

Nonlinear learning pedagogy: Does it have an impact on physical education in elementary schools? Pedagogía del aprendizaje no lineal: ¿tiene impacto en la educación física en las escuelas primarias?

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Abstract. Nonlinear pedagogy has the potential to be an effective strategy for teaching and studying physical education in elementary school a way that allows students to develop their skills. This study aims to determine whether there is an effect of physical education teacher readiness in implementing nonlinear pedagogy learning in Indonesia, Malaysia, and the Philippines. This Study used an experimental method with one group pre-test-post-test design. The research participants were physical education teachers in elementary schools in Indonesia, Malaysia, and the Philippines ($n = 90$). 40 question online survey with a validity level of 0.74 and a reliability level of 0.80 is used to assess teacher preparedness for implementing nonlinear learning. With the aid of a literature review, secondary data was gathered. The paired sample t-test results revealed that $0.05 > 0.000$, indicating that the data variance was the same. The significance result indicates that $0.000 < 0.05$ (confidence interval = 99%) when looking at the assumed equal variances, which means that H_0 is rejected. According to the data, there are 25 teachers or 27,8% who are ready to carry out nonlinear pedagogy learning, 42 teachers or 46,7% are not ready, and 23 teachers or 25,5% are unprepared. Nonlinear pedagogy learning has an effect on PE teachers' readiness in the three countries. The intended effect is to demonstrate that PE teachers are not ready to use nonlinear pedagogy in their lessons. The recommendation from the finding is that teachers need training in nonlinear pedagogy and adequate support to succeed in nonlinear pedagogy learning.

Key words: Elementary school, Nonlinear pedagogy, Physical education.

Resumen. La pedagogía no lineal tiene el potencial de ser una estrategia eficaz para la enseñanza y el estudio de la educación física en la escuela primaria, una forma que permite a los estudiantes desarrollar sus habilidades. Este estudio tiene como objetivo determinar si existe un efecto de la preparación de los maestros de educación física en la implementación del aprendizaje de la pedagogía no lineal en Indonesia, Malasia y Filipinas. Este estudio utilizó un método experimental con un diseño de pre-prueba y post-prueba de un grupo. Los participantes de la investigación fueron profesores de educación física en escuelas primarias de Indonesia, Malasia y Filipinas ($n = 90$). Se utiliza una encuesta en línea de 40 preguntas con un nivel de validez de 0,74 y un nivel de confiabilidad de 0,80 para evaluar la preparación de los maestros para implementar el aprendizaje no lineal. Con la ayuda de una revisión de la literatura, se recopilaron datos secundarios. Los resultados de la prueba t de muestras pareadas revelaron que $0.05 > 0.000$, lo que indica que la varianza de los datos era la misma. El resultado de significancia indica que $0.000 < 0.05$ (intervalo de confianza = 99%) cuando se observan las varianzas iguales asumidas, lo que significa que se rechaza H_0 . Según los datos, hay 25 docentes o el 27,8% que están listos para llevar a cabo el aprendizaje de la pedagogía no lineal, 42 docentes o el 46,7% no están preparados y 23 docentes o el 25,5% no están preparados. El aprendizaje de la pedagogía no lineal tiene un efecto en la preparación de los profesores de educación física en los tres países. El efecto buscado es demostrar que los profesores de educación física no están listos para usar la pedagogía no lineal en sus lecciones. La recomendación del hallazgo es que los maestros necesitan capacitación en pedagogía no lineal y un apoyo adecuado para tener éxito en el aprendizaje de la pedagogía no lineal.

Palabras clave: Escuela primaria, Pedagogía no lineal, Educación física.

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Introduction

Approach differences can be one of the problems in physical education learning (Syrmpas, Digelidis, Watt, & Vicars, 2017). Physical education instruction has shifted from a traditional to a student-centered approach. Teachers place a high value on learning that focuses on prescribed technical skills while ignoring the environment and student desires. The student-centered approach in which the teacher serves as a facilitator and students are urged to tackle problems critically through independent exploration (Guangxin, Dunguo, & Qichen, 2022; Hortigüela, Fernández-Río, & Pérez-Pueyo, 2016; Lee, Chow, Button, & Tan, 2017). Differences in approach can be one of the problem factors in physical education learning (Carranza-Bautista, 2020; Hortigüela –Alcala, Hernando-Garijo, & Pérez-Pueyo, 2021). There has been a shift in physical education teaching from the traditional teacher-centered approach to a student-centered approach. Teachers put a lot of emphasis on learning that

focuses on structured technical skills, not paying attention to the environment and student desires. In a student-centered approach, the teacher is a facilitator, and students are challenged to critically solve problems through individual exploration.

