Critical thinking ability and learning independence: predictors of Physical Education academic achievement

Capacidad de pensamiento crítico e independencia en el aprendizaje: predictores del rendimiento académico en Educación Física

Authors

Bagas Listyo Cahyo Putro [1]
Suhadi [2]
Amat Komari [3]
Ngatman [4]
Hedi Ardiyanto Hermawan [5]
Tri Ani Hastuti [6]
Wawan Sundawan Suherman [7]
Dimyati [8]
Amri Hartanto [9]

[1, 2, 3, 4, 5, 6, 7, 8, 9] Yogyakarta State University (Indonesia)

Corresponding author:
Bagas Listyo Cahyo Putro
bagaslistyo.2024@student.uny.ac.id

How to cite in APA

Putro, B. L. C., Ngatman, N., Hermawan, H. A., Hastuti, T. A., & Hartanto, A. (2025). Critical thinking ability and learning independence: predictors of Physical Education academic achievement. *Retos, 73*, 360-374. https://doi.org/10.47197/retos.v71.110391

Abstract

Introduction: Academic ability plays a crucial role in student success, particularly in mastering critical thinking skills. Students with strong academic performance are typically better at formulating ideas and solving problems logically. In the context of Physical Education (PE), cognitive and affective skills such as critical thinking and learning independence are essential for academic achievement.
Objective: This study aims to examine the relationship between critical thinking skills and learning independence with academic achievement in Physical Education.
Methodology: This is a correlational study involving 128 eleventh-grade students (72 males, 56 females; aged 14–15 years) from Senior High School 1 Pleret. Data on critical thinking and learning independence were collected using Likert-scale questionnaires. Academic achievement was measured using PE report card scores. Data were analyzed using SPSS version 21 with a significance level of $p < 0.05$.
Discussion: The findings indicate that both critical thinking skills ($p = 0.000$) and learning independence ($p = 0.001$) significantly affect academic achievement in PE. Together, these variables contributed 45.60% to the variance in PE academic performance. These results affirm the importance of fostering cognitive and independent learning skills within PE instruction.
Conclusions: Critical thinking and learning independence significantly influence PE academic achievement. Therefore, integrating these skills into PE curricula is recommended. Future development of instructional models should focus on enhancing students' critical thinking and independence to support active engagement and academic accountability across learning activities.

Keywords

Critical thinking skills, learning independence, Physical Education academic achievement.

Resumen

Introducción: La capacidad académica es un factor determinante en el éxito estudiantil, especialmente en el desarrollo del pensamiento crítico. Los estudiantes con buen rendimiento académico suelen ser más competentes en la formulación de ideas y en la resolución lógica de problemas. En la asignatura de Educación Física, estas habilidades cognitivas y afectivas son esenciales para el logro académico.
Objetivo: El objetivo de este estudio es analizar la relación entre las habilidades de pensamiento crítico y la independencia en el aprendizaje con el rendimiento académico en Educación Física.
Metodología: Este estudio es de tipo correlacional. La población estuvo compuesta por 128 estudiantes de grado XI (72 hombres y 56 mujeres, edad 14–15 años) del Colegio Secundario 1 de Pleret. Se utilizaron cuestionarios tipo Likert para medir el pensamiento crítico y la independencia en el aprendizaje. El rendimiento académico se evaluó mediante las calificaciones en Educación Física. Se utilizó el software SPSS versión 21 con un nivel de significancia de $p < 0.05$.
Discusión: Los resultados muestran que tanto el pensamiento crítico ($p = 0.000$) como la independencia en el aprendizaje ($p = 0.001$) influyen significativamente en el rendimiento académico en Educación Física. Ambas variables explican el 45.60% de la varianza.
Conclusiones: El pensamiento crítico y la independencia en el aprendizaje son factores importantes en el rendimiento académico en Educación Física. Se recomienda integrarlos en el diseño didáctico para fomentar una participación activa y el desarrollo de competencias cognitivas responsables.

Palabras clave

Habilidades de pensamiento crítico, independencia en el aprendizaje, rendimiento académico en Educación Física.

Introduction

Education has progressed and developed in the 21st century (Festiawan et al., 2024; Kurniawan et al., 2024). The 21st-century skills are essential that everyone must master in order to succeed in facing challenges, problems, lives, and careers in the 21st century (Encinas, González, & Martín, 2021; Taningrum, Kriswanto, Pambudi, & Yulianto, 2024). Students are expected to develop high level of thinking skills in accordance with Society 5.0 (Dupri, Suherman, Budiana, & Juliantine, 2024).

The development and progress of a nation is influenced by the quality of education. Education is a strategic means and vehicle in the development of human resources. Therefore, education must receive serious attention and handling. Improvements in the education sector can be made by paying attention to learning activities in schools through curriculum improvement. Curriculum improvement from the 2013 curriculum to the Merdeka Curriculum is a careful step in responding to challenges in the field of education in Indonesia. The Merdeka Curriculum is a rearrangement in the national education system in Indonesia in order to welcome the changes and progress of the nation in order to adapt to changing times. In the Merdeka Curriculum, there are competencies of the Pancasila Student profile, namely independence and critical thinking (Marsidin, 2022).

Critical thinking skills and learning independence are one of the factors that determine student success in academic achievement. Students with good academic ability will be more competent in constructing ideas and solving problems logically (Mahanal, Zubaidah, Sumiati, Sari, & Ismirawati, 2019). Likewise with Physical Education, that Physical Education from the perspective of motor behavior, aspects such as cognition, emotion, communication, and culture can be addressed, which are fundamental to the formation of an individual in an integral way (Rodriguez Rodriguez, Alvarez-Seoane, Arufe-Giráldez, Navarro-Paton, & Sanmiguel-Rodríguez, 2022; Yani et al., 2024). Physical Education subjects are also designed to instill self-confidence (Wainwright, Goodway, Whitehead, Williams, & Kirk, 2018), help learners understand the importance of rules and abide by them as a way to promote discipline and teamwork, improve skills (Barker, Nyberg, & Larsson, 2021), and foster a spirit of cooperation among learners (Charlina et al., 2024; Yaakop, Koh, & Mohammad Yasin, 2023). The subject of Physical Education needs to be given greater value within the school environment, as it can contribute to the health of all students in addition to the necessary learning (de Andrade et al., 2023).

The top priority of an education system is to educate students on how to learn and think critically. Critical thinking is a thinking skill that is associated with active activity because it involves a question and answer process. It is a higher-order thinking skill, as it encompasses the evaluation and creation levels of cognitive development (Wechsler et al., 2018). Critical thinking is an essential skill that needs to be developed in students at school because it enables them to analyze information deeply, evaluate different perspectives, and make decisions based on logical reasoning (Yuliawan, Suherman, & Nopembri, 2024). Critical thinking in learning encourages students to be actively involved in discussions, asking and answering questions, thinking critically, explaining each answer proposed (López et al., 2020). A child who thinks critically is able to analyze and evaluate any information he receives (Tao et al., 2021).

