., cognitive, associative, and autonomous stages (Kakebeeke et al., 2021; Veiskarami & Roozbahani, 2020). Children's gross motor skills improvement is an essential predictor of the level of physical activity. Meanwhile, the contributing factors to children's gross motor skills improvement are the genetic and environmental factors (Huang et al., 2017; Sagr & Sagr, 2020), as well as their participation in physical activities. Specifically, gross motor skills robustness is also supported by high physical activity.

In addition, movement efficiency requires numerous elements consisting of physical, psychological, and emotional skills. The fundamental movement skills are classified into object control skills (such as catching and throwing), locomotor skills (such as running and jumping), and stability skills (such as balancing and turning). Bremer & Lloyd (2021) categorized locomotor movement into walking, running, jumping, hopping, and galloping. Meanwhile, non-locomotor movements include turning, circling, and balancing. Lastly, manipulative movement represents the movement used to control an object such as throwing, passing, poking, catching, kicking, and receiving.

Physical activities are essential for physical fitness because they increase the body's functional capacity by enhancing the maximum oxygen consumption (VO<sub>2</sub>max), body composition, muscle strength and durability, as well as flexibility (Aktug & Demir, 2020; Luan et al., 2019; Lucini & Pagani, 2021). Physical activities can be described as health or fitness exercises (Bull et al., 2020; Rodríguez-Larrad et al., 2021; Wang & Boros, 2021). Physical activity is described as activity that is performed continuously. The rarely performed physical activity affects physical fitness.

Play movement education-based learning offers physical activities with movements that support children's movement skills development (Coppola et al., 2021; Sevimli-Celik et al., 2011) because movements are classified as innovative and fun activities to enhance children's gross motor skills development (Ozdogar et al., 2017). Enjoyable physical activities stimulate improvement in children's movement skills (Brachman et al., 2021; van Santen et al., 2020).

Erdyneeva et al., (2021) defined physical fitness as the body's capacity and ability to adapt to physical loading without inflicting excessive fatigue. Higher physical fitness enhances a person's physical ability and reduces his/her chance of getting injured. Physical condition is related to the optimum and efficient ability and capability of the body. If a person has excellent physical condition, he/she can enjoy his/her free time and perform activities using the remaining energy. The aspects of physical fitness include flexibility, strength, balance, speed, agility, durability, explosive power, and coordination.

The school-age (6–12 years old) is defined by concrete operational development. Ideally, during this period, children should frequently learn, but most of them experience unstable desires because they are required to memorize information and use other skills with low levels of physical activity. Jiaying et al., (2022) stated that movement stimulates children's growth and development, while regular movement pattern enhances their growth quality. Therefore, most elementary school students' activities are dominated by fun, free, and independent games.

Children have a remarkable brain potential that should be maximally utilized. The left and right brain hemispheres perform different roles. Intellectual intelligence (IQ) is a natural intelligence, but emotional (EQ) and spiritual intelligence (SQ) should be trained from an early age at school and at home. Children's learning styles are divided into the styles that focus on improving visual, hearing, and excessive ability (Asbari et al., 2020; Najib & Wiyani, 2016; Santosa et al., 2021).

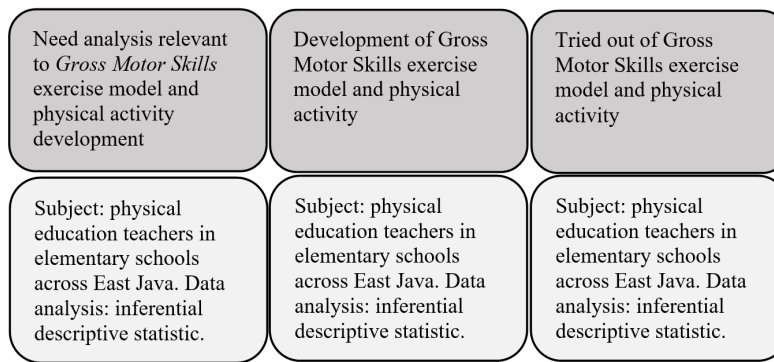
Additionally, children's intelligence is classified into eight categories, i.e., (1) linguistic intelligence – ability to speak and write properly; (2) logical–mathematical intelligence – ability to perform reasoning, calculating, and logical thinking abilities; (3) visual–spatial intelligence – ability to paint, take pictures, and sculpt; (4) bodily–kinesthetic intelligence – skills to use each body part; (5) musical intelligence – ability to modify songs, sing, and play musical instruments; (6) interpersonal intelligence – socialization skills, (7) intrapersonal intelligence – ability to regulate feeling and self-awareness; (8) naturalistic intelligence – ability to recognize the nature.