Several studies have shown that the readiness of physical education teachers sometimes does not have readiness in understanding learning models (Bruno, 2020). Scholars have found that Self-directed learning readiness predicts critical thinking and general self-efficacy by 50.5% (Turan & Koç, 2018). As a result, teacher readiness in understanding learning models is important for learning.

Although most students (typically 80% or more) enjoyed physical education subjects in the traditional or teacher-centered approach (Jaakkola, Yli-Piipari, Barkoukis, & Liukkonen, 2017; Rekaa, Hanisch, & Ytterhus, 2019; Silverman, 2017). Unlike many subjects and those taught in schools, physical education also includes a substantial component of active play, both in

the form of individual sports and sports that have a strong appeal to young people. However, there are still beneficial children, with up to 20% of children who dislike physical education sessions being distracting. Furthermore, there is evidence that an increasing number of students view physical education to be less relevant, interesting, and pleasurable (Gard, Hickey-Moodey, & Enright, 2013). The student-centered approach, particularly in nonlinear pedagogy, established a learning environment that promoted perceived competence, autonomy, and relatedness, potentially increasing intrinsic motivation and enjoyment during practice (Lee et al., 2017).

Effective Physical Education (PE) programs should include the growth of an individual in all major learning areas, including psychomotor, perceptual, cognitive, and affective development (Maksymchuk et al., 2018). For example, Physical education is one of the subjects used in the 2013 curriculum in Indonesia which applies student-centered learning. P.E is also an important part of the national education program, and it aims to improve physical fitness, movement skills, critical thinking skills, social skills, reasoning, emotional stability, moral action, a healthy lifestyle, and the introduction of a clean environment by providing learning experiences that are organized and carried out systematically based on the values of faith and devotion to God Almighty (Sutapa et al., 2020).

Unsurprisingly, skill acquisition has long been a topic of interest among sports science support personnel and practitioners, such as PE instructors and sports coaches, who establish the foundation for studying how people move and interact with their surroundings on a regular basis. The advantages of creating effective techniques to improve skill acquisition and development of Physical Literacy extend beyond the arena of sports or physical activities in clubs and schools and also play a vital role in assisting persons in gaining functionality in their motions (Lee et al., 2017). For instance, Physical Literacy is defined as a holistic process of enriching the perceptual, cognitive, physical, emotional, and social processes involved in learning and performing a variety of activities throughout one's life (Trecroci, Invernizzi, Monacis, & Colella, 2022).

In curricular studies research, one of the student-centered or student-oriented learning approaches is Nonlinear Pedagogy which has a very big difference when applied to Physical Education (Crotti et al., 2021; Martín-Barrero & Camacho Lazarraga, 2020). The work's pedagogically oriented approach to values orientation has provided the basis for curricular development and analysis (Chow et al., 2006). It has been noted that one of the most prominent value orientations in the physical education domain is disciplinary or subject mastery, where practitioners seek to teach perceptual motor skills through verbal explanations, demonstrations, practice exercises, and gameplay simulations (Chow et al., 2006). However, there are other important value orientations in

educational and curriculum studies, such as the learning process approach, which highlights the importance of how learning occurs, as well as the ecological integration of learners with specific learning contexts (Gaetano, 2012). This value orientation suggests that learners play an important role in the acquisition of game skills and that the learning process needs to occur in the context of representative performance in teacher-facilitated physical education classes.

Nonlinear pedagogy is a new pedagogical approach with a theoretical foundation in ecological dynamics. It provides scientists and practitioners with a framework that can provide an understanding of how functional movement can be taught to students. The Nonlinear Pedagogical Approach includes nonlinear learning in the learning process and provides teaching with understanding principles to support physical education teaching (Chow & Atencio, 2014). They are theoretically guided by the ecological dynamics framework, creating a perspective that conceptualizes the etymological roots in education as "exducere", which means guiding individuals out of their world (Rudd, Woods, Correia, Seifert, & Davids, 2021). A teacher in learning must guide, pay attention to and encourage the exploration of each individual so that they gain experience of perceptions on everything that can support their behaviour. This pedagogical approach can help students regulate themselves in the environment and be more responsive to opportunities that arise to act as they should (Buendía, Martínez, Izquierdo, & Mármol, 2021; Merino & Lizandra, 2022).