Critical thinking skills are needed by students in dealing with problems in everyday life (Changwong, Sukkamart, & Sisan, 2018). Critical thinking is an ability possessed by all individuals, which can be measured, trained, and developed. One's critical thinking is inseparable from one's way of reasoning about what one is doing (Thamrin, Gustian, Suhardi, Zhongfulin, & Suryadi, 2024). The concept of critical thinking is a multifaceted notion widely debated and defined in various ways in the academic literature, influenced by various theoretical frameworks and adapted to different contexts. Definitions of critical thinking share common elements. In essence, critical thinking is understood as a complex and holistic cognitive process whose purpose is to explore statements or problems in order to reach a valid conclusion or select the alternative with the highest probability of success (Morancho, 2024).

The study Marnı, Alıman, & Harsıatı, (2020) showed that students who have the ability to think critically will be able to easily examine the problems faced, search for and choose the solution at hand, search and students can choose the right, logical and useful solution, someone who has this critical thinking ability will be useful, one of which students have a role as a provision to face the future. Thus, critical thinking is important as a measure of student learning activities. There is no significant difference in students' critical thinking skills in gender differences and knowledge groups. The results showed that 22 sub-indicators of students' critical thinking were found to be similar in gender and 20 sub-indicators were

also found to be similar in knowledge groups. This research supports the new paradigm that students regardless of gender and knowledge group need critical thinking skills.

However, some previous studies have revealed that students' critical thinking tends to be unsatisfactory (Irwanto, Rohaeti, & Prodjosantoso, 2019), even in some empirical research. For example, that students' critical thinking is at a low level (Akgun & Duruk, 2016). Similarly, reporting inadequate critical thinking among students (Bakir, 2015). In fact, critical thinking is closely related to academic achievement, the ability to write (Soodmand Afshar, Movassagh, & Radi Arbabi, 2017). Critical thinking skills are related to various variables; the learning environment, the social context of learning, and the teaching style of the teacher. Thus, teachers need to train students in improving their critical thinking skills by using learning strategies that stimulate students to think critically (Ahdhianto, Marsigit, & Nurfauzi, 2020).

While there is agreement that critical thinking is a human cognitive process that allows one to use a specific set of cognitive skills, there is significant controversy over which skills should be taught to develop such thinking. Researchers disagree about the skills that make someone a critical thinker, however, it seems clear from the literature that there is general agreement that critical thinking includes a range of mental processes and skills such as interpretation, analysis, evaluation, inference, explanation, and self-regulation (Alsaleh, 2020).

In addition to the ability to think critically, independence is needed by students. Learning independence is the most important thing in a learning process. Learning independence is a learning activity that takes place and is more driven by its own ability, its own choice and compares itself with its learning activities (Widiyanti & Setiyawati, 2022). Students who have learning independence will be more active in learning activities. Therefore, they have the initiative to seek new experiences through independent learning activities without the help of friends or teachers (Davis, Chen, Van der Zee, Hauff, & Houben, 2016; Maldonado-Mahauad, Pérez-Sanagustín, Kizilcec, Morales, & Munoz-Gama, 2018; Wong, Khalil, Baars, de Koning, & Paas, 2019).

Independence owned by students is needed to foster self-confidence and faster in receiving learning materials, thus shaping the character of students for the better. Independence is the ability to break away from dependence on others in carrying out daily activities or tasks on their own or with a little guidance according to the stage of ability and capacity (Wijaya, Darizal, Sabillah, Annasai, & Fitri, 2024). Learning independence is a process in which students control their own learning process and the objectives of the learning. Learning independence is an activity of student awareness to want to learn without coercion from the surrounding environment in order to realize responsibility as a student in facing learning difficulties (Ananda, 2019). Learning independence is related to learning activities that take place more driven by their own will, their own choice and their own responsibility in learning, learning independence is also related to the thrust of intensive, directed and creative learning activities (Peacock & Cowan, 2018).

Research results show that learning independence affects math learning outcomes (Harahap, 2024; Nasution & Pasaribu, 2021) and accounting (Astri, Nurdin, & Suroto, 2023). There is an influence between learning independence and math problem solving ability. Learning independence is one of the important factors in determining student learning outcomes because those who have good independence will find their own concepts and ways of learning, so they can understand and be able to solve problems (Yasin et al., 2020). Students with high learning independence are better than low independence on learning outcomes (Ananda, 2019).

Based on the results of observations of students, it shows that (1) the critical thinking skills possessed by students are still low, this is reflected in the results of observations, namely in general, students are still very dependent on the teacher. Dependence on the teacher in the sense that when the teacher presents the material and gives the test, students are less critical in solving it, sometimes still asking the teacher how the formula will be used, what to do next, even though the teacher has previously provided an explanation of the material. Many factors influence this, but one of them is the lack of critical thinking skills so it is difficult to solve it. (2) learning independence has not entirely appeared in students in the teaching and learning process. From the results of observations, some students already have learning independence, meaning that some do not. One of the attitudes shown by students in the classroom who do not have learning independence is that they still often ask their friends, even when given homework

there are still many who copy from their friends. This means that students do not have the awareness to complete tasks independently.

Based on some previous findings and facts in the field, there are problems related to critical thinking skills and learning independence. Both variables are still very rare or even not found results in relation to Physical Education academic achievement. So this study aims to reveal the relationship of critical thinking skills and learning independence to Physical Education academic achievement.

Method

Participants

This research was conducted in junior high schools in Indonesia. The population in this study were XI grade students at Senior High School 1 Pleret which amounted to 128 students (Male 72, Female 56, age ± 14-15 years). The sample technique is done Simple Random Sampling. Simple random sampling is a probability sampling technique that involves randomly selecting a subset of a population, where each member of the population has an equal chance of being selected. Inclusion criteria for adolescent students in this study are not having disease limitations.

Procedure

This type of research is correlational approach. Where this research wants to prove the relationship of critical thinking skills and learning independence to Physical Education academic achievement. Data collection instruments for critical thinking skills using a rubric developed by Greenstein (Fatmawati, Zubaidah, & Mahanal, 2019). The assessment of critical thinking skills consisted of 4 scores (1-4) as a reference to examine each item with criteria (4 = perfect, 3 = good, 2 = enough, 1 = less), consisting of apply, evaluate, use data to develop critical insights, analyze, synthesize. The researcher then conducted a Cronbach's alpha reliability analysis which amounted to 0.821. There are six indicators of independence instruments, namely having their own initiative, formulating learning goals, diagnosing learning goals, identifying learning resources or literature, choosing and applying appropriate learning strategies, evaluating learning outcomes. The instrument uses a four-choice Likert scale (strongly agree, agree, disagree, and strongly disagree) (Eriyanto, Roesminingsih, & Soeherman, 2021). The researcher then conducted a Cronbach's alpha reliability analysis which amounted to 0.784. The instrument used to determine the academic achievement of Physical Education is based on the report card scores of Physical Education subjects.

