

Students' performance level, teachers' mastery of materials, and implementation of fundamental motor skills: A sequential explanatory mixed-method study

OKTARIFALDI¹, SONI NOPEMBRI², YUDANTO³, MOHD IZWAN BIN SHAHRIL⁴, IBNU ANDLI MARTA⁵

^{1,2,3}Department of Physical Education, Faculty of Sport Science and Health, Universitas Negeri Yogyakarta, INDONESIA

⁴Faculty of Sport Science and Coaching, Sultan Idris Education University, MALAYSIA

⁵Department of Sports Education Faculty of Sport Science, Universitas Negeri Padang, INDONESIA

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Abstract:

Problem Statement. Fundamental motor skills are crucial predictors of optimal physical activity engagement. Elementary school settings offer significant potential for fostering these skills through Physical Education (PE). However, studies indicate substantial gaps in fundamental motor skills development in Indonesia, particularly related to students' motor competence. **Purpose.** This study aimed to explore the relationships among students' fundamental motor skill levels, teachers' mastery of materials, and the implementation of fundamental motor skill practices in learning. **Methods.** This research implemented an explanatory sequential design of the mixed-method approach, consisting of several stages. The first stage was to measure students' fundamental motor skills using the Test of Gross Motor Development (TGMD-2). The second stage evaluated teachers' mastery of learning materials and the learning implementation through a cross-sectional survey with convenience sampling. Following that, qualitative data through the semi-structured interviews were revealed in the third stage. The subject was 428 elementary school students aged 7 to 9 years old. Additionally, it involved 1371 PE teachers in elementary schools; 18 were chosen as representatives for the interview session. The data were then analyzed using IBM SPSS Statistic ver.25. **Result.** The first finding revealed that the average score of students' Gross Motor Quotient was 78.70, categorized at the average level (percentile 30). Meanwhile, the score of object control skills was at a low level (percentile 8). There was a significant difference in fundamental motor skills of students aged 7, 8, and 9 ($p < 0.05$), which tended to reduce with age. The next finding showed that only 542 out of 1371 teachers (39.52%) mastered the learning materials well. Additionally, 454 (33.01%) implemented the fundamental motor skills in the learning process. **Conclusions.** These teachers did not master the materials because of limited accessible sources for learning, so they were not competent in designing materials related to fundamental motor skills. Consequently, they did not effectively implement them in the learning process. Hence, this research concludes that the main predictors causing students' low competence were the low level of students' fundamental motor skills, the inadequate mastery of learning materials by Physical education teachers, and inefficient learning implementation.

Keywords: Fundamental motor skills, physical education teachers, elementary students, locomotor, control object

Introduction

Fundamental motor skills (FMS) are important components of children's development (Bremer & Cairney, 2018; AL-Nemr & Reffat, 2024). These skills are known as a set of gross motor skills to activate large muscles of the body, upper limbs, and lower limbs (Korbecki et al., 2017; Kela & Chombo, 2023). FMS is the 'ABC' of motion that creates basic human movements (Goodway et al., 2014; Pangrazi & Beighle, 2019). Many scholars state that it is a building block that becomes an obligatory prerequisite of basic competence to do daily activities and special physical activities over a long-term period (Wick et al., 2017; Logan et al., 2018; de Bruijn et al., 2019; Buns & LaValle, 2020). Thus, scholars believe that adequate FMS in children is the best predictor for teenagers to keep active in physical activities (Barnett et al., 2009; Dong et al., 2024).

Fundamental motor skills are generally categorised into locomotor skills, object control skills, and stability (non-locomotor) skills. First, locomotor skills refer to the movements transitioning body parts from one place to another, like running, jumping, hopping, galloping, sliding, leaping, and skipping. Meanwhile, object control skills require manipulating movements using hands or legs, such as kicking, catching, throwing, striking, and rolling a ball. The last one is stability (non-locomotor) skills involving postural gestures, such as bending, curling, turning, and twisting (Goodway et al., 2019; Rudd et al., 2015).

The development of FMS does not occur on its own as somebody gets older. Instead, it has to be taught continuously and combined with other movement patterns in structured physical activities (Pang & Fong, 2009). A study revealed that children aged 3 to 10 years old have effective development of FMS mastery through structured and continued practice programs (Lin & Yang, 2015). Another study showed that the early childhood period was the crucial time to implement the learning program of FMS structurally because the acquired motor competencies had to be practiced as they did not optimally develop in children's natural growth (Goodway & Branta, 2003; Valentini & Rudisill, 2004; Koolwijk et al., 2023).

Adequate FMS is a predictor of successful children's movement. Teachers are also responsible for developing and increasing students' competence to master more complex and difficult motor skills (Kokstejn & Musalek, 2019). Some studies reported that the early development and competence of motor skills might reflect future participation in physical activities (Dong et al., 2024). Longitudinal studies confirmed that the motor skills of 6-year-old children had a positive correlation with long-term physical activities by the time they were 26 years old (Lloyd & Bremer, 2014). Moreover, higher scores of locomotor skills were reported to predict engagement in moderate physical activities and to suppress children's sedentary behaviour from time to time (Kasanen et al., 2023).

One of the determining factors that influence how children acquire fundamental motor skills is the forms and patterns of the movements in the physical activities they carry out (Chan et al., 2019). For instance, gradually practicing continuous and structured physical activities is highly recommended to optimize the functions of body parts in increasing fitness and students' psychomotor mastery (Nopembri & Sugiyama, 2021). Earlier research also revealed that fitter students had better academic achievements and motor skills than those who were not (de Bruijn et al., 2018). Children with better gross motor skills constantly have a healthy life and are physically active until they are teenagers (Barnett et al., 2008). In contrast, those with lower gross motor skills tend to be less physically active until adulthood (Hardy et al., 2012).

As is known, physically active individuals, regardless of their chosen activities, have higher quality of life parameters than less active (Pluto-Pradzynska et al., 2022).

Surprisingly, the importance of gross motor skills and adequate motor experiences of children have not received appreciation and support from parents, societies, and even the teachers who directly interact with children (Bakhtiar & Famelia, 2017; Benda et al., 2021; Gu et al., 2019; Hardy et al., 2013; Hasan et al., 2013; Hastie, 2017; Oktarifaldi et al., 2024). As a matter of fact, many studies revealed that more than half of children in the world had insufficient motoric competence when they graduated from elementary schools (Gu et al., 2019; Hardy et al., 2013; Hastie, 2017). In particular, the children's mastery of gross motor skills in Indonesia is relatively low and does not correspond to their age level (Bakhtiar & Famelia, 2017; Hasan et al., 2013; Oktarifaldi et al., 2024). They are supposed to have perfect motoric competence when they are in elementary school (Goodway et al., 2019). Physical Education (PE) is a subject in elementary school that has a big influence on fostering motor skills for children and teenagers. The subject has also been reported to advance the students' social and psycho-evolution (Backman & Barker, 2020). As stated in the curriculum, this subject focuses on promoting concepts and skills of motor movements for students in doing physical activities (Lynch, 2019), as well as to reach fundamental motor skills as the strong basis in physical activities (Romero-Martínez et al., 2024). It was confirmed that the higher level of competence people had, the more complex additional skills in transition and sports competence they attained (Brian et al., 2020).

