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STUDENTS' REASONING ACHIEVEMENT BASED ON NET AND WALL CATEGORY IN PHYSICAL EDUCATION

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ABSTRACT

Background: Reasoning refers to logical thinking involving problem-solving and decision-making skills. Physical Education teachers need to manage teaching and learning processes efficiently to build reasoning ability among students. The purpose of this study was to identify the students' reasoning achievement level based on the net and wall category using RSAT in Physical Education.

Methods: A quasi-experimental design was used in this study in four schools in the district of Hilir Perak, Perak. The sample of the study consisted of 240 Form 2 students who used RSAT instrument (validity, $r = .78$; reliability, $r = .74$) in the pre-test and post-test. The treatment group underwent teaching and learning programs based on the net and wall TGfU model while the control group underwent the badminton technical model. The subjects of the control group received six teaching and learning sessions based on the plans provided.

Results: The pre-test result of treatment group showed overall ($M = 2.21$; $SD = 0.30$) compared to the control group ($M = 2.18$; $SD = 0.43$). The students of the treatment group ($M = 3.64$; $SD = 0.67$) showed higher mean score compared to control group ($M = 2.88$; $SD = 0.82$) in post-test. The achievement level of the treatment group students showed that the majority of respondents achieved good level ($n = 85$; 60.70%) while the control group achieved pass level ($n = 62$; 44.30%).

Conclusion: The study concluded that the use of RSAT could improve the reasoning level among students holistically and comprehensively. The implication of the study suggested an RSAT instrument to be used as an alternative instrument for determining the level of the learning domain based on reasoning to achieve higher-order thinking skills.

Keywords: Reasoning, Physical Education, Net, and Wall Category, Teaching Games for Understanding, Higher Order Thinking Skills.

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INTRODUCTION

The transformation of education in Malaysia moves towards the intellectual, physical, spiritual, and emotional development of students. Reasoning skills are an important aspect emphasized in knowledge mastery. The reasoning is related to the fundamentals of reasoning skills, types of reasoning, reasoning model and reasoning in education. Based on the Reasoning Handbook [1], reasoning refers to logical thinking involving problem-solving and decision-making skills which are the bases of the mastery of higher-order thinking skills (HOTS).

The reasoning is the skill of making logical considerations by making judgments using common sense or mind surveys. Generally, reasoning skills is the use of logical thinking in understanding a situation or idea. The reasoning is a cognitive process of the occurrence of something based on facts, knowledge, data, and problem-solving strategy to come up with conclusions and decisions [2]. Reasoning skills as the ability to analyze information and solve problems literally. Reasoning involves the basic knowledge of the everyday life aspects that the individuals need to understand through logical thinking of the reasons why some behaviors occur and its impact in life [3].

Reasoning skills involve the process of obtaining information and making inferences based on individual assumptions [4]. One's intellectual reasoning ability enables him to understand ideas and concepts more clearly to make a reasonable conclusion. The Ministry of Education Malaysia explains reasoning skills as a catalyst in making logical and rational considerations of all thinking skills and strategies [1].

Reasoning skills are a fundamental process in cognitive development. The basic process of reasoning consists of storing, reusing, matching and executive procedures [5]. The process of obtaining information, the strategies in achieving goals, the attempts to solve problems and challenges are important steps in reasoning. The process involves the statement of the problem, determination of the goal, selection of the proposed solution, selection of the strategy, testing of the proposed solution, assessment of findings from the proposed solution and the review of the necessary steps. Creativity and critical thinking are needed in the problem-solving process, as these two aspects determine the quality of the solutions taken. Lastly, the composing skill is the process of creating new information to produce written or oral ideas through pictures, graphs, mind maps and passages.

Spatial, logical, numerical, and abstract reasoning are cognitive processes in reasoning skills. Logical reasoning is more relevant to be used in games-teaching as it involves motor skills [6]. There are two types of logical reasoning skills - inductive reasoning and deductive reasoning. Inductive reasoning is the consideration made resulted from a few examples or specific situations for conclusion making. Deductive reasoning requires students to make consideration from general-to-specific situations. Teaching starts by stating generalizations, followed by examples.

Reasoning skills need to be implemented in a planned

and attractive way and challenge students' imagination. Teachers need to create a learning atmosphere that can raise curiosity to explore the topic deeply. Lesson planning should emphasize reasoning skills in the aspects of problem-solving and decision making [7, 8].

Activities that focus on intellectual development and student's thinking ability need to be applied in teaching and learning either outside or inside the classroom according to the suitability of the subject. The activities implemented can use various methods and techniques such as discussion, quizzes, graphic management, cooperative learning and so on [9]. Discussions and questioning-and-answering can stimulate students to think critically, creatively, and capably. The relationship between logical reasoning levels, teachers need to familiarize students with questions that provide the space to answer why and how question. Teachers can also plan tasks that require the students to discuss and question and answer [10]. Students are encouraged to look from different perspectives or viewpoints on events and problems in decision making or problem-solving [10].