Data analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 21. The statistical analysis used is descriptive statistics, inferential statistics consisting of normality, linearity, and multiple regression tests. The level of statistical significance was set at p-value <0.05.

Results

The results of descriptive analysis of Critical Thinking Ability, Learning Independence, and Physical Education academic achievement are presented in Table 1.

Table 1. Descriptive statistics

Variable	Mean ± SD
Critical Thinking Ability	44.93 ± 9.49
Learning Independence	32.80 ± 2.27
Physical Education Academic Achievement	78.04 ± 4.76

Based on Table 1, obtained data on Critical Thinking Ability (44.93 ± 9.49), Learning Independence (32.80 ± 2.27), and Physical Education Academic Achievement (78.04 ± 4.76), shows that the average

value of Critical Thinking Ability, Learning Independence, and Physical Education academic achievement is greater than the standard deviation value, so this data deviation can be said to be good.

Normality Test

The normality test uses the Kolmogorov-Smirnov test, namely by looking at the Asymp. Sig (2-tailed) residual variable if the value is above 0.05, it can be said that the data is normally distributed. A summary of the normality test results is presented in Table 2.

Table 2. Normality test analysis results

Variable	Sig.
Critical Thinking Ability	0.183
Learning Independence	0.707
Physical Education Academic Achievement	0.126

Based on the results in Table 2, it shows that the data of Critical Thinking Ability (p-value 0.183 > 0.05), Learning Independence (p-value 0.707 > 0.05), and Physical Education Acedemic Achievement (p-value 0.126 > 0.05), which means the data is normally distributed.

Linearity Test

Linearity testing is done through the F test. The relationship between the independent variable (X) and the dependent variable (Y) is declared linear if the p-value> 0.05. The results of the linearity test can be seen in Table 3.

Table 3. Linearity test analysis results

Variable Independent	Variable Dependent	Sig.
Critical Thinking Ability	Physical Education	0.284
Learning Independence	Academic Achievement	0.312

Based on the results in Table 3 shows that the data of Critical Thinking Ability to Physical Education Academic Achievement (p-value 0.284 > 0.05), and Learning Independence to Physical Education Academic Achievement (p-value 0.326 > 0.05). So, it can be concluded that the relationship between the independent variable and the dependent variable is linear.

Hypothesis Test Results

Testing the hypothesis of the relationship between coach leadership type and coach-athlete relationship on mental toughness is done with t test analysis (partial) and F test (simultaneous), the results are as follows:

Table 4. Partial test analysis results (t test)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	48.115	4.809		10.005	.000
Critical Thinking Ability	.228	.043	.453	5.287	.000
Learning Independence	.600	.180	.286	3.340	.001

Based on the analysis results in Table 4 above, it can be explained as follows.

1. The critical thinking ability variable on physical education academic achievement obtained a p-value of 0.000 <0.05, so that critical thinking ability has a significant effect on physical education academic achievement. The correlation is positive, meaning that the better the ability to think critically, the better the academic achievement of Physical Education.
2. The learning independence variable on Physical Education Academic Achievement obtained a p-value of 0.001 <0.05, so that learning independence has a significant effect on Physical Education

academic achievement. The correlation is positive, meaning that the better the learning independence, the better the academic achievement of Physical Education.

Table 5. F test analysis results (Simultan)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1441.810	2	720.905	58.371	.000[a]
Residual	1667.311	135	12.350		
Total	3109.121	137			

Based on the analysis results in Table 5, the p-value is 0.000 <0.05, so there is a significant influence between critical thinking skills and learning independence on Physical Education academic achievement. It can be concluded that the regression model chosen is feasible to test the data and the regression model can be used to predict that critical thinking ability and learning independence together have a significant effect on Physical Education academic achievement.

The results of the analysis of the Coefficient of Determination (R^2) of physical activity, Critical Thinking Ability, Learning Independence on Physical Education academic achievement are presented in Table 6.

Table 6. Results of the coefficient of determination analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.681[a]	.464	.456	3.51432

Based on the Coefficient of Determination (R2) in Table 6, it shows that the Adjusted R Square coefficient of determination is 0.456. This means that the contribution of critical thinking ability variables and learning independence to Physical Education academic achievement is 45.60%, while the remaining 54.40% is influenced by other factors outside this study.

Discussion

The results showed that critical thinking skills have a significant effect on physical education academic achievement. The correlation is positive, meaning that the better the critical thinking ability, the better the academic achievement of Physical Education. The results showed that critical thinking ability has a positive effect on students' academic achievement in learning Mathematics (Tanujaya, Mumu, & Margono, 2017). The results showed that there is a relationship between critical thinking skills and learning achievement (Fatmawati et al., 2019). The results show that critical thinking and all components of reflective thinking positively and significantly predict achievement with habitual action having the lowest impact and reflection showing the highest influence. Self-monitoring indirectly exerts a positive influence on achievement through comprehension and reflection. It was also found that among the four subscales of reflective thinking, reflection and critical reflection predicted critical thinking positively and significantly (Ghanizadeh, 2017).

Students with low thinking skills have below-average Physical Education learning outcomes (Whittle, Benson, Ullah, & Telford, 2018). Critical thinking skills are individual abilities used to analyze arguments and provide interpretations based on rational perception, analysis of assumptions, and logical interpretation. Critical thinking can stimulate students to solve problems related to learning materials. Critical thinking ability is thinking critically about the information available to achieve a deep understanding (Supena, Darmuki, & Hariyadi, 2021). These skills, of course, can help students to deal effectively with social problems, scientific problems, and practical problems. Therefore, these skills can be integrated into the learning process through exercises and simulations (Von Colln-Appling & Giuliano, 2017).

Teaching students to have a critical thinking attitude in teaching and learning is the most important and considerable challenge today (Dekker, 2020). Physical education has a unique way of providing value learning during the learning process, namely through motion learning which in the motion learning process will occur in the process of increasing students' critical thinking skills which are trained when students are faced with problems or failures in completing motion tasks. Critical thinking skills are

developed in physical education through a learning environment that encourages experiences that direct students to answer questions posed by the teacher, encourage students to ask questions, develop solutions, put forward ideas, reflect and provide reasoned and defensible suggestions to be used as a decision, and develop personal and social skills (Pill & SueSee, 2017).

Physical education supports students to learn by thinking critically. This is because physical activity allows individuals to apply new strategies, try new movements and evaluate the value of responses immediately students can be challenged to come up with unique solutions to movement problems, create new versions of games, and think about issues related to fitness and health. Critical thinking is the ability to understand assumptions, values, attitudes and beliefs. Almost all approaches take critical thinking as the process begins when thinking begins in the mind and ends when it turns into behavior (Bulgurcuoglu, 2016). People who are able to think critically are people who always form concepts in their thinking then the results of thinking from these concepts will be carried out as an analytical study to be decided and actions to solve problems, especially motion problems in physical education learning.