Elementary schools and physical education have been identified as impactful indicators for teaching and promoting FMS, providing access and facilities through the structured PE subject (Lander et al., 2017). In Indonesia, elementary school students are expected to understand and master fundamental motor skills, such as locomotor skills, object control skills, and non-locomotor skills (Menteri Pendidikan, 2018). As the authority to advance students' physical literacy at school, teachers have to possess sufficient knowledge, skills, and practical experiences (Barratt et al., 2024). They also need to figure out the characteristics of students to determine suitable learning strategies to increase the quality of the PE subject at schools (Saryono & Nopembri, 2013).

Professional PE teachers should be able to support the students' learning process if the teachers are knowledgeable about FMS (de Niet et al., 2021). Motor development and competence will be attained through teacher-student interaction and active participation in the learning process (Rodrigues et al., 2015). One of the teacher's roles is to explore students' physical activities through sport-based school, extracurricular programs, and structured education (Zalech, 2021). Nevertheless, conceptual barriers such as lack of understanding of the learning model, limited pedagogical strategies in designing, managing, and implementing the learning, and lack of facilities and support for teachers affect the learning process and the achievement of students' competence (Harvey et al., 2020).

To reach optimal learning, collaborations between academicians in universities and teachers as practitioners at schools are needed in order to create qualified physical education content (Valério et al., 2021). This study was conducted to reveal an in-depth relationship between the low level of students' FMS, the mastery of learning materials by teachers, and the implementation of learning and practice in the factual condition at schools. Considering that no studies have revealed the connection between teachers' mastery and learning implementation in the PE subject toward students' motor skills. This study is useful in exposing the causes of the low level of Indonesian students' motor skills.

Materials & Methods

Participants

The subjects of this research were 428 elementary school students aged 7 to 9 years old. Additionally, the research involved 1371 PE teachers at the elementary school level throughout Indonesia. In the quantitative phase, this research recorded ten public elementary schools with a total number of students was 428. Of these participants, 228 male and 200 female students agreed to serve as samples for fundamental motor skill assessment. Moreover, 1371 PE teachers from 17 provinces in Indonesia were chosen as survey respondents to measure learning material mastery and learning implementation. On the other hand, in the qualitative phase, 18 out of 1371 PE teachers were requested to be interviewed. In this phase, 14 of them were certified teachers, and 4 of them were not certified yet, but they had 7-to-28-year teaching experiences.

Research design

This study used a sequential explanatory mixed-method design. The mixed-method design is a combination of quantitative and qualitative methods to conduct deeper analyses of the phenomena rather than using a single method (Almalki, 2016; Creswell, 2011). It was conducted in several stages. The first stage was to measure students' fundamental motor skills as quantitative data. It was then followed by surveying teachers' mastery of materials and learning implementation. The next phase was collecting qualitative data through semi-structured interviews (thematic analysis) (Creswell & Creswell, 2017; Nampai et al., 2022).

Instruments and procedure

As this research involved several phases, different instruments were employed in each phase. For instance, this research obtained data on fundamental motor skills from cross-sectional studies of the population of elementary schools in West Sumatra (Wang & Cheng, 2020). In this phase, the Test of Gross Motor Development Second Edition (TGMD-2) was used as an instrument. The data was collected by recording videos with two trials to measure the gross motor skill performance of children aged 3 to 10 years old. The recording focused on the sub-skills of locomotor skills of TGMD-2, such as running, galloping, leaping, hopping, sliding, and jumping, and the movements of object control skills, like striking, catching, dribbling, throwing, under-rolling, and kicking (Ulrich, 2000).

Following that, data on learning material mastery and implementation were attained by distributing questionnaires to teachers in a large-scale survey. The questionnaire consisted of 10 questions; 5 questions were about the teachers' mastery of FMS materials, and the other 5 questions were about the implementation of FMS in learning practice. Each question contained four alternative answers. It is important to note that participants in this survey were recruited through convenience sampling, a type of non-probability sampling technique. One of the reasons was that the population was easily accessed and suitable for research purposes (Stratton, 2021).

Finally, qualitative data were compiled by using a thematic approach of a semi-structured interview. An interview is an interaction where questions are asked to gain in-depth information about an interesting topic or theme of a research (Ruslin et al., 2022). The interview guideline was formed based on the survey results, including 10 open questions to explore respondents' perspectives on the material mastery and implementation of FMS. The allocated time was 30 to 40 minutes for each respondent. Interestingly, 10 teachers did the interview face to face, while 8 teachers were interviewed through telephone. All of the interviews were digitally recorded.

Statistical analysis

Data analyses were conducted in 3 stages. Stage 1 used a descriptive method to portray the average score of FMS in general, the standard deviation, and the group's percentage of male and female students. The one-way ANOVA test was carried out to see the differences in the average score of FMS of students aged 7, 8, and 9 years old. The normality test was conducted before operating the one-way ANOVA test to see if the data were normally distributed. In stage 2, the mastery of learning materials and learning implementation were represented. The average score, standard deviation, and percentages were reported separately. The analysis of these statistical calculations was conducted by using IBM SPSS statistics ver. 25. Unlike the previous stages, stage 3 attained qualitative data from the interview. The data were analysed using a thematic approach. This analysis included multiple steps, such as (1) familiarization, (2) coding, (3) generating themes, and (4) defining and naming themes (Braun & Clarke, 2006; Suryobroto et al., 2022).

Ethics committee

Before collecting the data, the authors obtained legal permissions in Decree No. 009/YSO/III/2023 from the school principals, teachers, and parents to collect data on fundamental motor skills. Besides, another Decree No. B/310/UN34.16/DL.16/2023 from Universitas Negeri Yogyakarta was given to obtain data on teachers' mastery of learning materials and implementation.

Results

Quantitative data

This section presents two key findings. The first part consists of the results of the FMS measurements among the students. It is then followed by the results of teachers' assessments of their mastery of FMS materials.

Fundamental Motor Skills

In general, the average score of Gross Motor Quotient (GMQ) of 428 students was 78.70. This score was classified as low. If we look closely at the participants' gender, the results showed a similar tendency. For

example, the GMQ score of male students was below the average level. Similarly, the average score for female students was also low. Furthermore, the locomotor skills of students were in percentile 30. This shows that the students were at the average level. However, the object control skills of the participants were back again in percentile 8, which was considered low. An interesting finding was that male students were consistently superior to female students in locomotor and object control skills. The data distribution of students' fundamental motor skills is presented in Table 1.

Table 1. General data description of students' Fundamental Motor Skills

Indicator	N	Fundamental Motor Skills				
		Average	Std	Min	Max	Rating
Gross Motor Quotients General	428	78.70	10.7	46	109	Low
Gross Motor Quotients Male	228	81.81	10.2	55	109	Below Average
Gross Motor Quotients Female	200	75.15	9.9	46	103	Low
Percentiles Locomotor	428	30.78	-	5	95	Average
Percentiles Object Control	428	8.21	-	1	50	Low

A more detailed figure can be seen in Table 2, especially regarding the gender difference and score classification. Of 428 students, 202 students (47%) had below-average GMQ scores. Then, male students had better scores in locomotor skills and object control skills. The research also showed that there were 7 levels of score categories: very superior, superior, above average, average, below average, low, and very low.

