

Interdisciplinary physical education: implementation and insights of Indonesian PE teachers Educación física interdisciplinaria: implementación y perspectivas de los profesores de educación física de Indonesia

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Abstract. Interdisciplinary physical education (PE) learning is an innovation that combines other subjects with physical education which is really needed at this time. The purpose of this study is to measure the extent of knowledge and implementation of interdisciplinary PE learning of PE teachers in Indonesia. A descriptive quantitative research method through a survey approach was used in this study. A questionnaire instrument related to the implementation and knowledge of interdisciplinary PE was used and distributed to 184 PE teachers in Indonesia (80 in elementary school, 45 in senior high school, and 59 in senior high schools). Data processing was analyzed using descriptive statistics. The research results explained that only 17 PE teachers (21.25%) in elementary schools had ever carried out interdisciplinary PE learning and their average knowledge was 49.6 (enough to know). At junior high school level, only 13 PE teachers (28.9%) had carried out interdisciplinary PE learning with an average knowledge of 60.9 (know). At the high school level, only 3 PE teachers (5%) have ever implemented interdisciplinary PE learning with an average knowledge of 40.8 (enough to know). Overall, only 33 PE teachers (17.9%) have implemented interdisciplinary PE learning with an average knowledge of 49.6, which means they are in the "enough to know" category. Very few PE teachers in Indonesia apply interdisciplinary PE learning and their knowledge of interdisciplinary PE is only limited to knowing enough, this of course needs to be improved considering that interdisciplinary learning is a learning innovation that is really needed nowadays.

Keywords: interdisciplinary learning, physical education, learning innovation, PE teacher, subject collaboration.

Resumen. El aprendizaje interdisciplinar de educación física (EF) es una innovación que combina otras materias con la educación física realmente necesaria en estos momentos. El propósito de este estudio es medir el alcance del conocimiento y la implementación del aprendizaje interdisciplinario de educación física de los profesores de educación física en Indonesia. En este estudio se utilizó un método de investigación cuantitativo descriptivo mediante un enfoque de encuesta. Se utilizó y distribuyó un instrumento cuestionario relacionado con la implementación y el conocimiento de la educación física interdisciplinaria a 184 profesores de educación física en Indonesia (80 en la escuela primaria, 45 en la escuela secundaria superior y 59 en la escuela secundaria superior). El procesamiento de los datos se analizó mediante estadística descriptiva. Los resultados de la investigación explicaron que sólo 17 profesores de EF (21,25%) de escuelas primarias habían realizado alguna vez un aprendizaje de EF interdisciplinario y su conocimiento promedio era de 49,6 (suficiente para saber). En el nivel de secundaria, sólo 13 profesores de EF (28,9%) habían realizado un aprendizaje de EF interdisciplinario con un conocimiento promedio de 60,9 (saber). En el nivel de secundaria, sólo 3 profesores de educación física (5%) han implementado alguna vez el aprendizaje de educación física interdisciplinaria con un conocimiento promedio de 40,8 (suficiente para saber). En total, sólo 33 profesores de educación física (17,9%) han implementado el aprendizaje interdisciplinario de educación física con un conocimiento promedio de 49,6, lo que significa que están en la categoría "suficiente para saber". Muy pocos profesores de educación física en Indonesia aplican el aprendizaje de educación física interdisciplinaria y su conocimiento de la educación física interdisciplinaria solo se limita a saber lo suficiente; esto, por supuesto, debe mejorarse considerando que el aprendizaje interdisciplinario es una innovación de aprendizaje que realmente se necesita hoy en día.

Palabras clave: aprendizaje interdisciplinario, educación física, innovación en el aprendizaje, profesor de educación física, colaboración de materias.