The procedure in nonlinear pedagogy is that one must be able to understand the principles of the nonlinear approach, namely: Representativeness, Simplification of Tasks, Manipulation of Constraints, Functional Variability, and Focus of Attention (Chow, 2013).

Several Learning Models that have a nonlinear approach, such as a) Teaching Games for Understanding (TGFU) for teaching games in physical education is increasingly popular and is becoming one of the most widely applied teaching models in the world is advocating a learner-centered orientation, with an emphasis on exploratory learning in "game-like" situations (Chow et al., 2009), b) The Constraints-Led Approach (CLA) learning model has the potential to provide a framework for physical education so that students can understand how to carry out environmental-based task exploration. This is to form individuals who are more creative in solving problems from the tasks given by the teacher. Furthermore, understanding the underlying neurobiological processes in CLA to develop skill acquisition in the form of games can increase students' awareness of experiences in exploring a movement so that teachers understand that teaching is a dynamic art interwoven in science formed from motor learning theory (Renshaw, Davids, & Savelsbergh, 2010) Sports Education (SE) the main goal of Sports Education is for students to

become competent in an activity that is fun and gain confidence in carrying out activities for the entire duration of the season, thus motivating them to continue learning and improving, thereby increasing opportunities them to seek opportunities to participate in it in their free time (Del Valle Díaz, Cruz, Cabello, & de la Vega Marcos, 2022; Servilha de Lucca, Impolcetto, & Ginciene, 2021). However, this goal is unlikely to be achieved in the typical format for school physical education with short units in which parents form games for competition (e.g., 5v5 basketball, 6v6 volleyball) (Daryl Siedentop, Peter A. Hastie, 2011).

Each nation has its traditions, culture, and education system (Shaturaev, Jakhongir, 2021), all of which influence the learning process. However, few teachers worry about the student's learning process, primarily cognitive, psychomotor, and affective (Padial-Ruz, García-Molina, González-Valero, & Ubago-Jiménez, 2022). In Indonesia, most teachers neglect good cognitive, psychomotor and attitude formation to focus on academic achievement. Preliminary research revealed that as many as 57% of teachers in Indonesia are still practicing conventional learning. As many as 43% of teachers are already using other learning approaches, 60% of teachers in Malaysia are still doing conventional learning, as many as 40% of teachers are already using other learning approaches, and 58% of teachers in Filipinos use conventional learning and 42% use other learning. However, the achievement of this goal does not imply a change in the student's third realm of scientific study. As a result, this study is interested in seeing the teacher's view of student-based learning as the focus. In a nonlinear approach, examining these subjects will produce data about perceptions and learning processes towards science. Once data is available, scholars and educators can identify changes in the three domains of students in three countries from Indonesia, Malaysia, and the Philippines. As a result, research on the readiness of physical education teachers in learning with nonlinear learning models in three countries will add to the literature in the field of scientific education.

The remaining sections of this paper are organized as follows: Section 2 examines all materials and methods, Section 3 presents the findings, Section 4 discusses the findings, and Section 5 summarizes the findings with some recommendations for future research.

Method

Subjects/ Participants

This research enlisted the participation of 90 teachers Indonesian-Malaysia-Philippines from 12 elementary school participated in the present study. The participants were chosen using the stratified random sampling approach. The participants were on average 42.23 (SD = 9.63) years of age and had an average of 16 (SD=8.98) years of teaching experience. The teacher had an average

of 12.94 (SD= 8.18) years of teach physical education experience. In March to August 2022, an experimental test of the implementation of nonlinear learning will be undertaken.