Table 2. Score description of gross motor quotient, locomotor, and control object (male and female)

Gross Motor Quotients	General	Male	Female	Percentile	Percentile Locomotor			Percentile Object Control			Descriptive Rating
					General	Male	Female	General	Male	Female	
> 130	0	0	0	≥ 99	0	0	0	0	0	0	Very Superior
121 - 130	0	0	0	92 - 98	1	1	0	0	0	0	Superior
111 - 120	0	0	0	76 - 91	24	22	0	0	0	0	Above Average
90 - 110	70	52	18	25 - 75	225	137	2	34	19	15	Average
80 - 89	120	76	44	10 - 24	55	27	116	47	35	12	Below Average
70 - 79	169	81	88	2 - 9	116	40	76	236	122	114	Low
< 70	69	19	50	≤ 1	7	1	6	111	52	59	Very Low

After that, this research also investigated the difference in results based on their ages. For instance, the percentile of locomotor skills of a group of 7-year-old students was 37.75, classified as average. Meanwhile, the percentile of object control skills was 9.86, which was poor. In a group of 8-year-old students, the percentile of locomotor skills decreased to 31.60. This figure was classified at the average level. The object control skills also fell to 7.87, a poor level. Interestingly, the decrease happened again in a group of 9-year-old students, whose percentiles were 24.80, or below average. Similarly, the object control skills fell to the lowest score of 7.25, categorized as poor. The data distribution is presented in Table 3.

Table 3. The average score of general GMQ, male, female, percentile of locomotor and object control skills

Group	Indicator	N	Fundamental Motor Skills				
			Average	Std	Min	Max	Rating
7 years-old	GMQ General	101	83.54	7.6	70	106	Below Average
	GMQ Male	54	84.72	7.9	70	106	Below Average
	GMQ Female	47	82.19	7.01	73	103	Below Average
	Percentile Locomotor	101	37.75	-	5	95	Average
	Percentile Object Control	101	9.87	-	1	50	Low
8 years-old	GMQ General	184	78.95	10.5	52	109	Low
	GMQ Male	102	81.88	10.53	55	109	Below Average
	GMQ Female	82	75.30	9.18	52	100	Low
	Percentile Locomotor	184	31.60	-	1	84	Average
	Percentile Object Control	184	7.87	-	1	50	Low
9 years-old	GMQ General	143	74.94	11.1	46	106	Low
	GMQ Male	72	79.53	10.71	58	106	Low
	GMQ Female	71	70.30	9.45	46	100	Low
	Percentile Locomotor	143	24.80	-	1	84	Below Average
	Percentile Object Control	143	7.25	-	1	50	Low

In short, Table 3 indicates that the highest achievement of students' locomotor skills was at an average level by students aged 7 years old. Students' object control skills were at a poor level. The data also revealed that the object control skills of students aged 7, 8, and 9 years old were at a poor level. Moreover, it seemed that female students gained deficit object control skills compared to male students of all ages. The data analysis can be seen in Figure 1.

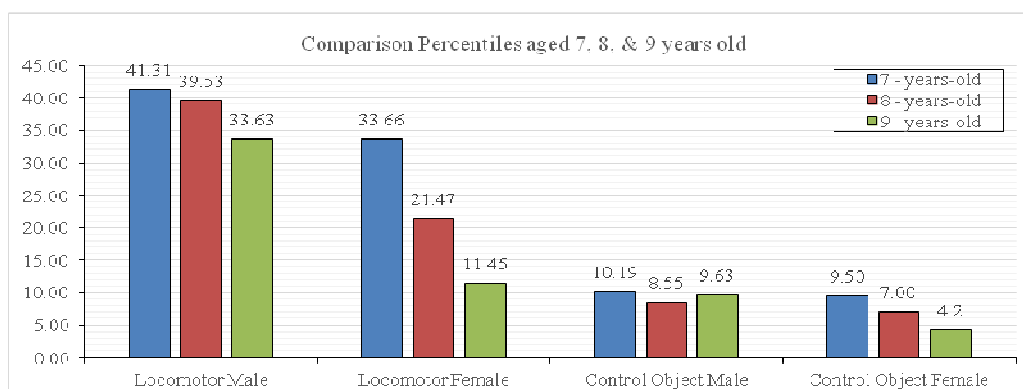


Figure 1. The comparisons of locomotor and object control skills of students aged 7, 8, and 9 years old

To figure out the differences in the average FMS score among students of groups 7, 8, and 9 years old, a normality test was conducted using the one-way ANOVA. Then, the Kolmogorov-Smirnov test was carried out on all students in all age groups. The results showed that significant scores of students in groups of 7, 8, and 9 years old were $0.079 > 0.05$, $0.081 > 0.05$, and $0.063 > 0.05$. Therefore, these three data were normally distributed. Moreover, the one-way ANOVA test was operated to reveal the differences among the student age groups. The result showed that the F-count was 21.64 with sig. 0.00. In other words, there was a significant difference in Indonesian students' FMS in the age of 7, 8, and 9 years old.

The teachers' mastery of Fundamental Motor Skill materials

The second data that this research tried to attain was regarding the competence of teachers in mastering the learning materials about fundamental motor skills. The data were collected using 5 survey questions to 1371 physical education teachers as respondents. The questionnaires asked participants about their knowledge of the content materials, development strategies, ideal time for development, references and sources of material, and pedagogical understanding. The description of the survey results is presented in Table 4.

Table 4. The score of the teachers' mastery of FMS materials

Questions	Score of responses			
	1	2	3	4
Teacher's knowledge and comprehension of FMS materials	11	149	588	623
Teacher's knowledge about development strategies of FMS materials	82	294	417	578
Teacher's knowledge about the crucial time of FMS development	362	170	329	510
Sources and references of FMS materials for teachers	31	257	675	408
Teacher's understanding of pedagogic and demonstrating FMS	106	364	311	590

Table 4 describes PE teachers' mastery of FMS materials. The table indicates that almost half of the population, i.e., 623 teachers (45.44%), possessed knowledge and comprehension of FMS materials. This figure slightly decreased to 578 teachers (42.16%) when it is related to the FMS development strategies. Although 590 teachers (43%) mastered pedagogical content in demonstrating FMS, only 408 teachers (29.76%) obtained relevant content from FMS materials.

Implementation of Fundamental Motor Skill Materials

Having obtained data on FMS and teachers' mastery of FMS materials, this research unveiled the implementation of FMS materials in the learning process. This stage was uncovered through 5 survey questions for 1371 Physical education teachers. The survey asked about teacher's implementation of materials, teacher's proficiency in assessment and evaluation, teachers' ability to organize FMS in the teaching process, and the barriers teachers found in teaching FMS. The results of the survey can be seen in Table 5.

Table 5. The scores of learning implementation of FMS materials

Questions	Score of responses			
	1	2	3	4
Are teachers capable of implementing FMS assessment using TGMD?	240	202	720	200
Have the FMS materials been implemented in the teaching process?	36	393	469	473
What are the barriers found in implementing the FMS materials?	190	323	408	450
Have teachers taught the FMS materials structurally?	167	328	443	433
How are students' motivation in learning FMS materials?	63	318	278	712

Table 5 summarizes that most teachers, i.e., 1171 teachers (85.41%), were not capable and had not conducted the FMS evaluation yet. In addition, 898 teachers (65.50%) have not taught FMS in the teaching process, and 921 teachers (67.18%) found difficulties in teaching FMS due to the lack of knowledge and understanding of FMS materials and limited sources and references. Finally, 938 teachers (68.42%) did not teach in a structured way. Strikingly, 659 teachers (48.07%) said that students felt motivated by FMS practices.