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Introduction

Along with the times and the world of education, the physical education learning process must also develop (Castro Vieira et al., 2023). Because the educational process will continue to change, and continue to be updated, thus exposing students to new learning challenges which sometimes cause them anxiety and often cause emotional conflict (Gil-Madrona et al., 2020). It is things like this that need to be addressed by teachers to avoid negative impacts that occur. So that there the various learning strategies and innovations must be applied by physical education teachers so that the learning process is not monotonous and can be more meaningful to students (Altavilla et al., 2022; Wallhead & O'sullivan, 2005). Conventional physical education learning is not meaningless (Castro Vieira et al., 2023), but it can cause boredom in students and make students ask to

learn less (Budi et al., 2021; Sağın, 2022). Moreover, a few years ago there was a covid-19 pandemic which had a huge impact on all areas of human life (Akgül et al., 2021; Supriadi et al., 2021), without exception in the field of education (O'Brien et al., 2020). During the Covid-19 pandemic, the physical education learning process in schools took place online (Jauhari et al., 2020; Qi, 2023), this resulted in learning loss due to lack of student motivation in physical education learning (Pier et al., 2021). This phenomenon is a challenge for physical education teachers to be able to innovate and develop learning strategies that are felt to be more effective and more meaningful and more needed by students entering the 21st century (Fizi et al., 2023).

There are many strategies and innovations in physical education learning that can be done, ranging from the utili-

zation of media (Suherman et al., 2019), technology (Almusawi et al., 2021), the application of games and even the application of traditional games (Budiman et al., 2024) or application of popular cooperation and cooperation-opposition games (Gil-Madrona et al., 2020), learning model innovation (Perlman, 2024), and what is still rarely done is the application of interdisciplinary learning. Interdisciplinary learning is a learning approach that combines several subjects into an active project that contains several concepts from these subjects (Hardy et al., 2021). The issue of interdisciplinarity has actually developed since ancient times and has also been a concern for philosophers and teachers of that era. The concept of interdisciplinarity is a manifestation between two or more fields of knowledge that can move from the communication of simple ideas to the integration of fundamental concepts related to epistemology, terminology, methodology, process, data, and research orientation (Urea, 2015).

From this definition, it can be seen that the interdisciplinary fields of science can be poured into a theme that is used to achieve a learning goal so that students are expected to have better knowledge including the ability to solve problems, make decisions, and find more effective methods in learning. In fact, the advantage of interdisciplinary learning is the achievement of learning objectives from each discipline combined in one learning process, this is felt to be more effective and different learning nuances will be felt by students, so that laziness and low motivation to learn students in physical education subjects will be resolved if through the interdisciplinary learning process.

In the concept of interdisciplinary learning, the learning process of physical education lessons can be combined with various other disciplines, such as combined with mathematics, physics, geography, biology, civic education, and so on. Previous studies have revealed the impact of interdisciplinary physical education learning, such as research conducted by Estrada et al which suggests that interdisciplinary physical education learning through the Sport Education Model learning approach is able to synergize with mathematics lessons, both learning objectives of each subject both physical education and mathematics can be achieved in an interdisciplinary physical education learning activity. (Estrada et al., 2019).

Other research also suggests the benefits and implementation of physical education learning programmes integrated with geography subjects in the Czech Republic and Slovenia have proven effective in achieving learning objectives and being able to further stimulate student learning motivation. Even teachers consider that interdisciplinary physical education learning in this case combined with geography subjects is very important to do (Vlček et al., 2019). Therefore, the opportunities and potential of interdisciplinary physical education learning must be truly utilised by physical education teachers because interdisciplinary physical education learning has many benefits and is also needed in today's learning. But in fact in Indonesia it is still rare to see the implementation of this interdisciplinary

physical education learning. Physical education teachers still often carry out conventional learning processes (Abduljabar, 2018; Mustafa & Dwiyogo, 2020) and so far physical education learning innovations in Indonesia have only revolved around the use of media (Junanda & Solihin, 2020; Karisman et al., 2018; Sukamto et al., 2021), game modifications (Hadyansah, 2021; Sutini, 2018), and the application of learning models (Ginajar, 2018; Juditya, 2018; Septiana et al., 2021).