Improving students' analytical thinking skills does not occur automatically, but there is engineering intervention by the teacher in various ways, such as providing data visualization and graphics (Friskawati & Supriadi, 2022; Stamatel, 2015), facilitating students to interact with colleagues from different cultures (Lee, 2017), using student worksheets in learning (Lestari, Rahmawati, & Handayani, 2021) or through grammatical (Youjun & Xiaomei, 2022). For example, suppose the teacher uses the Scientific Learning Model in a small ball game. In that case, the teacher first divides students into groups with various cultural and gender backgrounds (3-5 people) to encourage cross-cultural interaction. Observing activities are marked by the teacher displaying data of numbers, sentences, videos, pictures, and graphics and guiding students to make observations and differentiate, organize, and attribute data from their observation activities in group discussions. The next step is that the teacher guides and stimulates students to submit questions based on thinking processes and grammatically differentiating, organizing, and attributing about the subject matter. Third, the teacher guides students to conduct experiments/gather information/demonstrate small ball game material in play groups—the fourth step is associating the various successes and failures of students in small ball games. Finally, students communicate their learning outcomes using student worksheets (written and or orally) to their colleagues and the teacher (Blegur, Yustiana, Taufik, Ilham, & Hardiansyah, 2023).

The results showed that learning independence has a significant effect on Physical Education academic achievement. The correlation is positive, meaning that the better the learning independence, the better the academic achievement of Physical Education. The increase in student achievement is influenced by learning independence, where the higher the learning independence, the learning achievement will increase. There is a positive and significant influence between student learning discipline and student learning independence on economic learning outcomes (Refliana & Pertiwi, 2023). Self-directed learning is an active and constructive process in which students set learning goals and attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by goals as well as contextual features of their environment (Jansson & Ene, 2016). In addition, the drive and desire from within students can lead students to succeed in their learning (Pribadi & Chung, 2023). This happens because students can organize themselves to achieve the knowledge they need without relying on others (Van Laer & Elen, 2019).

Students who have student learning independence tend to learn better, are able to monitor, evaluate, and organize their learning effectively, save time efficiently, are able to direct and control themselves in thinking and acting, and do not feel emotionally dependent on others. Students are able to analyze complex problems, able to work individually or cooperate with groups, and dare to express ideas because they have student learning independence Independent learning is not the absence of teachers or fellow students, or the absence of face-to-face meetings in class. Class. The main feature of independent learning is the development of students' ability to carry out a learning process that does not depend on factors such as teachers, friends, classes and others. The level of student learning independence can be determined based on the size of the initiative and responsibility of students to play an active role in terms of learning planning, learning and learning process, learning process and learning evaluation. The greater the active role of students in learning shows that these students have a high level of learning independence (Putra & Ikhsan, 2019).

Learning independence occurs because of support from parents and teachers. Teachers provide support in the form of assignments and provide all facilities for learning. In addition, teachers also provide teaching to students to increase knowledge. Learning independence is very important in the student learning process, problems that can occur due to low learning independence have an impact on decreasing student achievement, lack of student responsibility and dependence on others in making decisions or in doing school assignments. Research results show the extent to which students are able to manage their own learning can significantly improve their learning outcomes (Zheng & Zhang, 2020).

Factors influencing academic achievement beyond critical thinking skills and independent learning: (1) Internal factors: Factors that come from within the student, such as intelligence, interest, talent, and motivation. (2) External factors: Factors that come from outside the student, such as the family environment, school environment, and community environment. (3) Learning arrangement factors: Factors related to learning arrangements at school, such as teaching methods, discipline, teaching and learning facilities and infrastructure, and student grouping systems.

Critical thinking skills and independence are not only needed in Physical Education learning, but in all subjects. Critical thinking skills are needed by students in dealing with problems in everyday life (Changwong et al., 2018). Students who have the ability to think critically will be able to easily examine the problems faced, search for and choose the solution at hand, search and students can choose the right, logical and useful solution, someone who has this critical thinking ability will be useful, one of which students have a role as a provision to face the future. Learning independence is the most important thing in a learning process. Learning independence is a learning activity that takes place and is more driven by its own abilities, its own choices and comparing itself with its learning activities (Widiyanti & Setiyawati, 2022). Research results show that learning independence affects math learning outcomes (Harahap, 2024; Nasution & Pasaribu, 2021) and accounting (Astri et al., 2023).

Regarding these influencing factors, we can categorize them into two main aspects: internal factors within the students themselves and external factors that surround the students. For instance, Smith et al. (2023) conducted a study with 302 adolescent participants and found that teenagers with attention deficit or hyperactivity disorders generally exhibit lower levels of learning motivation, which in turn affects their academic performance. The internal factors such as sleep (Hamvai et al., 2023; Jiménez Boraita, Gargallo Ibort, Dalmau Torres, & Arriscado Alsina, 2024), depression (Urbańska-Grosz, Walkiewicz, & Sitek, 2024), and disordered social media use (Sserunkuuma et al., 2023) also exert varying degrees of influence on academic performance.

The findings from this study on the influence of external factors on student learning achievement provide critical insights into how various elements outside the classroom significantly shape academic outcomes. The interpretation of these results highlights the intricate ways in which socio economic status, home environment, school environment, community context, and access to technology interplay to affect student learning. Previous research, such as that by Duncan, Kalil, and Ziol-Guest (2017), has extensively documented the strong link between socio economic status and educational outcomes. These studies highlight how higher socio economic status provides access to better educational resources, supportive learning environments, and additional academic opportunities, all of which enhance student performance.

Students from higher socio economic status backgrounds benefit from a wealth of resources that facilitate learning. These resources include access to quality educational materials, private tutoring, and extracurricular activities, which enhance cognitive skills and academic knowledge. Furthermore, higher socio economic status families often have the means to provide a conducive learning environment at home, such as quiet study spaces and educational technology. The stress associated with financial instability in lower socioeconomic status households can negatively affect students' concentration, motivation, and overall well-being, thereby impeding their academic performance.

The home environment is a critical determinant of student success, as evidenced by the significant correlation between parental involvement and academic achievement. Active parental engagement in a child's education manifested through practices such as helping with homework, attending school meetings, and setting high educational expectations fosters a supportive atmosphere that encourages learning. A structured and resource-rich home environment not only provides the necessary tools for academic tasks but also instills a sense of discipline and value for education. When parents are involved,

students are more likely to be motivated, develop better study habits, and achieve higher academic results.

The findings regarding the home environment and parental involvement align with Harris and Robinson (2016) framework on parental involvement, which posits that active family engagement in education positively influences student achievement. Parental involvement, particularly in the form of setting high educational expectations and providing a supportive home environment, is crucial for academic success. Our study's results support these conclusions, showing a significant correlation between parental involvement and student performance. The theoretical basis for these findings lies in the ecological systems theory by Bronfenbrenner (Crawford, 2020), which emphasizes the importance of the home environment as a microsystem that directly affects the child's development.