In response to the abovementioned issues, this study developed exercise models and physical activities for developing children's gross motor skills. The developed exercise models and physical activities were predicted to improve students' health and fitness, as well as influence their motor skill development in the adolescent and adult ages (Eliso, 2017). The promotion of physical activities is deemed important because it stimulates children's motor skills development (Koehne et al., 2016; Kropacova et al., 2019).

The exercise model and physical activities are expected to have positive effects in the short- and long-term, such as on their growth hormone, muscle mass, growth, as well as physical health and fitness.

## Materials and methods

This study was performed in three stages. In the first stage, a needs analysis relevant to the exercise model and physical activities was performed. The exercise model and physical activities were established in the second stage and tested in the third stage. The research procedures are described in Figure 1.



**Fig. 1.** Research procedures

The research procedures were initiated by (1) constructing a prototype of the gross motor skills exercise model and physical activities; (2) creating a guide book for the gross motor skills exercise model and physical activities; (3) socialization of gross motor skills exercise model and physical activities; (4) obtaining data relevant to gross motor skills exercise model and physical activities; (5) analyzing the data of gross motor skills exercise model and physical activities; (6) writing research articles and applying for intellectual property rights; and (7) scientific publication.

*Research design*

Using a survey to obtain the data, this study developed gross motor skills exercise models and physical activities.

*Research participants*

The participants of this study were physical education teachers and students in elementary schools in East Java, Indonesia, specifically from Batu City, Malang Regency, and Malang City.

*Research variables*

From the obtained data, the recent relevant issues, available facilities, available support, and expected outcomes were identified.

*Research instruments*

Various instruments were used to measure research variables that were defined by several indicators. The instruments consisted of (1) a needs analysis instrument; (2) expert validation and children's physical activities instrument; (3) psychological and children's development expert validation instrument; (4) learning technology expert validation instrument; and (5) testing instrument.

*Data analysis*

The obtained data were analyzed using descriptive and nonparametric inferential statistics.

**Table 1.** Categorization of qualitative analysis results (Adi & Fathoni, 2020)

No	Percentage	Category	Description
1	81.00–100.00%	Very valid, effective, and complete	Can be used without revision
2	61.00–80.00%	Relatively valid, effective, and complete	Can be used with minor revision
3	41.00–60.00%	Less valid, effective, and complete	Requires major revision and is suggested not to be used
4	21.00–40.00%	Non-valid, ineffective, and incomplete	Cannot be used
5	00.00–20.00%	Highly non-valid, ineffective, and incomplete	Cannot be used