The findings and discussion of the relationship between logical reasoning levels and the mastery of skills in football, tennis and netball games state that the group of students who studied tactical aspects and game strategies are more mature in decision making [10]. The discussion concludes that the findings are in line with the constructivism learning theory, which explains the cognitive and behavioral involvement of students enhances the understanding of learning concepts. The limitation of the study is it focuses only on the decision making factor without looking into the skills aspect. The scope of the study only involves three types of sports which have limited the findings of the study. The researchers suggest that a more detailed study in particular sports should be made for the reasoning instrument to be built more precisely.

One of the study focus on the cognitive development of students after conducting thinking game lessons suggest graphics management as a planned and targeted teaching technique [6]. Students are required to understand the information, generate ideas, and complete the assignments given to them. Students need to understand the information and generate ideas or make assumptions that are presented in graphics management. Students are introduced to simple and effective techniques in completing the assignment given. Teachers should also stimulate students to think when they look for answers to the questions stated.

Using project assignments to provide students with critical and creative thinking while framing and carrying out tasks [11]. Students need to reason to make good decisions in producing a project. Game techniques can create decision-making and problem-solving situations while playing. Students need to be trained to understand and determine the best strategies for mastering the game skills.

Reasoning classifies into five levels: low-level, empirical-inductive (concrete), transitional reasoning, hypothetical-deductive (formal) reasoning and high-level reasoning [12]. Empirical-inductive reasoning is thinking based on evidence specified to a theory in the form of generalization. Hypothetical-deductive reasoning is a

conclusion made based on the tested hypothesis. The mental growth of reasoning skills from concrete operations to formal operations takes place slowly and both are in the consecutive continuum. But they believe that there is a transitional reasoning thinking stage before moving to formal operation.

The study was carried out by practicing holistic approaches to game teaching, developing critical thinking and problem solving as well as fostering efficiency in implementation and evaluation aims to look at the impact of reasoning-based questions on the development of the TGfU learning model [8]. The findings of the study show that strong reasoning stimulation can generate effective action in games. Instructors must be equipped with in-depth knowledge and understanding of the concepts and ideas about critical thinking and problem solving during teaching and learning sessions. Students should be given stimulation and understanding of the relationship between knowledge and effective action.

One of the studies aims to determine the effectiveness of the TGfU model in promoting metacognitive activity in basketball games [13]. Based on the findings, the TGfU model group shows significantly higher cognitive scores than the Technical model group. Cognitive development supports the ability of planning, monitoring, evaluating and reasoning of the actions of students in the games. Students can use their skills to solve problems and find solutions for a game. In conclusion, the teaching of cognitive concept games enables the students to execute the games more effectively. The holistic understanding of the game concept improves the student's understanding of the real game.

Researchers in the field of education have acknowledged the importance of reasoning skills in the teaching and learning process. Reasoning skills should be applied in the teaching process and enhanced via teacher teaching strategies. Reasoning-concept teaching, a specific process of decision making and problem-solving skills, is seen as a crucial part of the development of the Physical Education subject. The ability to master reasoning skills can help to improve students' cognitive aspects and higher-order thinking skills. Therefore, Physical Education teachers need to manage teaching and learning processes efficiently to build reasoning ability among students through cognitive and behavioral developments to help students master them more effectively.

The objective of the study was to identify the students' reasoning achievement level based on net and wall category games using the Reasoning Skill Assessment Test (RSAT) in Physical Education.

METHODOLOGY

The study identified the students' reasoning achievement level based on net and wall category games using RSAT in Physical Education using a quasi-experimental design. A total of 280 Form 2 students in Hilir Perak, Perak were selected in this study. The subjects of the study were divided into the treatment group and the control group. The treatment group underwent net and the wall category teaching and learning program based on the TGfU

model while the control group underwent a badminton game's technical model. The subjects of the control group underwent six teaching and learning sessions according to the plans provided.

The research instrument used is the RSAT with the validity value ($r = .78$) and reliability ($r = .74$) during the pre-test and post-test. The percentage statistics, mean, and standard deviation are used to determine the students' reasoning achievement level through RSAT subjects.