Qualitative Data

This section provides qualitative findings as a result of the semi-structured interview. There are two main findings regarding teachers' mastery of FMS materials and their classroom implementation. These findings are presented narratively, and some useful insights are cited verbatim.

The teachers' mastery of Fundamental Motor Skill materials

All respondents agreed that knowledge and understanding of teaching materials play dominant roles in physical education subjects. It was revealed that many teachers did not have a good comprehension of FMS materials. The chair of the PE teacher forum in Padang city, Rizki, confirmed that teachers usually searched for additional materials outside the teaching modules, such as by creating their own content or using materials they got from any training from Sports Departments in universities. Eddy, a senior teacher, stated, "So far, I only know it from any readings and guideline books in schools about the components of fundamental motor skills but do not understand it comprehensively".

More than 75% of respondents did not know how to elaborate on students' FMS and the ideal time to develop it. Rival said, "Although I have been teaching for 8 years, I do not think this topic has been presented and discussed in a teacher forum. Even when I was in college, I did not know how to develop fundamental motor skills". Another response said that understanding the implementation strategies and times to develop FMS have not been acquired by many teachers.

According to the interview, 14 respondents stated they used sources and references of materials from modules provided by the authority. Among them, 8 respondents admitted that they also browsed the internet to obtain additional materials due to limited contents of fundamental motor skills in the books and modules requested by the Education Minister of Indonesia. For example, Saputra commented:

After we analysed it together in the Physical Education teacher forum of Elementary school, the contents of the modules only provided explanations and general movement examples. However, the ways to design meaningful FMS learning have not been explained. Thus, we are not skillful in designing the materials either. Respondents also explained their limited understanding of FMS materials made them unable to plan the learning program. Heru shared, "I had difficulties designing the FMS program due to a lack of knowledge and experience about it. I have never been enrolled in any training about it." Hakim added, "Although I have attended training, I am still not qualified to design the FMS learning because I do not have any concrete guidance yet."

Consequently, all respondents answered that the implementation of FMS was difficult to do if the learning programs had not been well-designed. All respondents admitted that the factual conditions of the learning process at elementary schools have not been suited to the recommendation of the authority. The respondents reported that the learning process still focused on quantity instead of the quality of students' FMS. Rizki, the chair of the Physical Education teacher forum in Padang, said, "We are trying our best to develop the FMS learning program, but the limited sources and the lack of experiences and training make us quantity-oriented". Thus, it is not surprising that the factual students' FMS is still low and insufficient.

Implementation of Fundamental Motor Skill material

The interview result showed that all respondents agreed that demonstrating FMS in elementary schools was really important. Unfortunately, the implementation is still challenging due to three main reasons. First, 13 out of 17 teachers admitted that they were not proficient in giving a good demonstration. One respondent (Mahendra) claimed that he had taught FMS in a well-structured program. Other respondents expressed the same responses, saying that they were unable to design the program, so they have not taught FMS. Alfand added, "We and the teacher forum in the regencies truly do not understand the FMS content and to design it". All respondents stated that their learning focused on quantity and was not well-structured. In other words, they did not implement FMS because they had limited understanding and sources about FMS itself.

Another main obstruction mentioned by the respondents was demonstrating, combining, and modifying fundamental motor skills in learning practice because they have limited source books and are not skillful. Furthermore, 4 respondents talked about the limited facilities at school. Farra stated: Implementation is the last process in teaching. Limited knowledge of learning mastery and skills in demonstrating fundamental motor skills are the main obstructions for teachers when teaching FMS materials. Besides, the limited sources and references also make it difficult to teach FMS optimally.

Lastly, all respondents stated that they were not competent in assessing students' FMS. Saputra said, "So far, we are not capable enough to assess and evaluate students' FMS because we only observe them generally". Yusi also said, "We realize that evaluation is one of the important elements in reaching the learning goals. However, we are still not capable of doing it, so it affects all processes in implementing FMS effectively at schools".

Discussion

The present findings revealed the factual conditions of acquired levels of fundamental motor skill competence for students aged 7, 8, and 9 years old in elementary schools in Indonesia. This study also exposed the relationship between the mastery of FMS materials and their implementation in the teaching process of Physical Education subject. The findings are divided into several parts based on the initial purpose stated in the earlier parts of this paper. First, data analyses showed that students' GMQ scores could not reach very superior and

superior levels. The average GMQ score was classified as poor, comprising the below-average GMQ score for male and poor for female students. Furthermore, the percentile of locomotor skills was 30 or at the average level. However, the percentile of object control skills was back to 8, at a poor level. Consequently, the students' FMS scores were not sufficient.

Many experts stated that for elementary students, the ideal average score of GMQ is supposed to be either very superior or superior levels (e.g., Gallahue et al., 2012). However, the findings of this study contrastively revealed that students' FMS is low and insufficient. Hence, improvements had to be made to gain optimum FMS development. A study confirmed that active collaborations between principals and teachers to implement structured programs are expected to increase students' FMS (Maia et al., 2024).

The next finding in this study is regarding the difference in FMS scores based on age groups. The study showed that FMS tended to reduce when the students grew older. This finding is relevant to previous studies (Oktarifaldi et al., 2024; Chovanová et al., 2023), which found lower-class elementary students significantly decreased as they got older. It rebutted the assumptions of parents and teachers that they thought FMS could develop naturally with age.

The analysis of three different groups of ages showed that the adequate average score of FMS was the 7-year-old student group. Meanwhile, students aged 8 and 9 years old were classified as poor. The limited time allocation contributed to the low quality of students' FMS. Hence, they do not have time to do physical activities outside the school (Budi et al., 2019). A possible solution is to optimize Physical Education learning in schools. It is significantly effective for students in the lower class when it applies to structured interventions (Bartolo et al., 2024).

Physical Education teachers have the opportunity to improve students' competence if they have sufficient knowledge and skills of FMS materials to develop students' motor skills (Eddy et al., 2021). Many interventions have been successfully applied in Physical Education FMS-based subjects (Bardid et al., 2017; Bryce, 2021). Besides having a good understanding, they should also be skillful in demonstrating and experiencing the strategies to develop FMS learning (Salters & Scharoun Benson, 2022). It is expected that mastery of learning materials and implementation are the main predictors of developing and increasing students' fundamental motor skills.

Nevertheless, participants' mastery of FMS materials in this research was not sufficient. The result provided that only 542 (39.52%) of 1371 teachers had a good understanding of FMS material. It is not in line with the role of teachers to design and manage the learning program for 1 semester, 1 week and 1 day as has been determined (Gacov, 2023). Physical Education teachers will be acknowledged as having good qualifications if they can positively and effectively use impactful learning to increase students' motor competence (Francesco et al., 2019). The result of this study revealed that the mastery of FMS learning was not adequate. However, the Minister of Education and Culture stated that it is an obligation for elementary students to have good FMS. The readiness of teachers to comprehend the content of knowledge and skills enables students to master the expected competence (Ivanii et al., 2020; Önal et al., 2023).

