

IMPROVING STUDENTS' ABILITY TO DECISION MAKING AND COMMUNICATE EFFECTIVELY THROUGH THE USE OF HYBRID NONLINEAR PEDAGOGICAL MODELS

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Abstract: The objective of this study is to examine and evaluate the influence of hybrid nonlinear educational models on decision-making and communication in the field of physical education. Techniques. The intervention group received instruction in physical education utilizing hybrid pedagogical techniques for a period of 12 weeks. In contrast, the control groups followed the physical education curricula of their schools. Pre-existing scales designed for student usage were utilized for decision-making and communication purposes, both before and during the program. To compare the two groups, we utilized paired sample *t*-tests, two-way and one-way analyses of variance, and a Pearson correlation analysis. Outcome. The research findings indicate that the intervention group exhibited a significant improvement in decision-making and communication when compared to the control group. The aforementioned conclusions are substantiated by the results of paired sample *t*-tests and two-way Analysis of Variance (ANOVA). The variance (ANOVA) and one-way ANOVA tests yielded statistically significant results. The *F* statistic was less than 0.05 ($F = 0.000 < 0.05$), and the *p*-value was less than 0.05 ($p = 0.000 < 0.05$) respectively. Furthermore, the intervention based on nonlinear pedagogy and invasion game learning resulted in an enhancement of decision-making and communication skills. Final remarks. Incorporating hybrid nonlinear pedagogical models into physical education instruction with invasion games might enhance students' communication skills and decision-making abilities. The findings of this study offer encouragement for physical education instructors to adopt teaching methodologies. In addition, research is being carried out to investigate the impacts of nonlinear pedagogy.

Keywords: Decision-making, communication, primary school students, nonlinear pedagogy

INTRODUCTION

Disparities in approaches might be a challenge in the field of physical education (Syrmpas et al., 2017). A student-centered strategy has replaced traditional physical education instruction. Teachers prioritize instruction that focuses on required technical skills, sometimes neglecting the surroundings and students' preferences. The student-centered approach involves the teacher assuming the role of a facilitator, while students are motivated to approach topics critically through independent inquiry (Guangxin et al., 2022; Lee et al., 2017). Divergent approaches can present a significant challenge to the implementation of physical education (Kozin et al., 2022). The conventional teacher-centric approach to physical education instruction has transitioned to a student-centric paradigm. Students are afforded the chance to cultivate independence in the learning process through the utilization of a student-centered technique. The teacher assumes multiple roles, both individually and in groups, serving as a conceptualizer, director, and facilitator for pupils to communicate critical viewpoints (Syahputri & Sukoco, 2020; Yi et al., 2020).

Although a significant proportion of students (usually 80% or more) expressed satisfaction with traditional or teacher-centered physical education classes, there was a demand for a fresh approach (Jaakkola et al., 2017; Rekaa et al., 2019; Silverman, 2017). Physical education has a primary focus on engaging in physical exercise, encompassing both individual and group sports. This distinguishes physical education from most other courses taught in schools. Conversely, there exist pupils who have a dislike for physical education within the school setting, so impeding the successful implementation of physical education instruction. Furthermore, there is compelling evidence indicating that a growing proportion of pupils perceive physical education to be of diminished significance, lacking in interest, and lacking in enjoyment (Gard et al., 2013).

The non-linear pedagogical approach, a component of student-centered learning, emphasizes a learning experience that prioritizes collaborative interaction and enhances multiple student competencies. This approach fosters

increased motivation among students during an engaging learning process (Lee et al., 2017; Sitepu et al., 2020).

Once it comes to how well students learn, physical education programs should focus on enhancing individual psychomotor, cognitive, perceptual, and affective abilities (Maksymchuk et al., 2018). Physical education is a subject included in the 2013 Curriculum of Indonesia, designed to foster a student-centered learning method. Physical education is a crucial component of the National Education System as it enhances multiple aspects of comprehensive learning outcomes. These include the development of motor skills, emotional intelligence, attitude values, social skills, critical thinking abilities, physical fitness, reasoning intelligence, healthy environmental management, and healthy lifestyles. The primary focus of Physical Education is to establish well-organized educational possibilities that are rooted in religious faith and centered around God (Sutapa et al., 2020).

In general, the outcomes of skills are of great interest to individuals and professionals in the field of sports, such as physical education instructors and sports coaches. They are responsible for studying the mechanics of human movement and interaction on a regular basis. The advantages of establishing efficient strategies to improve the acquisition and development of Physical Literacy have wide-ranging implications beyond sports or physical activities in societies or schools. They play a crucial role in helping individuals acquire functional movement (Silverman, 2017; Yi et al., 2020). Physical literacy encompasses the integration of cognitive processes, perception, fitness, effectiveness, and social connection into daily tasks, hence enhancing an individual's overall functioning (Trecroci et al., 2022).