Tabel 1.
Nonlinear learning intervention activities in experimental test

Indonesian-Malaysia-Philippines			
Session	Variable	PE Scope	Material
Pre Test			
1	Nonlinear Pedagogy	Invasion Game	Handball
2	Nonlinear Pedagogy	Invasion Game	Soccer
3	Nonlinear Pedagogy	Invasion Game	Basketball
4	Nonlinear Pedagogy	Invasion Game	Handball
5	Nonlinear Pedagogy	Invasion Game	Futsal
6	Nonlinear Pedagogy	Invasion Game	Basketball
7	Nonlinear Pedagogy	Invasion Game	Handball
8	Nonlinear Pedagogy	Invasion Game	Soccer
9	Nonlinear Pedagogy	Invasion Game	Futsal
10	Nonlinear Pedagogy	Invasion Game	Handball
11	Nonlinear Pedagogy	Invasion Game	Soccer
12	Nonlinear Pedagogy	Invasion Game	Basketball
Posttest			

Study organization

The research design used was a one group experimental pre- and post-test without a control group. In the beginning, I as a researcher, gave knowledge about how to carry out research to teachers. We give the teacher a pre-test using the teacher readiness instrument in teaching nonlinear pedagogy, we give an intervention consisting of 12 weeks of nonlinear learning for elementary schools, as shown in table 1, then we give a post-test using the teacher readiness instrument in teaching nonlinear pedagogy physical education materials. The instrument used uses the development of teaching readiness instruments in distance learning (Susanto, Mulyaningsih, Mujriah, Satriawan, & Sulfandi, 2022). 40 question online survey with a validity level of 0.74 and a reliability level of 0.80 is used to assess teacher preparedness for implementing nonlinear learning.

Table 2.
Research designs and intervention

Experiment	Paired Sample t-test
Pre-test	Questionnaire with 40 questions
Intervention	12 weeks nonlinear pedagogy learning
Post-test	Questionnaire with 40 questions
Participants	30 PE teachers from Indonesian Country 30 PE teachers from Malaysian Country 30 PE teachers from Philippines Country

Instrumentation

Using a questionnaire to collect data. The procedure for gathering data consists of selecting PE topics for the

5th and 6th grade elementary school curriculum applying nonlinear learning taught via Google meeting or zoom meeting. In addition, the researchers test PE subject matter using nonlinear pedagogical learning with non-respondents and invalid instruments. These interventions include (1) providing teachers with instructions for completing a list of questions, (2) preparing teachers for the pre-test for around 25 minutes, (3) Implement nonlinear learning pedagogy for twelve weeks and (4) Final evaluation of instructor preparedness for 30 minutes. The teacher readiness questionnaires are as follows (Table 3).

Table 3.
Teacher readiness questionnaire in nonlinear pedagogy learning

Variable	Factor	Indicator
Nonlinear Pedagogy	Technical expertise	Skills in using nonlinear pedagogy learning model
		Skills in using Constraints LED approach
		Skills in using Tactical Games approach
	Experience with teaching using nonlinear pedagogy	Nonlinear Learning planning skill
		Nonlinear Learning management skill
Attitude towards nonlinear pedagogy	Nonlinear Learning assessment skill	
	Communication attitude to nonlinear Science learning	
Time organization and time commitment	Social Implications of nonlinear science learning	
	Enjoyment of nonlinear science learning lessons	
Time organization and time commitment	Time commitment skills	
	Time management skills	

Statistic analysis

Descriptive data analysis was conducted separately and collectively for each grade level and gender, as well as for the two aspects of attitude. The t-test and two-way ANOVA were used after the assumption tests, which included normality ($p > 0.05$) and homogeneity ($p > 0.05$). The t-test was used to see whether there was any correlation between students' ATNP and other characteristics of respondents, such as gender and school grades. The TOSRA questionnaire's mean scores were compared by gender and grade using the ANOVA method. The main impact of both gender and school grade level, as well as the interaction effect of those two factors, were investigated using a two-way ANOVA approach.

Results

This study was conducted between March and August of 2022 with 90 participants from three countries, including 48 male and 42 female PE teachers. (Table 4).

This study utilized an experimental design to examine the effect of a nonlinear pedagogy intervention on fifth- and sixth-grade elementary students' physical education learning. Table 4 presents the results of the initial and final test's mean scores. The teacher's readiness before receiving the intervention was 5.2 or below, which is a low category, while the average teacher preparation following the

intervention was 6.6, or medium. Increased teacher preparation for nonlinear pedagogy by 1.6 or 21.1%.

Table 4.
The mean rating and significance of teacher preparedness in three countries.

Group	Pre-test	Post-test
	Mean score	Mean score
3 Country	5.2*	6.6*

* $p < 0.5$ (significantly different); ** $p < 0,1$ (very significantly different)

Table 5 indicates that 25 instructors or 27,8%, are prepared to implement nonlinear pedagogy learning, whereas 42 teachers or 46,7% are not ready, and 23 teachers or 25,5% are unprepared.