The school environment, encompassing factors such as teacher quality, school resources, and class sizes, plays a pivotal role in determining student learning outcomes. Highquality teachers are essential for effective instruction and student engagement. Teachers who are well-trained and experienced can employ diverse teaching strategies that cater to different learning styles, thus improving student comprehension and retention of material. Additionally, well-resourced schools with adequate facilities and smaller class sizes provide a more conducive learning environment, allowing for individualized attention and reduced distractions.

The community context, including neighborhood safety and community support, significantly influences student learning achievement. Students from safe and cohesive communities benefit from a sense of security and stability, which is crucial for focused and effective learning. Communities that offer supportive programs, such as after-school tutoring, recreational activities, and educational workshops, provide students with additional learning opportunities and social development. These programs help reinforce academic concepts, build confidence, and foster a sense of belonging and motivation. The influence of community factors on student achievement observed in this study aligns with research by Sampson (2017), which found that social cohesion and collective efficacy within communities contribute to better educational outcomes. Our results support the idea that students from supportive and safe communities perform better academically, reflecting the importance of a positive community context. Social networks and community resources significantly impact educational success.

Access to technology is increasingly recognized as a critical factor in modern education. Students with regular access to computers and the internet achieve higher academic outcomes, highlighting the importance of digital literacy and resources in today's learning environment. Technology provides students with access to a vast array of information, interactive learning tools, and educational software that can enhance understanding and engagement. However, the digital divide where students from lower socio economic status backgrounds have limited access to technology exacerbates educational inequalities. Ensuring equitable access to technology is crucial for leveling the playing field and allowing all students to benefit from digital learning resources.

For today's technology-driven, problem-riddled world, creative and critical thinking skills are vital for students who are faced with situations. In this purpose, idea generation, reflective judgment, selfregulation and attitude-disposition, which are both intuitive and teachable, are needed. For instance, in the idea generation phase, children can have an opportunity to look at their idea from various perspectives and expand them on a theme. In reflective judgement, analysing, synthesising, evaluating ideas from the idea generation phase become utilized as consistent with higher order thinking ability. It expands participant's creative thinking ability beyond their comfort zone. While in self-regulation phase monitoring and reflecting on progress and product are valued, during attitude disposition part, someone present idea while others not only listen but also add to the idea (Birgili, 2015).

In educational perspective both critical and creative thinking skills should be developed because in each branch of area, to analyze a discussion, to make inferences from meanings and comments, to make extensive and comprehensive reasoning and to judge toward assumptions are some competences through which every individual can evaluate what they see, hear or learn. Also, creating clear and convincing presentations should be one of the capabilities of the learners. As an illustration, how many individuals could ask if 2+2 = 4 consistently, or in which mathematical sets? Can negative words be understood as positive in the case of rhetoric speech? Why is there distributive property of multiplication over addition

but not that of division? How frequently "What is the reason behind…?" type of questions are asked or encouraged to be asked?

An initial model is proposed from critical thinking in physical education this model, critical thinking in physical education can be visualized as loosely configuring a four-step process: cognitive organizing, cognitive actions, cognitive outcomes, and psychomotor outcomes. In cognitive learning students need to be given the opportunity in inquiry or observation activities. However, to involve critical thinking, students must first given the opportunity to ask questions. Only during investigation and critical thinking skills can be activated through cognitive functions such as comparing, contrast, categorize, hypothesize, synthesize, estimate, and problem solving. Physical education learning which has a special role in the delivery of educational values through movement can also contribute to students' thinking abilities. Critical thinking does have a place in the psychomotor domain. Physical education and sports environment can provide support an environment for individuals to learn how to think critically. Students can be challenged to produce unique solutions for movement problems, making new versions of games, and thinking about issues related to fitness and health (Dupri, Risma, & Nazirun, 2020).

The process of motion learning in learning passing occurs in cognitive learning when students are confronted with the problem solving process for making decisions and confronted with several alternative answers available. In this process students come out at a higher level, because students judge several of each answer choices. Students are faced with decision making decisions. Learning that supports critical thinking is the one which uses questioning techniques that require students not only to repeat information (memorize), but also to analyze, synthesize, and evaluate information to solve problems and make decisions (think). Because critical thinking is a mental habit that necessitates students to think about their thinking and improving processes, it requires higher order thinking skills, not to memorize data or undertake what they read or were told without thinking critically.

Critical thinking has its position in the psychomotor (motion) domain. In this regard, Physical Education learning can provide a supportive environment for students to learn how to think critically. Describes an enriched learning environment in Physical Education as involving student choices, challenging and meaningful activities within the development zone of students, and providing supportive social interaction with sufficient time for learning – thus optimizing the opportunity for creative thinking, problem-solving, and critical thinking. Díaz et al. (2020) advocate the use of participatory educational approaches to foster an active, reflective and understanding attitude on the part of students in Physical Education, which favors their success in Physical Education classes.

The purpose of Physical Education is to maintain and improve the physical fitness of students (l Bayu, 2022). A quality Physical Education program has the potential for (at least) four unique contributions to the lives of students: (1) daily physical activity, (2) personal physical fitness level, (3) competency development in various physical and sports skills, and (4) necessary knowledge for an active and healthy lifestyle. In addition, physical fitness is an important indicator of the health status of children and teenagers, and of course a good predictor of health status in life (Cvejić, Pejović, & Ostojić, 2013). In the Physical Education teaching and learning process, the most important thing is to maximize the participation of students. This can happen if the learning environment supports students to feel safe, and comfortable, not feel tense and anxious, and be respected by the teachers.

Conclusions

The results revealed that critical thinking skills and learning independence have a significant effect on Physical Education academic achievement. Given their significance, critical thinking skills and learning independence have been recommended to be integrated into Physical Education learning. In the context of physical education, critical thinking skills and learning independence are very important to develop because they can help students identify movement problems and find solutions. Therefore, the development of learning models that can improve students' critical thinking skills and learning independence in Physical Education needs to be continued, because they are interrelated and prepare students to become good problem solvers and be able to make informed decisions and conclusions that are academically accountable and able to move actively in every lesson. Physical Education alone is certainly not enough, because the process of critical thinking skills requires a long and relatively long process and

needs support from all parties. The study's findings have practical implications for educators, policymakers, and parents. Educators should implement strategies that cater to diverse student needs, enhance parental involvement, and integrate technology into the curriculum. Policymakers are encouraged to address socioeconomic disparities, invest in school resources, and support community programs that benefit education. Parents are advised to foster supportive home environments and engage actively with schools to support their children's learning.