**Results**

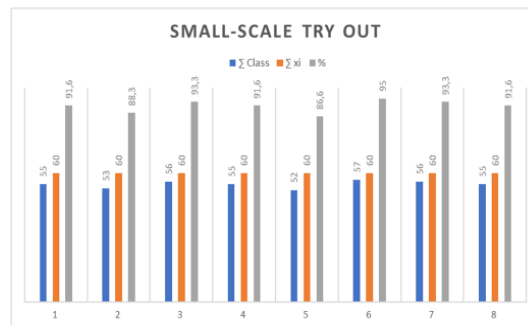
The obtained results were the gross motor skills exercise models and physical activities that are useful to enhance elementary school students' physical fitness. The models and activities were in the form of an application that can be downloaded from PlayStore or AppStore (using the 'Exercise models and physical Activities' search phrase) and installed on a smartphone. Meanwhile, it can be downloaded from Google Book using the 'Exercise models and physical activities for elementary school students' physical fitness' search phrase. The developed products were validated by three panels of validators, consisting of experts in children's physical activities, experts in psychology and children's development, and experts in learning media. These experts offered suggestions for the revision process. Later, the developed products were tested on 15 and 45 participants in the small and large-scale tests, respectively. Initially, this study was planned to be conducted in East Java, Indonesia; however, due to the COVID-19 pandemic, some areas were in the red zones. Consequently, the test was performed in the Malang area, which was in the yellow area. The test was completed by applying the health and safety protocol.

Qualitative and quantitative data were obtained from the expert validation process and tests involving the students. The obtained qualitative data were reduced into descriptive sentences. Meanwhile, quantitative data

were analyzed using descriptive inferential statistics, and the results were presented in the form of numbers and percentages.

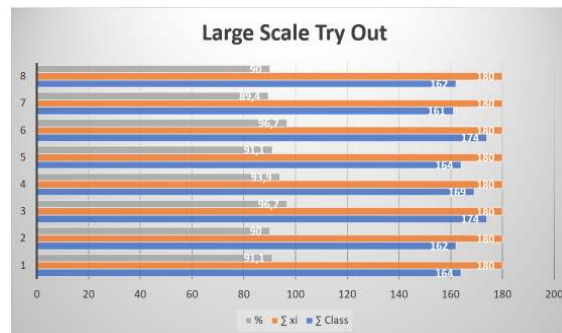
Based on the obtained qualitative data, the experts gave numerous suggestions. First, the button in the application should be adjusted depending on the context to help users perceive the materials they are about to choose. Second, some videos were not successfully uploaded, so they were unavailable. Third, there is no 'forgot password' feature on the login page. Fourth, in the evaluation exercise, some options cannot be selected, hindering users from completing the exercise. Fifth, the application sometimes experiences glitches when users are about to enter the exercise page. Sixth, one of the videos is not in HD quality; thus, game stages cannot be clearly observed. Seventh, the figure and concept in one of the games are not arranged neatly, possibly resulting in user confusion. Eighth, on the forgot password page, when the user clicks the forgot password button, there is a reloading issue in the application. Ninth, some inscriptions within the chapters are intermittent, disrupting the user's understanding of the developed product.

Further, the quantitative data are presented in the form of percentages and classified by data analysis during (1) expert validation, (2) small-scale tests, and (3) large-scale tests. The results of the validity test involving the children's physical activity experts, consisting of 10 components, showed the score of 104 (92.9%) out of 112. Thus, the developed product can proceed to the testing stage. The results of validation involving psychologists, consisting of 10 components, showed a score (F) of 76 (95%) out of the maximum score (N) of 80. The results of psychology experts' validity test suggest that the developed product can be used during the testing stage. Lastly, the results of the validity test involving the children's psychology and development expert consisting of 10 components showed the score of 12 (91.6%) out of the maximum score of 48. Thus, based on the validity test by the children's psychology and development expert, the product can proceed to the testing stage.



**Fig 2.** Data analysis results of small-scale testing

The small-scale test consisted of eight components. The results of this test showed the (F) score of 8 out of the maximum score (N) of 32, with 90.62%. Thus, this result indicates that the developed product can be used in large-scale tests.



**Fig 3.** Data analysis results of large-scale testing

The large-scale test consists of eight components, resulting in eight scores (F) from the maximum score (N) of 32, with a percentage of 93.75%. Finally, the results of the small- and large-scale testing were 90.62% and 93.75%, respectively. Therefore, the developed exercise models and physical activities improve the children's gross motor skills and enhance their physical fitness.