There is no empirical data that measures the extent to which interdisciplinary physical education learning is carried out in Indonesia, be it at the level of elementary schools, junior high schools, and also senior high schools or maybe even many physical education teachers in Indonesia still do not know about interdisciplinary physical education. Therefore, this study was conducted to determine the extent of implementation and knowledge related to interdisciplinary physical education learning in physical education teachers in Indonesia.

Materials and methods

Study participants

In accordance with research needs that focus on knowledge and implementation of interdisciplinary learning by physical education teachers, the target population in this research is physical education teachers in Indonesia. A total of 184 physical education teachers in Indonesia were selected as research samples using the convenience sampling technique, consisting of 80 physical education teachers in elementary schools (11 teachers had less than 5 years of teaching experience, 26 teachers had between 5-10 years of teaching experience, 29 teachers had teaching experience between 10-20 years, and 14 teachers have more than 20 years of experience), 45 physical education teachers in junior high schools (9 teachers have teaching experience of less than 5 years, 10 teachers have teaching experience of between 5-10 years, 17 teachers have teaching experience of between 10- 20 years, and 9 teachers have more than 20 years of experience), and 59 physical education teachers in senior high schools (14 teachers have less than 5 years of teaching experience, 23 teachers have between 5-10 years of teaching experience, 17 teachers have between 10-20 years of teaching experience , and 5 teachers have more than 20 years of experience).

Study organization

A quantitative research method with a survey approach was used in this study. The research instrument is in the form of a questionnaire related to the implementation and understanding of teachers of interdisciplinary learning which has a validity level of 0.85. The instrument was distributed during April - June 2023 through Google Form. for question materials related to interdisciplinary learning can be seen in table 1 below.

Table 1.

Interdisciplinary Learning Knowledge Instrument materials	
No	Materials Indicator
1	definition of interdisciplinary learning
2	Characteristics of interdisciplinary learning
3	the advantages and disadvantages of interdisciplinary learning The principles of interdisciplinary learning;
4	a. The principle of the process of extracting themes in interdisciplinary learning
	b. The principle of the process of implementing interdisciplinary learning
	c. The principles of the interdisciplinary learning assessment process
5	objectives and benefits of interdisciplinary learning
6	Interdisciplinary learning models

Statistical analysis

Descriptive statistical data processing was used in this study. The implementation or non-implementation of interdisciplinary physical education learning as a whole and at each level of education is described through simple percentages. While the results of physical education teachers'

Table 3
Knowledge level of interdisciplinary learning level result

School Level		teaching experiences (years)				N	percentage	knowledge level (\bar{x})	SD
		< 5	5-10	10-20	20 <				
elementary School (N=80)	ever did	2	7	7	1	17	21,25%	88	3,98
	never	9	19	22	13	63	78,75%	39,3	12,61
	Total	11	26	29	14	80	100%	49,6	23,03
Junior High school (N=45)	ever did	3	5	5	0	13	28,9%	90,3	3,94
	never	6	5	12	9	32	71,1%	49	13,65
	Total	9	10	17	9	45	100%	60,9	22,23
Senior High school (N=59)	ever did	0	2	1	0	3	5%	84	3
	never	14	21	16	5	56	95%	38,5	13,38
	Total	14	23	17	5	59	100%	40,8	16,49

From table 3 above, it can be seen that at the elementary school level out of 80 physical education teachers, 17 of them (21.25%) have implemented interdisciplinary physical education learning with an average interdisciplinary learning knowledge level score obtained of 88 (very knowledgeable), and as many as 63 teachers (78, 75%) have never implemented interdisciplinary physical education learning with an average interdisciplinary learning knowledge level obtained of 39.3 (don't know enough), overall the level of knowledge of interdisciplinary learning of physical education teachers in elementary schools has an average score of 49.6 that means their knowledge is classified as "enough to know" category. The percentage of the implementation of interdisciplinary physical education learning in elementary school can also be seen in figure 1.