Learning activities must ensure students' survival skills and success in real life. Teachers must select and predict what skills are future demands and needs and immediately integrate them into their student's learning experiences, such as focusing their teaching on analytical, evaluation, or creating thinking skills (Suhadi et al., 2023). The results of this study provide empirical evidence that integrating analytical thinking in learning experiences and mastery of movement skills contributes to students' physical education learning outcomes. Teachers need to ensure that when students are involved in learning and mastering movement skills, students also operate thinking skills that differentiate, organize, and attribute their decisions when using their movement skill preferences in play experiences and games during learning. At the same time, the evaluation of student learning outcomes should ideally also be based on analytical thinking itself (besides assessing the mastery of movement skills and psychosocial activities) so that there is coherence between the use of analytical processes in various student learning activities while at the same time making the analytical process a parameter for assessing student learning outcomes because it is following the mandate of the Indonesian education curriculum.

Acknowledgements

The author appreciates the cooperation of all the enthusiastic subjects. The research was funded by the author.

References

Ahdhianto, E., Marsigit, H., & Nurfauzi, Y. (2020). Improving fifth-grade students' mathematical problem-solving and critical thinking skills using problem-based learning. *Universal Journal of Educational Research*, *8*(5), 2012–2021. https://doi.org/10.13189/ujer.2020.080539

Akgun, A., & Duruk, U. (2016). The investigation of preservice science teachers' critical thinking dispositions in the context of personal and social factors. *Science Education International*, *27*(1), 3–15. https://eric.ed.gov/?id=EJ1100164

Alsaleh, N. J. (2020). Teaching critical thinking skills: Literature review. *Turkish Online Journal of Educational Technology-TOJET*, *19*(1), 21–39. https://eric.ed.gov/?id=EJ1239945

Ananda, R. (2019). The effect of learning strategies and learning independence on learning outcomes in learning evaluation subject. *International Journal on Language, Research and Education Studies*, *3*(3), 340–350. https://jurnal.uinsu.ac.id/index.php/ijlres/article/view/5632

Astri, S. A., Nurdin, N., & Suroto, S. (2023). Learning motivation, family environment and learning independence on accounting learning outcomes. *Soedirman Economics Education Journal*, *5*(2), 90–107. https://doi.org/10.32424/seej.v5i2.9330

Bakir, S. (2015). Critical thinking dispositions of pre-service teachers. *Educational Research and Reviews*, *10*(2), 225–233. https://doi.org/10.12691/education-9-2-1

Barker, D., Nyberg, G., & Larsson, H. (2021). Introduction to the PESP special issue:'Developing movement capability in physical education.' *Physical Education and Sport Pedagogy*, *26*(3), 225–229. https://doi.org/10.1080/17408989.2021.1886272

Birgili, B. (2015). Creative and critical thinking skills in problem-based learning environments. *Journal of Gifted Education and Creativity*, *2*(2), 71–80. https://doi.org/10.18200/JGEDC.2015214253

Blegur, J., Yustiana, Y. R., Taufik, A., Ilham, M., & Hardiansyah, S. (2023). Integrating analytical thinking skills into physical education to improve student learning outcomes. *Jurnal Keolahragaan*, *11*(2), 180–190. https://doi.org/10.21831/jk.v11i2.61176

Bulgurcuoglu, A. N. (2016). Relationship between critical thinking levels and attitudes towards reading habits among pre-service physical education teachers. *Educational Research and Reviews*, *11*(8), 708–712. https://doi.org/10.5897/ERR2016.2713

Changwong, K., Sukkamart, A., & Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *Journal of International Studies*, *11*(2). https://doi.org/10.14254/2071-8330.2018/11-2/3

Charlina, C., Roziah, R., Ismail, S., Piliang, W. S. H., Siswanto, S., Setyawan, H., … Eken, Ö. (2024). Effective verbal communication in physical education learning and sports coaching to improve achievement and health: A systematic review. *Retos*, *56*, 1139–1147. https://doi.org/10.47197/retos.v56.107308

Crawford, M. (2020). Ecological Systems theory: Exploring the development of the theoretical framework as con-ceived by Bronfenbrenner. *J Pub Health Issue Pract*, *4*(2), 170. https://doi.org/10.33790/jphip1100170

Cvejić, D., Pejović, T., & Ostojić, S. (2013). Assessment of physical fitness in children and adolescents. *Facta Universitatis: Series Physical Education & Sport*, *11*(2). http://facta.junis.ni.ac.rs/pe/pe201302/pe201302-02.pdf

Davis, D., Chen, G., Van der Zee, T., Hauff, C., & Houben, G.-J. (2016). Retrieval practice and study planning in MOOCs: Exploring classroom-based self-regulated learning strategies at scale. *Adaptive and Adaptable Learning: 11th European Conference on Technology Enhanced Learning, EC-TEL 2016, Lyon, France, September 13-16, 2016, Proceedings 11*, 57–71. Springer. https://doi.org/10.1007/978-3-319-45153-4_5

de Andrade, M. S., Bicalho, A. V., da Silva Montalvão, A. V., Ferreira, C. E. A., Costa, D. G. D., da Silva, V. R., … da Silva Triani, F. (2023). Representações sociais dos professores de educação física sobre o autismo: análise de teses e dissertações defendidas em programas brasileiros de pós-graduação. *Retos, 48*, 327–332. https://doi.org/10.47197/retos.v48.95719

Dekker, T. J. (2020). Teaching critical thinking through engagement with multiplicity. *Thinking Skills and Creativity*, *37*, 100701. https://doi.org/10.1016/j.tsc.2020.100701

Díaz, Ó. L., Mediavilla, A. A., Santos-Pastor, M., & Muñoz, L. F. M. (2020). Las metodologías activas en Educación Física: Una aproximación al estado actual desde la percepción de los docentes en la Comunidad de Madrid. *Retos, 38*, 587–594. https://doi.org/10.47197/retos.v38i38.77671

Duncan, G. J., Kalil, A., & Ziol-Guest, K. M. (2017). Increasing inequality in parent incomes and children's schooling. *Demography*, *54*(5), 1603–1626. https://doi.org/10.1007/s13524-017-0600-4

Dupri, D., Risma, N., & Nazirun, N. (2020). Foster culture of critical thinking in physical education. *4th International Conference on Sport Science, Health, and Physical Education (ICSSHPE 2019)*, 30–33. Atlantis Press. https://doi.org/10.2991/ahsr.k.200214.009

Dupri, D., Suherman, A., Budiana, D., & Juliantine, T. (2024). Critical thinking skills to physical education: the influence of learning models and gender. *Retos, 59*, 1065–1070. https://doi.org/10.47197/retos.v59.108759

Encinas, M. C., González, R. P., & Martín, N. G. (2021). La promoción y la enseñanza de las habilidades del pensamiento profundo y visible en las sesiones de Educación Física en Educación Primaria. *Retos, 41*, 387–398. https://doi.org/10.47197/retos.v0i41.84139