## Discussion

After a series of stages, the developed gross motor skills, exercise models, and physical activities were confirmed to have short-term positive effects. Meanwhile, in the long-term, they improve children's physiology such as their growth hormone level, muscle mass growth and development, as well as physical health and fitness. The product developed in this study includes: (1) an application that can be downloaded from either PlayStore or AppStore (using the "exercise model and physical activity" search phrase) or from (2) Google Book (using the "exercise model and physical activity for elementary school students' physical fitness" search phrase).

The developed products offer numerous benefits. First, these types of models and activities for elementary school students have never been previously developed. Second, the gross motor skills exercise models and physical activities can improve elementary school students' physical fitness. The products can be used as new references for exercise models and physical activities for elementary school teachers and parents whose children are still in elementary school. Because the small- and large-scale testing produced scores of 90.62 and 93.75%, respectively, the developed exercise models and physical activities contribute to enhancing children's gross motor skills and physical fitness.

A study performed by Pranoto, Ma'mun, Mulyana, & Kusmaedi (2021) revealed that fundamental movement skills contribute to the small-sided handball game skills by 21.8%, and the fundamental movement skills are correlated with the children's skills in playing games. Another study performed by Park, Kim, & Lee (2015) on the cardio circuit game exercise model resulted in  $Z = -8.368$ , indicating that most children were interested in the exercise model, which affected their physical fitness.

Physical activity is essential for physical fitness and enhances the body's functional capacity through the increase of maximal oxygen consumption (VO<sub>2</sub>max), body composition, muscle power and durability, and flexibility (Iannetta et al., 2020; O'Brien et al., 2017; Tedjasukmana et al., 2021). In addition, physical activity is beneficial for physical health and fitness (Mavilidi & Vazou, 2021; McPhee et al., 2016). Physical activity should be performed continuously. The rarely performed physical activities affect our physical fitness. Additionally, play movement education-based learning offers physical activities that support the development of children's movement skills (Gramespacher & Voss (2020) Sevimli-Celik & Johnson (2016)) because it is one of the innovative means to engage children in establishing their motor movement skills (Christ et al., 2021; Gabbiadini et al., 2022). Enjoyable physical activities stimulate children's movement development (Fang et al., 2020; Pekyavas & Ergun, 2017; Rafiei Milajerdi et al., 2021).

Therefore, according to the obtained results, the developed gross motor skills exercise model and physical activity enhance the elementary school students' physical fitness and improve various parts of their bodies such as their gross motor and fundamental movement skills.

## Conclusions

The gross motor skills exercise model and physical activity were developed to improve elementary school students' physical fitness. These products were confirmed to be accepted by most physical education teachers during the testing process. These gross motor skills, exercise models, and physical activities are important because physical activities are essential for physical fitness and increase children's maximum oxygen consumption (VO<sub>2</sub>max), body composition, muscle power and durability, and flexibility. Various physical activities should be performed regularly to improve physical fitness. Additionally, education should be provided to the teachers and society to avoid failures in the implementation of gross motor skill exercise models and physical activities for elementary school students.

In addition, we provided numerous suggestions related to our findings. The gross motor skills exercise models and physical activities, which were developed to enhance students' physical fitness, went through a series of stages, from expert testing to group testing. The obtained results show that the developed products can be used for elementary school students. In addition, the developed product can be used as a reference by the physical education teachers for the physical education courses.

Suggestion for dissemination: The final result of this research and development is the creation of products that fulfil the needs of society in the education context. The developed products are learning media that accelerate access to information for both the students and teachers. Meanwhile, the wide dissemination of the product requires additional evaluation to ensure product conformity to the environmental situation and society's needs.

Suggestions for future studies: Because the results of this study indicated the feasibility of the developed gross motor skills exercise models and physical activities, future studies should develop products with similar contexts by considering the current situation and needs. In addition, before conducting the study, future studies should consider the test materials to ensure that the developed products really solve the existing issues. Finally, for the effectivity test, future studies should use a comparison group to make sure that the developed products are beneficial and meaningful.

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