The data in table 3 shows the implementation of interdisciplinary physical education learning at the junior high school level. Out of 45 physical education teachers, 13 of them (28.9%) have implemented interdisciplinary physical education learning with an average interdisciplinary learning knowledge level score obtained of 90.3 (very knowledgeable), and as many as 32 (71.1%) teachers have never implemented interdisciplinary physical education learning with an average interdisciplinary learning knowledge level obtained of 49 (enough to know), overall the level of knowledge of interdisciplinary learning of physical education teachers in junior high schools has an

knowledge related to interdisciplinary physical education learning were calculated and interpreted into several categories in table 2 below.

Table 2.
Interpretation Categories of Interdisciplinary Learning Knowledge Scores

No	Range Score	Categories
1.	81 until 100	Very Knowledgeable
2.	61 until 80	Know
3.	41 until 60	Enough to know
4.	21 until 40	Don't know enough
5.	0 until 20	Don't know

Results

The Result of Indonesian physical education teacher knowledge level of interdisciplinary learning level can see in table 3 below.

average score of 60.9 it means that their knowledge belongs to the "know" category. The percentage of the implementation of interdisciplinary physical education learning in junior high school can also be seen in figure 2 below.

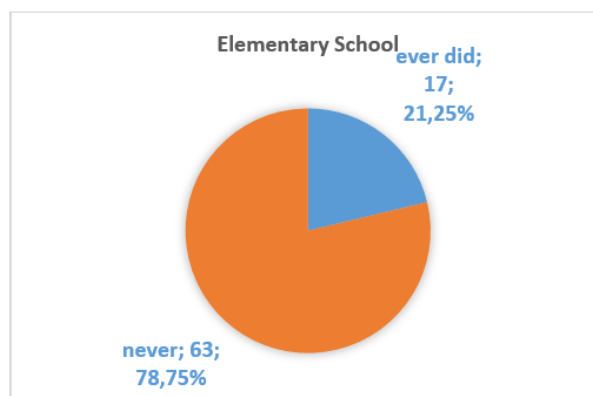


Figure 1. Percentage of Interdisciplinary Physical Education Learning Implementation in Elementary Schools

Then the data in table 3 so shows the implementation of interdisciplinary physical education learning at the junior high school level. At the senior high school level of 59 physical education teachers, only 3 of them (5%) have implemented interdisciplinary physical education learning with an average understanding level score obtained of 84 (very knowledgeable), and as many as 56 (95%) teachers

have never implemented interdisciplinary physical education learning with an average understanding level obtained of 38.5 (don't know enough), overall the level of knowledge of interdisciplinary learning of physical education teachers in senior high school has an average score of 40.8 it means that their knowledge is classified as "enough to know" category. The percentage of the implementation of interdisciplinary physical education learning in senior high school can also be seen in figure 3 below.

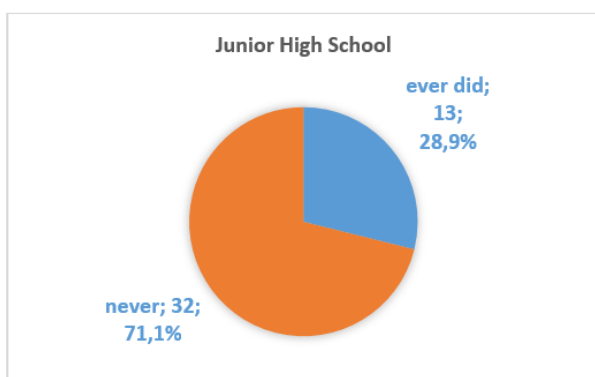


Figure 2. Percentage of Interdisciplinary Physical Education Learning Implementation in Junior High Schools