Eriyanto, M. G., Roesminingsih, M. V, & Soeherman, I. K. (2021). The effect of learning motivation on learning independence and learning outcomes of students in the package c equivalence program. *IJORER: International Journal of Recent Educational Research*, *2*(4), 455–467. https://doi.org/10.46245/ijorer.v2i4.122

Fatmawati, A., Zubaidah, S., & Mahanal, S. (2019). Critical thinking, creative thinking, and learning achievement: How they are related. *Journal of Physics: Conference Series*, *1417*(1), 12070. IOP Publishing. https://doi.org/10.1088/1742-6596/1417/1/012070

Festiawan, R., Sumanto, E., Febriani, A. R., Permadi, A. A., Arifin, Z., Utomo, A. W., … Pratama, K. W. (2024). The hybrid learning system with project based learning: Can it increase creative thinking skill and learning motivation in physical education learning? *Retos, 56*, 1009–1015. https://doi.org/10.47197/retos.v56.105047

Friskawati, G. F., & Supriadi, D. (2022). Video analysis with youtube platform for Physical Education, Health, and Recreation students's Higher Order Thinking Skills (HOTs). *Journal Sport Area*, *7*(1), 96–103. https://doi.org/10.25299/sportarea.2022.vol7(1).7737

Ghanizadeh, A. (2017). The interplay between reflective thinking, critical thinking, self-monitoring, and academic achievement in higher education. *Higher Education*, *74*, 101–114. https://doi.org/10.1007/s10734-016-0031-y

Hamvai, C., Kiss, H., Vörös, H., Fitzpatrick, K. M., Vargha, A., & Pikó, B. F. (2023). Association between impulsivity and cognitive capacity decrease is mediated by smartphone addiction, academic procrastination, bedtime procrastination, sleep insufficiency and daytime fatigue among medical students: a path analysis. *BMC Medical Education*, *23*(1), 537. https://doi.org/10.1186/s12909-023-04522-8

Harahap, A. (2024). The Impact of student learning independence on the learning outcomes of class X students of SMK Al-Bukhori Rantauprapat. *International Journal Of Humanities Education and Social Sciences*, *3*(4). https://doi.org/10.55227/ijhess.v3i4.879

Harris, A. L., & Robinson, K. (2016). A new framework for understanding parental involvement: Setting the stage for academic success. *RSF: The Russell Sage Foundation Journal of the Social Sciences*, *2*(5), 186–201. https://doi.org/10.7758/RSF.2016.2.5.09

Irwanto, I., Rohaeti, E., & Prodjosantoso, A. K. (2019). Analyzing the relationships between preservice chemistry teachers' science process skills and critical thinking skills. *Journal of Turkish Science Education*, *16*(3), 299–313. https://doi.org/10.12973/tused.10283a

Jansson, I., & Ene, K. W. (2016). Nursing students' evaluation of quality indicators during learning in clinical practice. *Nurse Education in Practice*, *20*, 17–22. https://doi.org/10.1016/j.nepr.2016.06.002

Jiménez Boraita, R., Gargallo Ibort, E., Dalmau Torres, J. M., & Arriscado Alsina, D. (2024). Lifestyle habits, health indicators and sociodemographic factors associated with health-related quality of life and self-esteem in adolescents. *Clinical Child Psychology and Psychiatry*, *29*(2), 493–512. https://doi.org/10.1177/13591045231200661

l Bayu, W. (2022). learning: improving critical thinking and physical fitness in physical education. *Jurnal Ilmiah Pendidikan*, *41*(2), 308–320. https://doi.org/10.21831/cp.v41i2.38654

Lee, H.-J. (2017). Thinking style across cultures: An interview with Richard Nisbett. *Cross Cultural & Strategic Management*, *24*(1), 99–104. https://doi.org/10.1108/CCSM-10-2016-0181

Lestari, D. S., Rahmawati, I., & Handayani, D. E. (2021). Student worksheets based on HOTS in elementary school. *Indonesian Journal Of Educational Research and Review*, *4*(2), 352–358. https://doi.org/10.23887/ijerr.v4i2.30210

López, M., Jiménez, J. M., Martín-Gil, B., Fernández-Castro, M., Cao, M. J., Frutos, M., & Castro, M. J. (2020). The impact of an educational intervention on nursing students' critical thinking skills: A quasi-experimental study. *Nurse Education Today*, *85*, 104305. https://doi.org/10.1016/j.nedt.2019.104305

Mahanal, S., Zubaidah, S., Sumiati, I. D., Sari, T. M., & Ismirawati, N. (2019). RICOSRE: A learning model to develop critical thinking skills for students with different academic abilities. *International Journal of Instruction*, *12*(2), 417–434. https://doi.org/10.29333/iji.2019.12227a

Marnı, S., Alıman, M., & Harsıatı, T. (2020). Students' critical thinking skills based on gender and knowledge group. *Journal of Turkish Science Education*, *17*(4), 544–560. https://doi.org/10.36681/tused.2020.44

Marsidin, S. (2022). Strengthening Pancasila student profiles in independent learning curriculum in elementary school. *International Journal Of Humanities Education and Social Sciences*, *1*(6). https://doi.org/10.55227/ijhess.v1i6.183

Nasution, D. S., & Pasaribu, L. H. (2021). The influence of interest, independence and learning resources on student learning achievement in mathematics lessons. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, *4*(2), 2743–2747. https://doi.org/10.33258/birci.v4i2.1983

Peacock, S., & Cowan, J. (2018). Towards online student-directed communities of inquiry. *Journal of Further and Higher Education*, *42*(5), 678–693. https://doi.org/10.1080/0309877X.2017.1302569

Pill, S., & SueSee, B. (2017). Including critical thinking and problem solving in physical education. *Journal of Physical Education, Recreation & Dance*, *88*(9), 43–49. https://doi.org/10.1080/07303084.2017.1367741

Pribadi, B. A., & Chung, K. S. (2023). Designing online learning: Comparative study between Indonesian Open University and Korea National Open University. *International Journal of Instruction*, *16*(2). https://doi.org/10.29333/iji.2023.16234a

Putra, P., & Ikhsan, M. (2019). Mathematical reasoning ability and learning independence of high school students through problem based learning model. *International Journal for Educational and Vocational Studies*, *1*(3), 217–223. https://doi.org/10.29103/ijevs.v1i3.1596

Refliana, F., & Pertiwi, M. (2023). The effect of learning discipline and learning independence on economics learning outcomes of class X students. *Indonesian Journal of Education Research (IJoER)*, *4*(3), 58–63. https://doi.org/10.37251/ijoer.v4i3.585

Rodriguez Rodriguez, J., Alvarez-Seoane, D., Arufe-Giráldez, V., Navarro-Paton, R., & Sanmiguel-Rodríguez, A. (2022). Textbooks and learning materials in physical education in the international context: Literature review. *International Journal of Environmental Research and Public Health*, *19*(12), 7206. https://doi.org/10.3390/ijerph19127206