With these ideas and experiences, PE teachers play important roles in encouraging students to explore their motor experiences in developing competence (Niemistö et al., 2023). It is believed that in Indonesia, the poor level of students' FMS is caused by teachers not mastering the FMS materials. Therefore, this lack of proficiency impacts the ability to design qualified learning materials. Some conceptual obstructions include the lack of understanding of the learning model, pedagogical strategies in planning the teaching program, managing and implementing the program, and support and facilities from the school authorities (Harvey et al., 2020). The lack of concern toward this condition leads to unqualified teachers. There is a need to develop teacher pedagogical skills to have optimum physical education subject (Tsangaridou et al., 2023).

In order to reach the optimal learning goals of Physical Education at schools, the academics at universities and the teachers at schools need to collaborate actively. When teachers are unable to solve some obstacles, such as designing a learning program or evaluating competence, they need to seek help to overcome the problems. Some studies claimed that the lack of teachers' competence was caused by the lack of training they had (Sevimli-Celik, 2021). They must be trained to develop qualified content materials. This is an investment of teacher professional competence and an important element to reach the learning goals (Tsangaridou et al., 2023). Ideally, PE teachers master the students' level of development and figure out the appropriate approaches to meet the student's needs in FMS learning since locomotor and object control skills are examined using 'level' of development. This understanding will help teachers design and teach fundamental motor skills well (Goodway et al., 2019). Therefore, it is necessary to increase teachers' awareness about the acquired gross motor skills and guidelines for optimal motor competence through training, qualification tests, and short courses to enhance the qualification (Gibson et al., 2024). Therefore, the students' competence will be developed maximally as their age level at school.

The findings revealed that PE teachers in Indonesia have been unable to optimally implement the learning materials. In all provinces as the object survey, the teachers have not taught well-developed FMS learning, whereas to gain good motor competence for students, the teachers are essentially concerned with the most central dimensions in physical practice by carrying out the proper materials in line with students' competence, and well proficient demonstration (Chen et al., 2016). During the teaching process, teachers comprehend the movements that they demonstrate to students, so they need to master the level of motor competence to be taught efficiently to

students (Francesco et al., 2019). The effect of the learning process depends on the communication, the clearness of contents, and the skillfulness of teachers in teaching and demonstrating the materials (Bavčević et al., 2018).

The concern is the teachers' needs in conducting the teaching, especially the enthusiasm of teachers dealing with technologies to gain knowledge, skills, and readiness to use those technologies as teaching media (Irwahand et al., 2022). Technology integration can be combined with a didactic approach as an innovative and effective way to develop students' motor competence in elementary schools (Monacis et al., 2022). It allows teachers to expose a large amount of materials to students through learning videos in the Physical Education subject. Another interesting finding from this research is the interview about the teachers' mastery of learning materials. Like the quantitative data, the results showed that the teachers did not comprehend the FMS material well. PE teachers are supposed to present themselves with good competence because, theoretically, they should be well-prepared for the basic profession (Ivanii et al., 2020). As agents of change and responsible for physical literacy development, teachers must have sufficient knowledge, skills, and practices (Barratt et al., 2024). More interviews are needed to gain more information about the learning strategies they applied to overcome the problems found in the teaching learning process (Harvey et al., 2020).

All the interviewees stated that fundamental motor skills were the dominant predictor in the teaching and learning process. They also mentioned that the students' low competence was inseparable from the teachers' role in preparing the learning program. The ability of students to perform motor skills depends on the ability of teachers to deliver a good, high-quality physical learning program (NASPE, 2014). Therefore, students' motor skills are believed to be significantly connected to the teachers' mastery of learning materials.

Literature studies proved that teachers with sufficient ability to comprehend the materials and pedagogical skills to plan and apply various pedagogical approaches to students' learning styles can help their students gain better FMS scores (Cohen et al., 2012). The interview revealed that the majority of teachers proved that they were not fully mastering a variety of sub-skill movements of locomotor and object control skills. Moreover, they were unable to give relevant feedback on the materials. This happens due to the lack of material understanding and insufficient skills. Additionally, they did not have proper guidelines for implementing the FMS materials for elementary students. It is revealed that experiences and mastery of learning materials for teachers are very necessary for students to be competent (Önal et al., 2023).

The respondents stated that the quality of students' motor performances was not good enough. However, they assisted it only from their observations. In fact, the ability to measure students' FMS is essential for teachers in planning the learning program. Learning practice should be evaluated, and the feedback should be acknowledged as the important elements affecting teachers' qualifications and the targeted learning goals (Flores, 2017; Montoya-Grisales et al., 2022). Furthermore, almost all teachers conveyed that the structured learning program has not been conducted due to many reasons and obstacles, such as the limited sources of learning materials and the unavailability of concrete guidelines.

Most respondents required guidelines with demonstration videos to assist them in teaching and practicing. They also claimed that the cause of students' low FMS was that the structured learning program had not been taught in their schools. As it is known, FMS will be optimally developed when a structured learning program is conducted continually, and the feedback is given in line with students' own needs (Goodway & Branta, 2003; Valentini & Rudisill, 2004). This study revealed that significant problems in students' motor competence could have a worse effect on students because of optimal learning mastery and implementation of FMS by Physical education teachers of Elementary schools in Indonesia.

Conclusions

In conclusion, this research confirms that the factual condition of students' fundamental motor skills (FMS) at elementary schools in Indonesia is insufficient and in the range of poor levels. Based on the findings of this study, the teachers' mastery of learning materials, which is not yet optimal, becomes the trigger to an ineffective learning program. Hence, it affects the learning implementation of FMS in the classroom. This study also reveals that students' FMS tends to decrease as they age. This implies that intervention is needed to facilitate students in developing their motor skills through physical activities, especially for students who have a tendency to be inactive. Physical education programs, which are optimal in intracurriculars and extracurriculars, become the best possible way to increase students' fundamental motor skills. The collaboration of the authorities, academics, and practitioners is important in training and mentoring the Physical Education teachers to design and implement the learning program, as well as evaluate students' FMS. It is suggested that further researchers should develop an effective learning model and implement interventions to increase students' fundamental motor skills in Indonesia.