Table 5.
Categorization of teacher readiness for nonlinear pedagogy learning

No	Category	Criteria	Total	Percentage
1	Ready	155-180	25	27,8%
2	Not ready	95-154	42	46,7%
3	Unprepared	< 95	23	25,5%
N			90	

Hypothesis testing

The hypothesis developed in this study is: H0: Nonlinear pedagogical learning has no effect on the final score of teacher readiness in three countries. H1: Nonlinear pedagogical learning has an effect on the final score of teacher readiness in three countries. If sig. (p value) ≤ 0.05 (5%) then H0 is rejected meaning the data is not distributed normally. Conversely, if sig. (p value) > 0.05 (5%) then H1 is accepted meaning data is normally distributed. In Table 6, the results of the paired sample hypothesis test indicate that $0.05 > 0.000$, so it is assumed that the variance of the data is the same. The next step is to determine whether the paired sample t-test can refute the hypothesized relationship. Taking into account the assumption of equal variances, the significance results indicate that $0.000 < 0.05$ (confidence interval = 99%) rejects H0. Thus, it is demonstrated that nonlinear pedagogical learning has an effect on teacher readiness in three countries.

Table 6.
Analysis of paired sample test results

	Paired Differences			t	df	Sig (2-tailed)
	Mean	SD	SE			
Pair 1 Pre-test-post-test 3 countries	-7.036	5.367	0.765	-7.320	56	0.000

SD = Standart Deviasi, SE = Standart Error of Mean

Normality test

The significance levels of the Kolmogorov-Smirnov Test distribution were $0.487 > 0.005$ and $0.0589 > 0.05$, indicating that the data variance was normally distributed (Table 7).

Table 7.
Normality test results

Experiment Group	Kolmogorov-Smirnov Test	P-value	Distribution
School	Pre	0,487	>0.05
	Post	0,589	>0.05

Discussion

This study's primary purpose was to investigate the impact of a 12-week nonlinear pedagogy learning intervention on physical education classes. The intervention consists of Physical Education lessons on Invasion Games (basketball, soccer, handball, and futsal). This content is consistent with the curriculum for elementary schools (Hasani, Juansah, Sari, & El Islami, 2021); because importance of understanding the teacher's orientation to the curriculum to provide more tailored professional development that can help teachers accommodate the most important pedagogical features of the curriculum (Troyer, 2019). The results of this study support the assumption that nonlinear learning has an effect on teacher preparedness. These findings are in line with studies on how the Modern Educational Environment has an impact on teacher preparedness (Fedorov, Ilaltdinova, Guseva, & Frolova, 2021). The level of competence a teacher possesses, particularly their understanding with nonlinear pedagogy, has an impact on how prepared they are (Chow, Komar, Davids, & Tan, 2021). How frequently do you participate in training for student-centered learning. Aside from that, having access to facilities that support sports has an impact on fulfilling PE goals (Szczepaniak, 2020). The current system of linear or traditional learning makes it difficult to attain PE objectives. because instruction is typically thought of as a "direct" and practical process. In many schools, the instructor serves as the primary source of instruction (Harvey, Gil-Arias, & Claver, 2020). Meanwhile, nonlinear learning in PE lessons actually need a good understanding by the teachers so that they can be carried out effectively (Komar, Potdevin, Chollet, & Seifert, 2019).

Previous research revealed that the preparation of physical education teachers in preparing learning models still needs to be improved (Bruno, 2020); some teachers also apply traditional models, which means they are still implementing teacher center learning (Gómez-Criado & Valverde-Esteve, 2020; Servilha de Lucca et al., 2021). This study also found that readiness in teaching with a nonlinear pedagogy or more in a student center is still lacking.

There are at least four areas of readiness where nonlinear pedagogy learning has an impact on PE readiness teachers in three different countries: technical understanding of nonlinear pedagogy among teachers, teaching experience with student-centered or nonlinear pedagogy-based learning, attitudes toward nonlinear pedagogy learning, and commitment and time management (Lee et al., 2017).. Because due to the teacher's inability to effectively direct the students movement, learning is not being implemented at its best (Lindgren & Barker, 2019). Consequently, because there is no precedent, the development of movement or physical activity becomes complicated. Another result is

that not all instructors and learners are interested in exploring the connection between nonlinear pedagogy and teacher-centered learning. There are teachers who are unable to effectively use learning platforms or media, and this cannot be ignored (Coppola, Schembri, Manzo, & Sgrò, 2021). According to the level of ability of graduate teachers from three countries, graduates generally have the status of a bachelor's degree.