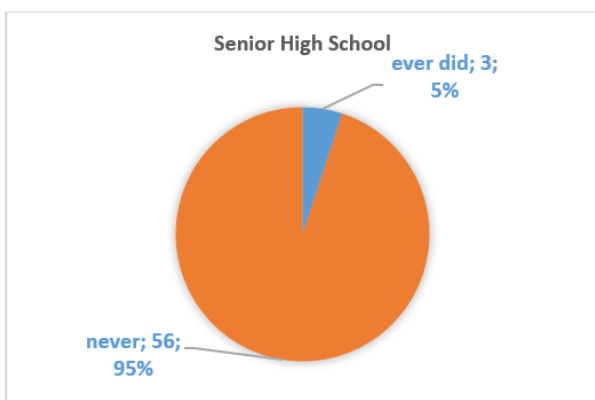


Figure 3. Percentage of Interdisciplinary Physical Education Learning Implementation in Senior High Schools

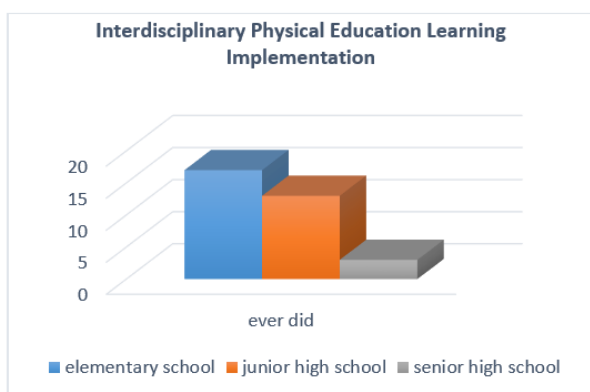


Figure 4. Comparison of the number of interdisciplinary physical education learning implementations at each school level

Overall, out of 184 physical education teachers in West Java, only 33 teachers (17.9%) have implemented interdisciplinary physical education learning in learning

activities at school and the overall average score of interdisciplinary learning knowledge level of physical education teachers is 49.6 which means it belongs to the enough to know category. A comparison of the implementation of interdisciplinary physical education learning in elementary schools, junior high schools, and senior high schools can be seen in Figure 4 below.

In figure 4 above, it can be seen that the implementation of interdisciplinary physical education learning in Indonesia is mostly applied by physical education teachers in elementary schools, namely 17 teachers who have done it, followed by physical education teachers in junior high schools, namely 13 teachers who have done it, and only 3 physical education teachers in senior high schools who have done the interdisciplinary physical education learning process.

More data in table 3 shows the implementation of interdisciplinary physical education learning at each school level based on teachers' experience which can be illustrated in figure 5 below.

In figure 5 above, The number of teachers who have implemented interdisciplinary physical education learning can be seen based on the length of time they have been teaching. At primary school level, there are 2 physical education teachers who have less than 5 years of teaching experience, 7 physical education teachers who have 5-10 years of teaching experience, 7 physical education teachers who have 10-20 years of teaching experience, and 1 physical education teacher who has more than 20 years of teaching experience. At the junior high school level, there were 3 physical education teachers who had less than 5 years of teaching experience who had implemented, 5 physical education teachers who had 5-10 years of teaching experience who had implemented, 5 physical education teachers who had 10-20 years of teaching experience who had implemented, and no physical education teachers who had more than 20 years of teaching experience who had implemented interdisciplinary physical education learning. At the senior high school level, none of the physical education teachers with less than 5 years of teaching experience had implemented, 2 physical education teachers with 5-10 years of teaching experience had implemented, 1 physical education teacher with 10-20 years of teaching experience had implemented, and none of the physical education teachers with more than 20 years of teaching experience had implemented interdisciplinary physical education learning.

Discussion

The results of the above research show that very few physical education teachers in Indonesia at the elementary school, junior high school, and senior high school levels have ever implemented interdisciplinary physical education learning. Interdisciplinary physical education learning itself is a form of physical education learning that is combined

with other subjects at the time of its implementation (Sunarti et al., 2020). Combining the curriculum between subjects is done so that it can be implemented simultaneously during learning without setting aside other subjects so that the objectives or achievements of each subject can be achieved in one learning activity (Ignjatović & Miloradović, 2018). The limited number of physical education teachers in Indonesia who implement and their poor knowledge of interdisciplinary physical education learning is unfortunate given the potential and benefits of interdisciplinary physical education learning itself.