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References

- Almalki, S. (2016). Integrating Quantitative and Qualitative Data in Mixed Methods Research—Challenges and Benefits. *Journal of Education and Learning*, 5(3), 288. <https://doi.org/10.5539/jel.v5n3p288>
- AL-Nemr, A., & Reffat, S. (2024). Relationship between body mass index, fundamental movement skills, and quality of life in primary school children. *Physical Activity Review*, 12(1), 80–87. <https://doi.org/10.16926/par.2024.12.08>
- Backman, E., & Barker, D. M. (2020). Re-thinking pedagogical content knowledge for physical education teachers—implications for physical education teacher education. *Physical Education and Sport Pedagogy*, 25(5), 451–463. <https://doi.org/10.1080/17408989.2020.1734554>
- Bakhtiar, S., & Famelia, R. (2017). Institute Role of Teachers' Education In Improving the Standard of Development Achievement Rate and Standard of Teacher and Education Personnels of Early Childhood Education. *International Conference of Early Childhood Education (ICECE 2017)*, 83–86. <https://doi.org/https://doi.org/10.2991/icece-17.2018.20>
- Bardid, F., Lenoir, M., Huyben, F., De Martelaer, K., Seghers, J., Goodway, J. D., & Deconinck, F. J. A. (2017). The effectiveness of a community-based fundamental motor skill intervention in children aged 3–8 years: Results of the “Multimove for Kids” project. *Journal of Science and Medicine in Sport*, 20(2), 184–189. <https://doi.org/10.1016/j.jsams.2016.07.005>
- Barnett, L. M., Van Beurden, E., Morgan, P. J., Brooks, L. O., & Beard, J. R. (2008). Does childhood motor skill proficiency predict adolescent fitness? *Medicine and Science in Sports and Exercise*, 40(12), 2137–2144. <https://doi.org/10.1249/MSS.0b013e31818160d3>
- Barnett, L. M., van Beurden, E., Morgan, P. J., Brooks, L. O., & Beard, J. R. (2009). Childhood Motor Skill Proficiency as a Predictor of Adolescent Physical Activity. *Journal of Adolescent Health*, 44(3), 252–259. <https://doi.org/10.1016/j.jadohealth.2008.07.004>
- Barratt, J., Dudley, D., Stylianou, M., & Cairney, J. (2024). A conceptual model of an effective early childhood physical literacy pedagogue. *Journal of Early Childhood Research*. <https://doi.org/10.1177/1476718X231219580>
- Bartolo, D., Garbeloto, F., & Ferraz, O. (2024). Effect of a physical education program in early childhood education on the performance of fundamental movement skills based on teaching styles: divergent discovery and practical. *Pedagogy of Physical Culture and Sports*, 28(2), 93–101. <https://doi.org/10.15561/26649837.2024.0202>
- Bavčević, T., Prskalo, I., & Bavčević, D. (2018). A comparative analysis of different models for management of the teaching process in physical education. *Acta Kinesiologica*, 12(2), 57–66.
- Benda, R. N., Marinho, N. F. S., Duarte, M. G., Ribeiro-Silva, P. C., Ortigas, P. R., Machado, C. F., & Gomes, T. V. B. (2021). A brief review on motor development: fundamental motor skills as a basis for motor skill learning. *Brazilian Journal of Motor Behavior*, 15(5), 342–355. <https://doi.org/10.20338/bjmb.v15i5.257>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Bremer, E., & Cairney, J. (2018). Fundamental movement skills and health-related outcomes: A narrative review of longitudinal and intervention studies targeting typically developing children. *American Journal of Lifestyle Medicine*, 12(2), 148–159. <https://doi.org/10.1177/1559827616640196>
- Brian, A., Getchell, N., True, L., De Meester, A., & Stodden, D. F. (2020). Reconceptualizing and Operationalizing Seefeldt's Proficiency Barrier: Applications and Future Directions. In *Sports Medicine* (Vol. 50, Issue 11, pp. 1889–1900). Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1007/s40279-020-01332-6>
- Bryce, C. J. C. (2021). School Based Motor Skill Interventions for Developmentally Delayed and Non-Delayed Children. In *Global Pediatric Health* (Vol. 8). SAGE Publications Inc. <https://doi.org/10.1177/2333794X211057707>
- Budi, R. D., Kusuma, N. H. M., Syafei, M., & Stephani, R. M. (2019). The Analysis of Fundamental Movement Skill in Primary School Student in Mountain Range. *Atlantis Press*, 195–198. <https://doi.org/https://doi.org/10.2991/icsshpe-18.2019.56>
- Buns, M., & LaValle, K. (2020). The Influence of a University Homeschool Physical Education Program on Fundamental Motor Skills and Self-Confidence. *Journal of Education and Development*, 4(2), 1. <https://doi.org/10.20849/jed.v4i2.737>
- Chan, C. H. S., Ha, A. S. C., Ng, J. Y. Y., & Lubans, D. R. (2019). Associations between fundamental movement skill competence, physical activity and psycho-social determinants in Hong Kong Chinese children. *Journal of Sports Sciences*, 37(2), 229–236. <https://doi.org/10.1080/02640414.2018.1490055>
- Chen, W., Mason, S., Hypnar, A., & Bennett, A. (2016). Assessing Motor Skill Competency in Elementary School Students: A Three-Year Study. In *Journal of Sports Science and Medicine* (Vol. 15). <http://www.jssm.org>
- Chovanová, E., Majherová, M., & Bendíková, E. (2023). Age- and Gender-Specific Levels and Differences in Children's Gross Motor Coordination During Prepuberty. *Physical Activity Review*, 11(2), 86–93. <https://doi.org/10.16926/par.2023.11.24>

- Cohen, R., Goodway, J. D., & Lidor, R. (2012). The effectiveness of aligned developmental feedback on the overhand throw in third-grade students. *Physical Education and Sport Pedagogy*, 17(5), 525–541. <https://doi.org/10.1080/17408989.2011.623230>
- Creswell, J. W. (2011). Controversies in mixed methods research. *The Sage Handbook of Qualitative Research*, 4(1), 269–284.
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- de Bruijn, A. G. M., Hartman, E., Kostons, D., Visscher, C., & Bosker, R. J. (2018). Exploring the relations among physical fitness, executive functioning, and low academic achievement. *Journal of Experimental Child Psychology*, 167, 204–221. <https://doi.org/10.1016/j.jecp.2017.10.010>
- de Bruijn, A. G. M., Kostons, D. D. N. M., van der Fels, I. M. J., Visscher, C., Oosterlaan, J., Hartman, E., & Bosker, R. J. (2019). Importance of aerobic fitness and fundamental motor skills for academic achievement. *Psychology of Sport and Exercise*, 43, 200–209. <https://doi.org/10.1016/j.psychsport.2019.02.011>
- de Niet, M., Platvoet, S. W. J., Hoebler, J. J. A. A. M., de Witte, A. M. H., de Vries, S. I., & Pion, J. (2021). Agreement Between the KTK3+ Test and the Athletic Skills Track for Classifying the Fundamental Movement Skills Proficiency of 6- to 12-Year-Old Children. *Frontiers in Education*, 6. <https://doi.org/10.3389/educ.2021.571018>
- Dong, L., Fan, R., Shen, B., Bo, J., Pang, Y., & Song, Y. (2024). A comparative study on fundamental movement skills among children with autism spectrum disorder and typically developing children aged 7–10. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1287752>
- Eddy, L., Hill, L. J. B., Mon-Williams, M., Preston, N., Daly-Smith, A., Medd, G., & Bingham, D. D. (2021). Fundamental Movement Skills and Their Assessment in Primary Schools from the Perspective of Teachers. *Measurement in Physical Education and Exercise Science*, 25(3), 236–249. <https://doi.org/10.1080/1091367X.2021.1874955>
- Flores, M. A. (2017). Practice, theory and research in initial teacher education: international perspectives. In *European Journal of Teacher Education* (Vol. 40, Issue 3, pp. 287–290). Routledge. <https://doi.org/10.1080/02619768.2017.1331518>
- Francesco, C., Coco, D., Frattini, G., Vago, P., & Andrea, C. (2019). Effective teaching competences in physical education. *Journal of Physical Education and Sport*, 19, 1806–1813. <https://doi.org/10.7752/jpes.2019.s5265>
- Gacov, S. (2023). The responsibilities of the physical education teacher as a pedagogue in the school physical activity program. *Physical Education, Sport, Kinesitherapy Research Journal*, 6(1), 1–9. <http://journal.pesk.eu>
- Gallahue, D. L., Ozmun, J. C., & Goodway, J. D. (2012). *Understanding Motor Development Infants, Children, Adolescent, Adults*. Mc Graw Hill Companies, Inc. , 7(1), 1–461.
- Gibson, V., van der Merwe, E., & Coetzee, B. A. (2024). Early childhood practitioners' awareness of gross motor milestone acquisition and movement guidelines. *South African Journal of Childhood Education*, 14(1). <https://doi.org/10.4102/sajce.v14i1.1226>
- Goodway, J. D., & Branta, C. F. (2003). Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Research Quarterly for Exercise and Sport*, 74(1), 36–46. <https://doi.org/10.1080/02701367.2003.10609062>
- Goodway, J. D., Famelia, R., & Bakhtiar, S. (2014). Future directions in physical education & sport: Developing fundamental motor competence in the early years is paramount to lifelong physical activity. *Asian Social Science*, 10(5), 44–54. <https://doi.org/10.5539/ass.v10n5p44>
- Goodway, J. D., Ozmun, J. C., & Gallahue, D. L. (2019). *Understanding Motor Development Infants, Children, Adolescents, Adults*. JONEST AND BARTLETT LEARNING, 8(1), 1–397.
- Gu, X., Chen, S., & Zhang, X. (2019). Physical literacy at the start line: Young children's motor competence, fitness, physical activity, and fitness knowledge. *Journal of Teaching in Physical Education*, 38(2), 146–154. <https://doi.org/10.1123/jtpe.2018-0069>
- Hardy, L. L., Barnett, L., Espinel, P., & Okely, A. D. (2013). Thirteen-year trends in child and adolescent fundamental movement skills: 1997–2010. *Medicine and Science in Sports and Exercise*, 45(10), 1965–1970. <https://doi.org/10.1249/MSS.0b013e318295a9fc>
- Hardy, L. L., Reinten-Reynolds, T., Espinel, P., Zask, A., & Okely, A. D. (2012). Prevalence and correlates of low fundamental movement skill competency in children. *Pediatrics*, 130(2). <https://doi.org/10.1542/peds.2012-0345>
- Harvey, S., Pill, S., Hastie, P., & Wallhead, T. (2020). Physical education teachers' perceptions of the successes, constraints, and possibilities associated with implementing the sport education model. *Physical Education and Sport Pedagogy*, 25(5), 555–566. <https://doi.org/10.1080/17408989.2020.1752650>
- Hasan, A., Hyson, M., & Chang, C. M. (2013). Early childhood education and development in poor villages of Indonesia: Strong foundations, later success. *The World Bank: Whashington, D.C*, 1, 1–189. <https://doi.org/http://dx.doi.org/10.1596/978-0-8213-9836-4>