Nonlinear Pedagogy is a student-centered learning strategy that has a distinct impact on physical education in curricular studies study (Crotti et al., 2021). The pedagogically focused approach of this study enhances the value of all parts and serves as a foundation for curriculum development. Subject or disciplinary expertise is widely recognized as a significant value orientation in the field of physical education. Practitioners strive to provide verbal explanations for teaching perceptual motor abilities, demonstrate techniques, conduct practice activities, and simulate game scenarios (Chow et al., 2006). Additional noteworthy value orientations in educational and curriculum studies encompass the learning process approach, which underscores the significance of the manner in which learning takes place, and the ecological integration of learners within specific learning settings (Gaetano, 2012; Lakhno et al., 2020). Students play a vital role in achieving the best learning outcomes, such as game skills. Teachers support students by demonstrating exemplary behavior that reflects certain values during the learning process. Students play an essential part in achieving the best learning outcomes, such as game skills. Teachers support students by demonstrating exemplary behavior that reflects certain values during the learning process.

Teaching Games for Understanding is a popular nonlinear learning model used in physical education. It focuses on a student-centered approach that encourages exploratory learning in scenarios that resemble games (Biesieda, 2022; Yi, 2010). The Constraints-Led Approach learning paradigm has the ability to offer a framework for physical education, enabling students to understand how to engage in the exploration of tasks based on the surroundings. The purpose of this is to foster individuals who demonstrate greater ingenuity in solving difficulties presented by the instructor. Furthermore, a thorough understanding of the fundamental neurobiological mechanisms is necessary to facilitate the development of skills in the Constraints-Led Approach. Utilizing games as a teaching method can enhance students' understanding of movement exploration, enabling teachers to assess their progress based on motor learning theory, teaching is an evolving and evidence-based kind of creative expression (Renshaw et al., 2010). Physical Education The main goal of Sports Education is to enable students to achieve proficiency in an enjoyable activity and develop self-assurance in performing activities throughout the season. This, in turn, encourages them to sustain their learning and progress, thereby enhancing their chances of engaging in it during their leisure time. Nevertheless, achieving this goal is improbable within the conventional structure of school physical education, characterized by brief modules where parents coordinate competitive games such as 5v5 basketball and 6v6 volleyball (Humphries, 2014).

The study implemented a nonlinear pedagogic learning model in the physical education and sports programs of the experimental group. The aim was to improve students' decision-making and communication skills. The main objective of this curriculum is to comprehensively improve students' communication and decision-making abilities, while also enhancing their overall pleasure of physical education. The program development process encompasses curriculum analysis, the production of a syllabus, and the development of a lesson outline that includes a diverse range of activities. Curriculum analysis highlights core and essential competencies. Competence is an essential talent that students must learn as part of the educational process. We developed a curriculum that includes the identified essential translation competencies (cognitive, affective, and psychomotor), as well as the necessary materials, course

duration, and suitable activities. Furthermore, the lesson plan provides a comprehensive outline of the syllabus, encompassing the specific day and time of each meeting, the subject matter, the learning activities (including introduction, body, and conclusion), and the allocated study period. Students participated in a 12-week physical exercise program that followed a nonlinear approach. As a result, The aim of this investigation is This study investigated the impact of hybrid nonlinear pedagogical models in physical education on decision-making and communication.

MATERIAL AND METHODS

Methods

In this article, researchers employ a quasi-experimental study paradigm utilizing a control group pre-post test design. The study took place at an elementary school in Yogyakarta, Indonesia.

Participants

Total of 82 students from a singular primary school took part in this investigation. The participants were chosen using a random selection method. Elementary school students often fall within the age range of 10 to 12. The inquiry was carried out in the Indonesian province of Yogyakarta. This province is situated in the western area of Indonesia. The distribution of the sample is displayed in Table 1.

Table 1. Subject characteristics intervention group

Explanation	Frequency	%
Gender		
Male	41	50
Female	41	50
Age		
11	26	35
12	56	65
Class		
5	26	35
6	56	65
School		
Primary School 1	27	32
Primary School 2	29	37
Primary School 2	26	31

Study organization

Observation and documentation serve as data collection methodologies. Data collection for this study involved the use of observation, assessment, and documentation instruments. During this inquiry, researchers collected data on the pre-test and post-test by means of observation. The teacher utilises lesson plans as a type of documentation, along with additional documentation during the pre-post-test and treatment sessions, which span a total of 12 meetings.