It can be seen in the research data, from the three school levels that quite a lot of interdisciplinary physical education learning is implemented by elementary school teachers. This can be caused by the characteristics of the subjects in elementary school itself, in general the subject matter taught at the elementary school level is basic material. So that when physical education teachers will create an interdisciplinary learning programme, they will not get too complex problems, especially when integrating other subjects into the physical education learning programme. For example, mathematics subjects that will be integrated in physical education in elementary schools, the material to be integrated is of course basic mathematics material in accordance with the existing curriculum whose level of difficulty and implementation will be easier such as addition and subtraction counting operations, simple multiplication and division counting operations, calculations of size, time, weight, and length, or simple formula and field calculations.

At the secondary school level, the number of teachers who had implemented integrated physical education learning was less than at the elementary school level. At the junior high school level, although in terms of presentation, it is slightly greater than the elementary school. At this level, the curriculum and materials in each subject are the development and continuation of elementary school, so the level of difficulty is slightly higher. For example, in mathematics, the material of integers, algebra, lines and angles, and so on must be integrated in physical education learning. Even at the high school level, very few teachers have implemented interdisciplinary physical education learning. The lesser implementation of physical education learning at the secondary school level is also because there are other difficulties mostly related to the implementation of interdisciplinary sequences in secondary schools naturally related to teachers' jobs. Indeed, from a vertical perspective, teachers are torn between their hierarchical orders (management, service, etc.) and the implementation of these orders in the classroom, while considering students and their needs (Tonnetti & Lentillon-Kaestner, 2023a).

The low number of interdisciplinary physical education learning implementations in Indonesia could be due to the strong disciplinary affiliations of physical education teachers. Disciplinary specialisation can make teachers reluctant to adopt interdisciplinary physical education learning programmes as they are often unaware of other disciplines and their content and tend to defend their own discipline (Gajić

& Zuković, 2013; T. Moser et al., 2017; Moss et al., 2019; Tonnetti & Lentillon-Kaestner, 2023b). In addition, the didactic construction of interdisciplinary sequences is more difficult than traditional sequences, including interdisciplinary learning takes more time because it forces teachers from different subjects to organise and meet more often (Fidalgo-Neto et al., 2014; Hardré et al., 2013; Harris & de Bruin, 2018; McPhail, 2018). The limited number of framework documents and manuals to guide teachers is also a barrier to implementing interdisciplinary physical education learning, especially for teachers who do not have experience in the field (Fidalgo-Neto et al., 2014; Moss et al., 2019).

The above is certainly unfortunate, considering that interdisciplinary physical education learning can be a solution and innovation in learning activities at school (Klaassen, 2018). The concept of learning in which there are elements of other subjects makes a different atmosphere during learning. So that students will be more enthusiastic when learning (Abdie & Juniu, 2014), inversely proportional to conventional learning which will tend to make students bored (Juditya et al., 2019). Through this interdisciplinary learning concept, not only the learning achievement goals in physical education subjects will be achieved, but the combined goals of other subjects will also be achieved (Kaittani et al., 2017). Interdisciplinary learning sequences also promote improved academic learning by providing a better understanding of academic content (Bollati et al., 2018; Cuervo, 2018), and these interdisciplinary approaches provide a more holistic understanding of learning (Cuervo, 2018; Harris & de Bruin, 2018). These approaches create connections between disciplines, contribute to the development of a better understanding of disciplinary logic, and encourage the transfer of knowledge and skills between disciplines (Kate et al., 2019), encourage deeper learning and provoke student reflection (McPhail, 2018; Pountney & McPhail, 2019) which, in turn, has a positive effect on student achievement on summative assessments (Holmbukt & Larsen, 2016). As a previous study entitled "Physical Activity With Eduball Stimulates Graphomotor Skills in Primary School Students" showed that the eduball method successfully supported teachers in developing graphomotor skills in children. More broadly, these findings explain once again that there is a need to integrate physical and cognitive development in education, which can be achieved using an interdisciplinary PE model (Wawrzyniak et al., 2021). Another study entitled "The Sport Education Model as an Interdisciplinary Approach" suggests that physical education learning using the Sport Education Model is effective and can be applied in conjunction with mathematics learning (Estrada et al., 2019).