- Hastie, P. A. (2017). Revisiting the national physical education content standards: What do we really know about our achievement of the physically educated/literate person? *Journal of Teaching in Physical Education*, 36(1), 3–19. <https://doi.org/10.1123/jtpe.2016-0182>
- Irwahand, F. N. E., Mat-Rasid, S. M., Lee, J. L. F., Elumalai, G., Shahril, M. I., & Ahmad, M. A. I. (2022). Perceived barriers to adopting information and communication technology in physical education. *Pedagogy of Physical Culture and Sports*, 26(5), 291–299. <https://doi.org/10.15561/26649837.2022.0503>
- Ivanii, I. V., Vertel, A. V., Zlenko, N. M., Butenko, V. H., & Biler, O. S. (2020). Competence and Professional Skills in Training Future Specialists in the Field of Physical Education and Sports. *Propósitos y Representaciones*, 8(SPE2). <https://doi.org/10.20511/pyr2020.v8nSPE2.690>
- Kasanen, M., Laukkanen, A., Niemistö, D., Kotkajuuri, J., Luukkainen, N. M., & Sääkslahti, A. (2023). Do Fundamental Movement Skill Domains in Early Childhood Predict Engagement in Physical Activity of Varied Intensities Later at School Age? A 3-Year Longitudinal Study. *Journal of Motor Learning and Development*, 11(3), 424–443. <https://doi.org/10.1123/jmld.2023-0004>
- Kela, G., & Chombo, C. S. (2023). An Inquiry on Fundamental Movement Skills Taught to Pre-School Children in Zambezi Region of Namibia: A Teacher's Perspective. *Article in International Journal of Humanities Arts and Social Sciences*. <https://doi.org/10.56734/ijahss.v4n12a6>
- Kokstejn, J., & Musalek, M. (2019). The relationship between fundamental motor skills and game specific skills in elite young soccer players. *Journal of Physical Education and Sport*, 19, 249–254. <https://doi.org/10.7752/jpes.2019.s1037>
- Koolwijk, P., Hoeboer, J., Mombarg, R., Savelsbergh, G. J. P., & de Vries, S. (2023). Fundamental movement skill interventions in young children: a systematic review. In *International Journal of Sport and Exercise Psychology*. Routledge. <https://doi.org/10.1080/1612197X.2023.2210597>
- Korbecki, M., Wawrzyniak, S., & Rokita, A. (2017). Fundamental movement skills of six- to seven-year-old children in the first grade of elementary school: A pilot study. *Baltic Journal of Health and Physical Activity*, 2017(4), 22–31. <https://doi.org/10.29359/bjhp.09.4.02>
- Lander, N. J., Hanna, L., Brown, H., Telford, A., Morgan, P. J., Salmon, J., & Barnett, L. M. (2017). Physical education teachers' perspectives and experiences when teaching FMS to early adolescent girls. *Journal of Teaching in Physical Education*, 36(1), 113–118. <https://doi.org/10.1123/jtpe.2015-0201>
- Lin, S.-J., & Yang, S.-C. (2015). The Development of Fundamental Movement Skills by Children Aged Six to Nine. *Universal Journal of Educational Research*, 3(12), 1024–1027. <https://doi.org/10.13189/ujer.2015.031211>
- Lloyd, M., & Bremer, E. (2014). Long-Term Importance of Fundamental Motor Skills: A 20-Year Follow-Up Study Autism, Motor Skill and Physical Activity View project Physical Literacy View project. <https://doi.org/10.1123/apaq.2013-0048>
- Logan, S. W., Ross, S. M., Chee, K., Stodden, D. F., & Robinson, L. E. (2018). Fundamental motor skills: A systematic review of terminology. In *Journal of Sports Sciences* (Vol. 36, Issue 7, pp. 781–796). Routledge. <https://doi.org/10.1080/02640414.2017.1340660>
- Lynch, T. (2019). Physical Education and Wellbeing. In *Physical Education and Wellbeing*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-22266-6>
- Maia, J., Santos, C., Pereira, S., Hedeker, D., Barreira, T. V., Garganta, R., Farias, C., Garbeloto, F., Tani, G., Cruz, H., Chaput, J. P., Stodden, D. F., & Katzmarzyk, P. T. (2024). A multivariate multilevel approach to unravel the associations between individual and school factors on children's motor performance in the REACT project. *American Journal of Human Biology*. <https://doi.org/10.1002/ajhb.24080>
- Monacis, D., Colella, D., & Limone, P. (2022). Non-linear didactic technology-based intervention to enhance basic motor competencies with MOBAK-5: a pilot study in primary school. *Physical Activity Review*, 10(1), 22–30. <https://doi.org/10.16926/PAR.2022.10.03>
- Montoya-Grisales, N. E., Almonacid-Fierro, A., Arroyave Giraldo, D. I., & González, K. B. V. (2022). Design and validation of a questionnaire to assess the Pedagogical Content Knowledge of Colombian Physical Education students in the practicum. *Pedagogy of Physical Culture and Sports*, 26(5), 300–310. <https://doi.org/10.15561/26649837.2022.0504>
- Nampai, U., Setiawan, C., & Yeats, J. T. (2022). Teachers' beliefs about the trends of current physical education. *Jurnal Penelitian Dan Evaluasi Pendidikan*, 26(1), 98. <https://doi.org/10.21831/pep.v26i1.50397>
- NASPE. (2014). Moving into the future: National standards for physical education. Reston, VA :, 1–66.
- Niemistö, D., Barnett, L. M., Laukkanen, A., Tolvanen, A., & Sääkslahti, A. (2023). Perceived motor competence in early childhood predicts perceived and actual motor competence in middle childhood. *Scandinavian Journal of Medicine and Science in Sports*, 33(10), 2025–2038. <https://doi.org/10.1111/sms.14438>
- Nopembri, S., & Sugiyama, Y. (2021). Assessing psychosocial skills and negative emotional states of elementary school students in Yogyakarta Area. *International Journal of Instruction*, 14(3), 59–72. <https://doi.org/10.29333/iji.2021.1434a>
- Oktarifaldi, Nopembri, S., Yudanto, & Bin Shahril, M. I. (2024). The fundamental motor skills and motor coordination performance of children in West Sumatera Province, Indonesia. *Pedagogy of Physical Culture and Sports*, 28(1), 4–15. <https://doi.org/10.15561/26649837.2024.0101>