Table 2. Design of studies and intervention

Experiment	Paired Sample t-test
Pre-test	Instrumentation Observation
Intervention	12 weeks
Post-test	Instrumentation Observation
Participants	VI C 27 Students Nonlinear pedagogy learning
	VI D 29 Students Linear pedagogy learning
	V C 26 Students Control

Procedure

At the beginning of the study, we created a new physical education programme for children in the first intervention group. This programme focused on invasion activities and used a nonlinear pedagogy approach. We also developed a scale to measure the children’s decision-making and communication skills. In the second intervention group, we implemented a different programme that used invasion games and a linear pedagogy approach. We also used the same scale to assess the children’s decision-making and communication skills. For the control group, we followed a regular curriculum that included invasion games in their physical education and sports programmes. We provided additional training to the physical education and sports instructors assigned to the first and second intervention groups, but not to the control group. Each programme has a duration of one semester, which is equivalent to 12 weeks. Both before and after all physical education and sports programmes, we distribute decision-making and communication scales to all pupils.

Table 3. Strategies for treating non-linear learning in experimental testing

Nonlinear-Linear-Control			
Session	Variable	Physical Education Scope	Material
1	Pre-Test		
2	Nonlinear-linear-control	Invasion Game	Soccer
3	Nonlinear-linear-control	Invasion Game	Basketball
4	Nonlinear-linear-control	Invasion Game	Handball
5	Nonlinear-linear-control	Invasion Game	Futsal
6	Nonlinear-linear-control	Invasion Game	Basketball
7	Nonlinear-linear-control	Invasion Game	Handball
8	Nonlinear-linear-control	Invasion Game	Soccer
9	Nonlinear-linear-control	Invasion Game	Futsal
10	Nonlinear-linear-control	Invasion Game	Handball
11	Nonlinear-linear-control	Invasion Game	Soccer
12	Post-Test		

Statistical analysis

Data analysis is conducted using SPSS Version 27.0 for Windows. A repeated measures analysis of variance (ANOVA) was employed to compare the intervention 1 and 2 groups, together with the control group, both before and after the implementation of the physical education and sports programmes. The one-way ANOVA was employed to assess the disparities in decision-making and communication among groups prior to and following the introduction of the physical education and sports programme. Paired sample t-tests are specifically used to evaluate differences across groups.

RESULTS

According to use parametric methods of statistical analysis, it is necessary to do a normality test on the data:

Table 4. The outcome of the process of determining normality and the subsequent exchange of information

Kolmogorov-Smirnov					
		Decision Making		Communication	
Class		df	Sig	df	Sig
Pre-test	Kontrol	26	0.099	26	0.122
	Nonlinear	27	0.075	27	0.200
	Linear	29	0.056	29	0.129
Post-test	Kontrol	26	0.123	26	0.052
	Nonlinear	27	0.133	27	0.087
	Linear	29	0.200	29	0.151

Figure 1 demonstrates a notable interaction between the average ratings of the intervention and control groups ($F(2.430) = 30.771, p = 0.000$), suggesting that the groups exhibited significant differences in the rate of change in their decision-making skills from before the intervention to after the intervention. A unidirectional analysis of variance (ANOVA) also demonstrates statistically significant variations in group decision-making. The intervention nonlinear group experienced significant changes in decision making, with a mean score of 2.43 before testing and a mean score of 3.31 after testing. The linear intervention group cohort experienced a significant decrease in decision making ability, with the mean score dropping from 2.33 before testing to 2.08 after testing. No significant differences exist between the pre- and post-test results for both the first control group ($M=2.26$) and the second control group ($M=2.26$). This is additionally supported by the paired sample t-test, which demonstrated a statistically significant disparity.

The study found significant changes in decision making among the participants in the intervention nonlinear group ($t(27); p = 0.000$). The paired sample t-test conducted on the intervention linear group revealed a statistically significant difference in decision making ($t(29); p = 0.000$). In contrast, there were no notable differences in decision making among the control group ($t(26); p = 0.961$).