Sampson, R. J. (2017). Collective efficacy theory: Lessons learned and directions for future inquiry. *Taking Stock*, 149–167. https://doi.org/10.4324/9781315130620-6

Smith, Z. R., Flax, M., Becker, S. P., & Langberg, J. (2023). Academic motivation decreases across adolescence for youth with and without attention-deficit/hyperactivity disorder: Effects of motivation on academic success. *Journal of Child Psychology and Psychiatry*, *64*(9), 1303–1313. https://doi.org/10.1111/jcpp.13815

Soodmand Afshar, H., Movassagh, H., & Radi Arbabi, H. (2017). The interrelationship among critical thinking, writing an argumentative essay in an L2 and their subskills. *The Language Learning Journal*, *45*(4), 419–433. https://doi.org/10.1080/09571736.2017.1320420

Sserunkuuma, J., Kaggwa, M. M., Muwanguzi, M., Najjuka, S. M., Murungi, N., Kajjimu, J., … Griffiths, M. D. (2023). Problematic use of the internet, smartphones, and social media among medical students and relationship with depression: An exploratory study. *Plos One*, *18*(5), e0286424. https://doi.org/10.1371/journal.pone.0286424

Stamatel, J. P. (2015). How data visualization can improve analytical thinking in cross-national crime research. *International Journal of Comparative and Applied Criminal Justice*, *39*(1), 31–46. https://doi.org/10.1080/01924036.2014.961495

Suhadi, S., Handoko, R. D., Mawarti, S., Santoso, N., Antoni, M. S., & Andriyani, F. D. (2023). Teachers' lesson plan in the implementation of HOTS oriented physical education learning. *Jurnal Keolahragaan*, *11*(1), 131–139. https://doi.org/10.21831/jk.v11i1.59655

Supena, I., Darmuki, A., & Hariyadi, A. (2021). The influence of 4C (Constructive, Critical, Creativity, Collaborative) learning model on students' learning outcomes. *International Journal of Instruction*, *14*(3), 873–892. https://doi.org/10.29333/iji.2021.14351a

Tanujaya, B., Mumu, J., & Margono, G. (2017). The relationship between higher order thinking skills and academic performance of student in mathematics instruction. *International Education Studies*, *10*(11), 78–85. https://doi.org/10.5539/ies.v10n11p78

Tao, X., Li, X., Chen, W., Liang, T., Li, Y., Guo, J., & Qi, L. (2021). Self-adaptive two roles hybrid learning strategies-based particle swarm optimization. *Information Sciences*, *578*, 457–481. https://doi.org/10.1016/j.ins.2021.07.008

Thamrin, L., Gustian, U., Suhardi, S., Zhongfulin, W., & Suryadi, D. (2024). The implementation of contextual learning strategies to stimulate students' critical thinking skills. *Retos, 53*, 52–57. https://doi.org/10.47197/retos.v53.102501

Urbańska-Grosz, J., Walkiewicz, M., & Sitek, E. J. (2024). Is there sufficient evidence for the association between executive dysfunction and academic performance in adolescents with major depressive disorder?: a systematic review. *European Child & Adolescent Psychiatry*, *33*(7), 2129–2140. https://doi.org/10.1007/s00787-023-02275-9

Van Laer, S., & Elen, J. (2019). The effect of cues for calibration on learners' self-regulated learning through changes in learners' learning behaviour and outcomes. *Computers & Education*, *135*, 30–48. https://doi.org/10.1016/j.compedu.2019.02.016

Von Colln-Appling, C., & Giuliano, D. (2017). A concept analysis of critical thinking: A guide for nurse educators. *Nurse Education Today*, *49*, 106–109. https://doi.org/10.1016/j.nedt.2016.11.007

Wainwright, N., Goodway, J., Whitehead, M., Williams, A., & Kirk, D. (2018). Laying the foundations for physical literacy in Wales: The contribution of the Foundation Phase to the development of physical literacy. *Physical Education and Sport Pedagogy*, *23*(4), 431–444. https://doi.org/10.1080/17408989.2018.1455819

Wechsler, S. M., Saiz, C., Rivas, S. F., Vendramini, C. M. M., Almeida, L. S., Mundim, M. C., & Franco, A. (2018). Creative and critical thinking: Independent or overlapping components? *Thinking Skills and Creativity*, *27*, 114–122. https://doi.org/10.1016/j.tsc.2017.12.003

Whittle, R. J., Benson, A. C., Ullah, S., & Telford, A. (2018). Investigating the influence of question type and cognitive process on academic performance in VCE physical education: A secondary data analysis. *Educational Research and Evaluation*, *24*(8), 504–522. https://doi.org/10.1080/13803611.2019.1612256

Widiyanti, R. P., & Setiyawati, E. (2022). Literature study: Analysis of student learning independence and student learning outcomes in online learning in Elementary Schools. *Academia Open*, *6*, 10–21070. https://doi.org/10.21070/acopen.6.2022.2416

Wijaya, R. G., Darizal, D., Sabillah, M. I., Annasai, F., & Fitri, E. S. M. (2024). The effect of playing playdough and collage on improving fine motor skills in early childhood in terms of independence. *Retos, 51,* 1146–1152. https://doi.org/10.47197/retos.v51.101396

Wong, J., Khalil, M., Baars, M., de Koning, B. B., & Paas, F. (2019). Exploring sequences of learner activities in relation to self-regulated learning in a massive open online course. *Computers & Education*, *140*, 103595. https://doi.org/10.1016/j.compedu.2019.103595

Yasin, M., Huda, S., Putra, F. G., Syazali, M., Umam, R., & Widyawati, S. (2020). IMPROVE learning model and learning independence: influence and interaction on mathematics problem-solving abilities in islamic boarding school. *Journal of Physics: Conference Series*, *1467*(1), 12003. IOP Publishing. https://doi.org/10.1088/1742-6596/1467/1/012003

Youjun, T., & Xiaomei, M. (2022). Computational thinking: A mediation tool and higher-order thinking for linking EFL grammar knowledge with competency. *Thinking Skills and Creativity*, *46*, 101143. https://doi.org/10.1016/j.tsc.2022.101143

Zheng, B., & Zhang, Y. (2020). Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment. *BMC Medical Education*, *20*, 1–7. https://doi.org/10.1186/s12909-020-02023-6

Authors' and translators' details:

Bagas Listyo Cahyo Putro	bagaslistyo.2024@student.uny.ac.id	Author
Suhadi	suhadi@uny.ac.id	Author
Amat Komari	amatkomari@uny.ac.id	Author
Ngatman	ngatman@uny.ac.id	Author
Hedi Ardiyanto Hermawan	hedi_ardiyanto@uny.ac.id	Author
Wawan Sundawan Suherman	wansuherman@uny.ac.id	Author
Tri Ani Hastuti	tri_anihastuti@uny.ac.id	Author
Dimyati	dimyati@uny.ac.id	Author
Amri Hartanto	amry7766@yahoo.com	Translator