- Önal, A., Taş, Z., Filiz, B., & Hergüner, G. (2023). Teachers' Views on the Implementation of the Values within the Scope of the Physical Education and Sports Curriculum. *Egitim ve Bilim*, 48(213), 205–229. <https://doi.org/10.15390/EB.2023.11785>
- Pang, A. W. Y., & Fong, D. T. P. (2009). Fundamental motor skill proficiency of Hong Kong children aged 6-9 Years. *Research in Sports Medicine*, 17(3), 125–144. <https://doi.org/10.1080/15438620902897516>
- Pangrazi, R. P., & Beighle, A. (2019). *Dynamic Physical Education for Elementary School Children*. Human Kinetic Publisher, 19(III), 1–720.
- Pluto-Pradzynska, A., Pluto-Pradzynska, K., Frydrychowicz, M., Lagiedo-Zelazowska, M., Owoc, J., Benjamin, S., Au, T. Y., Jaracz, K., Dworacki, G., Wysocki, J., & Wasik, J. (2022). Are yoga and physical activity determinants of quality of life in Polish adults? a cross-sectional study. *BMJ Open*, 12(9). <https://doi.org/10.1136/bmjopen-2021-059658>
- Rodrigues, D., Leal Avigo, E., José, J., Barela, J. A. (2015). Proficiency of fundamental motor skills in children of a public school in the city of São Paulo. In *Brazilian Journal of Motor Behavior Research Article Rodrigues, Avigo & Barela (Vol. 9)*. <https://doi.org/https://doi.org/10.20338/bjmb.v9i1.53>
- Romero-Martínez, J., Menescardi, C., García-Massó, X., & Estevan, I. (2024). Efectos de la actividad física durante las clases sobre la alfabetización motriz: una revisión sistemática Effects of class-based physical activity in physical literacy: a systematic review. *Retos*, 311–322. <https://doi.org/https://doi.org/10.47197/retos.v52.100143>
- Rudd, J. R., Barnett, L. M., Butson, M. L., Farrow, D., Berry, J., & Polman, R. C. J. (2015). Fundamental movement skills are more than run, throw and catch: The role of stability skills. *PLoS ONE*, 10(10). <https://doi.org/10.1371/journal.pone.0140224>
- Ruslin, Mashuri, S., Sarib, M., Rasak, A., & Alhabsyi, F. (2022). Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies Ruslin. *Journal of Research & Method in Education*, 12(1), 22–29. <https://doi.org/10.9790/7388-1201052229>
- Salters, D., & Scharoun Benson, S. M. (2022). Perceptions and Use of Teaching Strategies for Fundamental Movement Skills in Primary School Physical Education Programs. *Children*, 9(2). <https://doi.org/10.3390/children9020226>
- Saryono, & Nopembri, S. (2013). Analisis Kebutuhan Pembelajaran Pendidikan Jasmani Olahraga Kesehatan Berbasis Integrated Physical Education di Sekolah Dasar. *Jurnal Pendidikan Jasmani Indonesia*, 9(2), 81–86. <https://doi.org/http://dx.doi.org/10.21831/jpji.v9i2.3009>
- Sevimli-Celik, S. (2021). Moving between theory and practice: preparing early childhood pre-service teachers for teaching physical education. *Journal of Early Childhood Teacher Education*, 42(3), 281–298. <https://doi.org/10.1080/10901027.2020.1735588>
- Stratton, S. J. (2021). *Population Research: Convenience Sampling Strategies*. In *Prehospital and Disaster Medicine (Vol. 36, Issue 4, pp. 373–374)*. Cambridge University Press. <https://doi.org/10.1017/S1049023X21000649>
- Suryobroto, A. S., Setiawan, C., Nampai, U., & Marhaendro, A. S. D. (2022). A thematic analysis of teachers' experience in inclusive physical education teaching. *Cakrawala Pendidikan*, 41(3), 754–763. <https://doi.org/10.21831/cp.v41i3.50531>
- Tsangaridou, N., Pieroua, M., & Charalambous, C. Y. (2023). An analysis of content development in physical education: Preschool teachers' selection of instructional tasks. *European Physical Education Review*, 29(1), 91–106.
- Ulrich, D. (2000). *Test of Gross Motor Development Second Edition*. 2(II), 1–60.
- Valentini, N. C., & Rudisill, M. E. (2004). Motivational Climate, Motor-Skill Development, and Perceived Competence: Two Studies of Developmentally Delayed Kindergarten Children. In *JOURNAL OF TEACHING IN PHYSICAL EDUCATION (Vol. 23)*. <https://doi.org/https://doi.org/10.1123/jtpe.23.3.216>
- Valério, C., Farias, C., & Mesquita, I. (2021). Pre-service teachers' learning and implementation of student-centred models in physical education: A systematic review. *Journal of Physical Education and Sport*, 21(6), 3326–3338. <https://doi.org/10.7752/jpes.2021.06452>
- Wang, X., & Cheng, Z. (2020). Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. In *Chest (Vol. 158, Issue 1, pp. S65–S71)*. Elsevier Inc. <https://doi.org/10.1016/j.chest.2020.03.012>
- Wick, K., Leeger-Aschmann, C. S., Monn, N. D., Radtke, T., Ott, L. V., Rebholz, C. E., Cruz, S., Gerber, N., Schmutz, E. A., Puder, J. J., Munsch, S., Kakebeeke, T. H., Jenni, O. G., Granacher, U., & Kriemler, S. (2017). Interventions to Promote Fundamental Movement Skills in Childcare and Kindergarten: A Systematic Review and Meta-Analysis. In *Sports Medicine (Vol. 47, Issue 10, pp. 2045–2068)*. Springer International Publishing. <https://doi.org/10.1007/s40279-017-0723-1>
- Zalech, M. (2021). Student perception of pe teachers and its effect on their participation in pe classes and sports: A new perspective on teacher competencies. *Journal of Physical Education and Sport*, 21, 1106–1111. <https://doi.org/10.7752/jpes.2021.s2139>