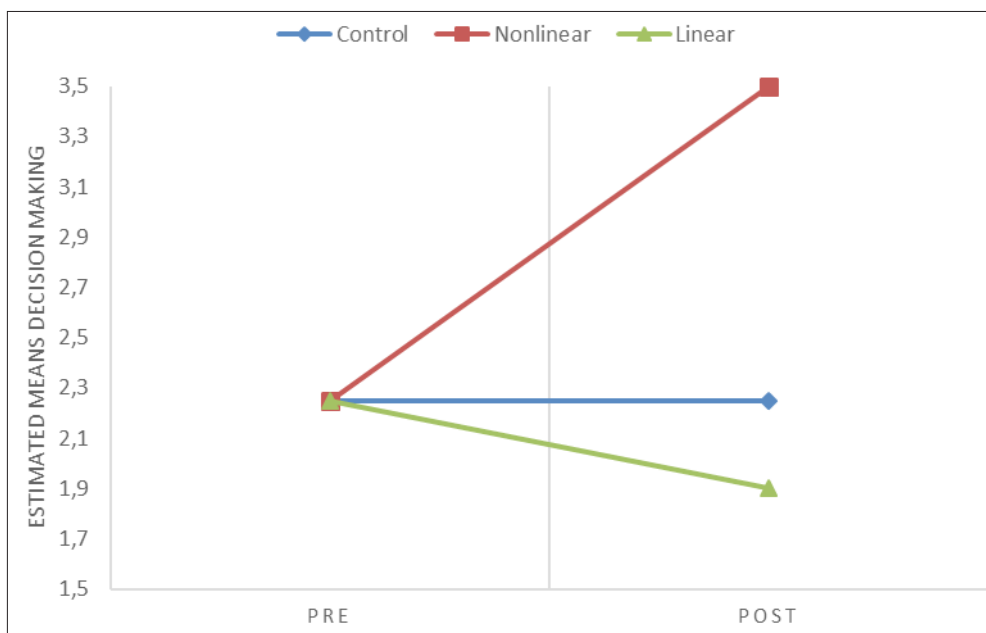


Figure 1. Comparative decision-making indicator testing students in the experimental and control group (or intervention group) before and after the experiment

As shown in Figure 2, there was a significant interaction between the intervention and control groups' mean scores. ($F(2.386) = 9.436, p = 0.000$), indicating that there were significant differences between the groups in the rate of change from pre-intervention to post-intervention in their communication. A one-way ANOVA also reveals significant group differences in communication. There are substantial incremental shifts in communication from before ($M=2.38$) to after testing ($M=3.66$) in the intervention nonlinear group group. The linear intervention group experienced a reduction in communication from before ($M=2.55$) to after testing ($M=2.33$). Similarly, the control group exhibited a decrease in their pre-test ($M=2.28$) and post-test ($M=2.19$) scores. This is also corroborated by the paired sample t-test, which demonstrated statistically significant deviation in communication in the nonlinear intervention group ($t(27); p 0.0001$). Paired sample t-test in the intervension linear group also showed a significant differences in communication ($t(29); p = 0.001$). There were no significant differences in communication in the control group ($t(26); p = 0.266$).

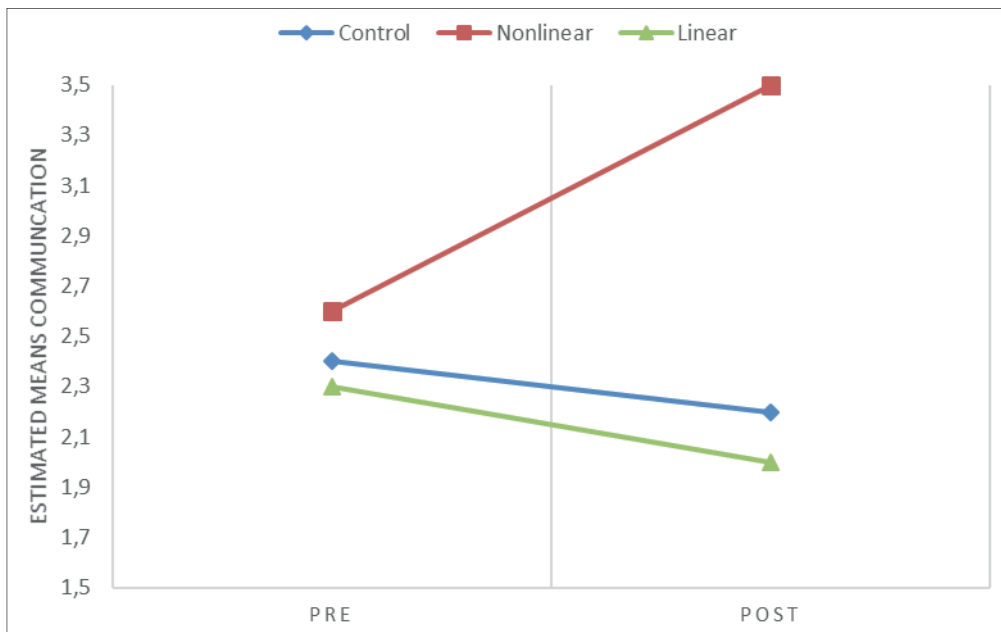


Figure 2. Significant interaction between the intervention and control groups' mean scores

DISCUSSION

The hybrid learning approach based on nonlinear pedagogy prioritizes the decision-making variable as a means to enhance efficacy. The decision-making process in this lesson involves strategic elements, such as executing passes, dribbling, and shooting towards the goal (Práxedes et al., 2018).