The positive impact is not only felt by other subjects combined into interdisciplinary physical education learning, this positive impact will also be felt by the physical education subject itself. Even though the learning process is done through physical activity, like physical education learning in general, there are new nuances that are also

learned in students' physical activities, not only moving, but students also implementing the learning of other subjects in each of their movements. You can imagine how, for example, mathematics subjects are heavy on numbers and arithmetic, where the learning process is usually carried out in closed classrooms and students just sit at their desks, each with different learning nuances. In interdisciplinary physical education learning, the learning process about numbers and arithmetic in mathematics is packaged and implemented directly through physical activities such as football, basketball, or even traditional sports games and others. This can arouse students' motivation and interest in learning, so that learning goals will be more easily achieved (Vazou et al., 2012).

An example of interdisciplinary physical education learning with mathematics, for example, before being asked to move, students are given mathematical problems that they have to solve, so that the demands of movement that they have to do are focused on the answer to the mathematical problem. In athletics learning, for example, how far students have to run must be in accordance with the mathematical problem the teacher gives;

Teacher (*giving questions*): Mother has 400 eggs, 100 eggs were broken and fell, 50 eggs have been used to cook cakes, and another 50 eggs have been given to neighbors. So how many eggs do you have left?

Answer: 200 eggs. (then students have to run 200 meters).

In the example above, it is clear that the calculation learning that exists in mathematics learning is only stated and recorded on book sheets, with interdisciplinary learning it becomes more directly applied. This is what the world of education really hopes for, where the knowledge and knowledge gained by students in the learning process can be applied and integrated into their lives directly. So that the learning process that students go through will be more meaningful.

The positive impact will not only be obtained by students, but teachers will also get positive impacts, such as collaboration with colleagues from all disciplines, interdisciplinary teaching can encourage teacher professional development (Braskén et al., 2020). An interdisciplinary physical education learning approach also allows physical education teachers to be aware of what is happening in other disciplines and provides teachers with opportunities to increase their knowledge and expertise, especially in disciplines they do not teach. Interdisciplinary teaching allows teachers to create and understand relationships between disciplines (Braskén et al., 2020; K. M. Moser et al., 2019).

This research has revealed the small number of physical education teachers in Indonesia who implement physical education learning in Indonesia and the limited knowledge of teachers regarding physical education learning. This illustrates that the physical education learning process in Indonesia is slightly behind other countries in terms of implementing interdisciplinary physical education learning, where the benefits of interdisciplinary or integration have even been recognized internationally; a number of countries with high PISA (Program for International Student Assessment) rankings have adopted

interdisciplinary/curriculum integration policies (S. M. Drake & Savage, 2016; S. Drake & Reid, 2018). Implementation of this policy includes a shift to project-based learning, combined with a focus on real-world inquiry (S. Drake & Reid, 2018).

Future research will be important if interdisciplinary physical education learning begins to be widely carried out by physical education teachers in Indonesia, especially research to evaluate and find out the extent of the impact that interdisciplinary physical education learning programs have on education in Indonesia

Conclusion

The low number of implementations of interdisciplinary physical education learning in Indonesia, whether at elementary school, junior high school or senior high school levels, is very unfortunate. In fact, interdisciplinary physical education learning programs can help overcome problems in the world of education. To support and increase the number of implementations of interdisciplinary physical education learning programs, teachers need qualified knowledge, so that the implementation process runs optimally because the construction of interdisciplinary physical education learning is more difficult than conventional learning. Therefore, the government, in this case the policy makers who oversee the world of education, need to provide outreach, seminars and workshops for physical education teachers in Indonesia. So that they know, understand, master and implement this physical education learning.

Conflict of interest

The authors declare that they have no conflict of interest.

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