RESULTS

Table 1: Achievement Level of Reasoning Skill Assessment Test

Location	Gender	Treatment group				Control group			
		Pre-test		Post-test		Pre-test		Post-test	
		M	SD	M	SD	M	SD	M	SD
Urban	Male	2.21	0.20	3.63	0.47	2.23	0.21	3.33	0.73
	Female	2.23	0.17	3.75	0.65	2.21	0.39	2.90	0.80
	Total	2.22	0.18	3.69	0.56	2.22	0.31	3.11	0.79
Rural	Male	2.19	0.37	3.51	0.82	2.13	0.49	2.66	0.76
	Female	2.18	0.41	3.66	0.72	2.16	0.55	2.65	0.85
	Total	2.19	0.39	3.58	0.77	2.14	0.52	2.65	0.80
Overall		2.21	0.30	3.64	0.67	2.18	0.43	2.88	0.82

Table 1 shows the achievement level of RSAT based on net and wall category games of the treatment group and control group students. The pre-test result of treatment group showed overall ($M = 2.21$; $SD = 0.30$) compared to the control group ($M = 2.18$; $SD = 0.43$). The treatment group students ($M = 3.64$; $SD = 0.67$) showed higher mean score in post-test compared to control group ($M = 2.88$; $SD = 0.82$). The difference of mean score in pre-test and post-test for the treatment group was 1.43 while the control group was 0.70.

Table 2: Achievement Grade Distribution of Reasoning Skill Assessment Test

Grade	Treatment group	Control group
Excellent	24.30 (n=34)	16.40 (n=23)
Good	60.70 (n=85)	21.40 (n=30)
Pass	8.60 (n=12)	44.30 (n=62)
Moderate	5.00 (n=7)	14.30 (n=20)
Weak	1.40 (n=2)	3.6 (n=5)

Table 2 shows the RSAT achievement in grade distribution. The study on the achievement grade distribution of the treatment group student showed that the majority of the respondents achieved good score ($n = 85$; 60.70%) while the control group achieved the pass level ($n = 62$; 44.30%).

Table 3: Mean Achievement of Reasoning Skill Assessment Test

Test Item	Treatment Group	Control Group
	Mean	Mean
Game Concept	3.60	2.83
Tactical Awareness	3.59	2.76
Decision Making	3.64	2.82
Skill Execution	3.72	3.18
Overall	3.64	2.90

Table 3 shows the mean achievement details of RSAT for the treatment group and control group students. The achievement of the treatment group for all four test items, i.e., game concept, tactical awareness, decision making and skill execution, show higher mean than the control group. However, the skill execution item for both groups shows an almost equivalent achievement level that is the treatment group (M = 3.72) and the control group (M = 3.18). Overall, the treatment group achievement (M = 3.64) was higher than the control group (M = 2.90).

Table 4: Analysis of Covariance Summary

Source	Sum of Squares	df	Mean Square	F	Partial Eta Squared
Corrected Model	66.817b	2	33.408	71.02*	.34
Intercept	15.324	1	15.324	32.58*	.11
Pretest Score	27.179	1	27.179	57.78	.17
Treatment	37.693	1	37.693	80.13*	.22
Treatment by Pretest Score	130.297	277	.470		
Error	3173.168	280			
Total	197.113	279			

**p < 0.05 $R^2 = 0.339$ (Adjusted $R^2 = 0.332$)

Based on table 4, $F(1, 280) = 80.132$, $P = 0.001$, shows the hypothesis in ANCOVA that the min adjusted mean is rejected. There was a significant difference between the study group that was adjusted with the pre-test and post-test between control group and treatment group. The pre-test showed that not significant different with post-test, $F(1, 280) = 57.78$, $P = 0.15$.

DISCUSSION

The analysis of data for the RSAT instrument was constructed based on the Specification Table of Higher Order Thinking Skills Testing [14]. The assessed reasoning aspect refers to the concept, tactic, strategy, decision making and game skill execution in a written way based on net and wall category games. The revised Bloom's Taxonomy contains six cognitive skills - remembering, understanding, applying, analyzing, evaluating and creating. The findings show that the achievement of the treatment group subjects in RSAT was higher than the control group overall. The findings also show that students were able to think and decide the game logically through the TGfU teaching model. This finding was consistent with the results [15, 16,17], where urban area students developed higher reasoning skills than rural area students and the achievement of female students was higher than male students. RSAT instrument was developed to measure the reasoning aspect in a game teaching process based on the ideas presented through writing. The implementation of RSAT on behavioral performance through writing test is in line with the needs of formative assessment to measure the students' reasoning achievement level [12]. The teacher assessed the students' reasoning skills achievement during each teaching and learning process. Evaluation of writing

in writing can have a positive impact on students' reasoning levels [5].

CONCLUSION

The study identified the students' reasoning achievement level based on the net and wall category using RSAT in Physical Education as an effort to produce scholarly thinking to improve the effectiveness of teaching and learning in schools. The development of ideas and thoughts regarding the construction of reasoning teaching and learning model is hoped to be a guide among educators to further strengthen their teaching effectiveness. The conclusion of the study shows that the use of RSAT can enhance the students' reasoning level holistically and comprehensively. RSAT instrument provides opportunities for students and teachers to share reasoning knowledge and skills efficiently. It is hoped that the RSAT instrument will be a guide for the development of knowledge in Physical Education as a whole. The implication of the study suggested the RSAT instrument be used as an alternative instrument for determining the level of the learning domain based on reasoning to achieve higher-order thinking skills.

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