Through the manipulation of task conditions, numerous games can be adjusted to facilitate learning and enable players to adapt to diverse practice scenarios. This scenario closely resembles a game characterized by substantial ambiguity regarding the adversary's behavior. By altering varied work conditions, athletes can adapt to the diversity of practice through numerous customized games. Learning that simulates genuine game scenarios by incorporating uncertainty over the behaviors of the opponent (Araújo et al., 2019). Additionally, it enables pupils to enhance their capacity for making informed decisions in the process of learning (Casey & MacPhail, 2018; Harvey et al., 2020).

Communication variables enhance the efficacy of nonlinear pedagogical learning models. Students are unable to acquire knowledge autonomously without the context of developing motor skills. When students in the nonlinear pedagogy group were prompted to discuss aspects of communication with friends and teachers that they found favorable in this learning approach, one student expressed their appreciation for the opportunity to freely voice their opinions. The student claims that his peers hardly heed his opinion, but they do listen to it when he speaks. An important aspect emphasized in the nonlinear approach is the affective component, where the hybrid model enhances students' communication skills. By assuming various roles such as coaches, managers, players, and spectators, students are trained to effectively communicate not only with their peers, but also with teammates, opponents, and coaches (Opstoel et al., 2020; Sanderson et al., 2017).

The nonlinear learning design perspective is further characterized by students assuming several roles in sports, facilitating communication among students. The most efficient method of including communication is through the creative expression of students' thoughts, which fosters the development of their thinking, enhances their vocabulary, and promotes the appropriate use of words (Alawamleh et al., 2022; Shaykhislamov, 2020). In the context of nonlinear learning, students who assume certain responsibilities experience increased cognitive freedom to engage in creative expression of their opinions and ideas. Additionally, they are motivated to excel within a team or group setting.

Following their involvement in physical education, children in the nonlinear pedagogy intervention group shown substantial progress in their decision-making and communication abilities. These findings indicate that students who participate in the nonlinear pedagogy intervention group have notable improvements in their decision-making and communication skills, specifically in the context of sports learning. Sports education enhances students' cognitive abilities, including decision-making, communication, skill development, and creativity (Olson et al., 2017; Práxedes

et al., 2018). Specialized sports education promotes pupils' independent problem-solving abilities. This method utilizes collective learning through the use of invasion games. Students acquire the capacity to apply their decision-making skills in order to tackle a variety of difficulties associated to games (Green et al., 2021). By incorporating hybrid games that include teaching games of understanding, sports education, and cooperative learning, students can actively engage in and get pleasure from their physical education lessons (Green et al., 2021), It significantly increases their ability to make decisions and communicate effectively.

Physical education exerts a beneficial influence on the decision-making and learning capacities of elementary school students. Sports competitions serve as real-life scenarios that foster a sense of responsibility in communication skills and cultivate students' ability to make informed decisions.

CONCLUSION

The intervention class experienced enhanced decision-making skills following the implementation of a nonlinear pedagogy-based invasion game learning. Based on the findings of the two-way ANOVA, one-way ANOVA, and paired sample t-test, which have F values of 0.05 ($F = 0.000 < 0.05$) and ρ values less than 0.05 ($\rho = 0.000 < 0.05$), there is a statistically significant difference between the two groups.

The experimental class experienced an improvement in their communication abilities following the implementation of a nonlinear pedagogy-based invasion game learning therapy. This is demonstrated by the outcomes of the two-way ANOVA, one-way ANOVA, and paired sample t-test, which exhibit F values less than 0.05 ($F = 0.000 < 0.05$) and ρ values less than 0.05 ($\rho = 0.000 < 0.05$), there is a notable difference.

Disclosure statement

The authors of this research have no financial stake or received any financial gain from it.

Conflict of interest

The authors state no conflict of interest.

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Primljen: 06. januar 2024. / Received: January 06, 2024

Prihvaćen: 23. april 2024. / Accepted: April 23, 2024