Regarding teaching experience, it was discovered that almost all respondents lacked nonlinear pedagogy teaching experience. Therefore, pedagogical nonlinear learning is completely novel and almost never practiced (Henriksen, Richardson, & Mehta, 2017). Moreover, sports lessons are replete with motor and physical functions that necessitate special teaching consideration (Tani, Bastos, Silveira, Basso, & Corrêa, 2021). This is consistent with the opinion of the expert that sports lessons are traditionally subjects that have a close relationship between teacher and student (Hutter, Oldenhof-Veldman, Pijpers, & Oudejans, 2017). This lack of confidence in applying nonlinear pedagogy hinders teachers' ability to interact with students, thereby impeding the learning process (Moy, Renshaw, Davids, & Brymer, 2019).

Relating the teacher's attitude toward nonlinear pedagogy learning, it was discovered that some teachers have a less cooperative attitude. This is proved by the absence of pedagogical nonlinear learning, in addition to the use of the cooperative learning model and TGFU. The capacity of educators to take initiative and assume responsibility for their work or responsibilities remains relatively low. In other words, the aspects of awareness, teaching strategy, evaluation, and interpersonal skills continue to be inadequate. In this study, it was discovered that the teacher's attitude toward weak indicators influences the nonlinear pedagogy learning process. During nonlinear learning pedagogy, teachers did not receive complete and honest feedback from their students, which is undeniable (García-López, Gutiérrez, Sánchez-Mora, & Harvey, 2019).

In terms of management and time commitment, there are a number of indicators that demonstrate teachers' lack of commitment to time management, such as their need to prepare lesson plans, their lack of optimism regarding nonlinear learning, and their inability to enjoy new challenges at work. In other words, teachers are not prepared for the new educational system (Patey, Jin, Ahn, Lee, & Yi, 2019). This factor also contributes to the low reading proficiency of teachers involved in the implementation of nonlinear pedagogy learning.

In addition, researchers analyzed teacher preparedness in relation to four teacher competencies: pedagogy, professional, social, and personality. Teacher readiness in pedagogical competence refers to the teacher's abilities or skills in managing the learning process or facilitating teaching and learning interactions with students (Fedorov et al., 2021; Lindgren & Barker, 2019). The readiness of

teacher pedagogical competence in three countries must be reflected in the teacher's ability to explain material, apply learning methods, ask and answer questions, manage classes, and conduct structured and accountable learning evaluations. This has not been observed, however, during the nonlinear pedagogy learning process.

Teacher readiness in relation to personality competence is, in brief, a personal readiness that reflects a steady, stable, mature, authoritative, exemplary, and exemplary personality. Personality teacher competence in three nations is viewed through the lens of a teacher who is patient, calm, responsible, democratic, sincere, intelligent, respectful of others, friendly, assertive, and imaginative. In nonlinear pedagogy learning material for physical education, the personality competence of teachers in three countries is quite good.

This research is useful for practical uses (regarding the use of nonlinear pedagogy for physical education teachers in elementary schools, elementary schools, and for further research) as well as research that contributes to nonlinear pedagogical theory related to teacher readiness to teach. So it is necessary to do further research and training for teachers on nonlinear pedagogy and add practical research applications.

Conclusion

Nonlinear learning has demonstrated effects on the preparedness of Physical Education teachers in three nations. Carry out nonlinear learning, however, tends to demonstrate the unpreparedness of physical education teachers in schools. The influencing factors readiness of physical education teachers in implementing nonlinear pedagogic learning in Indonesia, Malaysia, and the Philippines are that teachers' technical skills in preparing nonlinear learning plans are still low, their teaching experience in nonlinear learning is still low, attitudes toward nonlinear learning tend to be flat, and time management is poor.

While the limitations of this study are the different teaching abilities of teachers and school policies regarding the physical education curriculum.

In addition, the findings suggest that adequate nonlinear pedagogical training and support are required for success in nonlinear pedagogical learning.

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Conflict of interest

No potential conflict of interest was reported by the authors.

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