

## ORIGINAL ARTICLE

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## COGNITIVE DEVELOPMENT BASED ON THE VOLLEYBALL GAMEPLAY IN PHYSICAL EDUCATION

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## ABSTRACT

**Background:** The purpose of this study is to determine the effects of the Teaching Games for Understanding (TGfU), Sport Education Model (SEM), and Hybrid Teaching Games for Understanding Sport Education Model (HTGfU-SEM) on the cognitive performance among Form 1 students on volleyball gameplay. Student's cognitive focusing on the tactical decision-making aspect of opening and closing space and selection of skills used in the game.

**Methodology:** The study is using the quasi-experimental method involving a sample of 96 Form 1 students. The control group is TGfU while, the treatment groups are SEM and HTGfU-SEM. The research instrument was adapted from the Game Performance Assessment Instrument (GPAI) with the validity value ( $r = .81$ ). These modified instruments were used to assess the cognitive aspects of badminton gameplay. The Mean, SD, ANOVA, ANCOVA, MANOVA and posthoc test were used to analyze the cognitive data.

**Results:** As for the overall tactical decision making via a multivariate test in volleyball gameplay indicated significant effect through SEM. Especially for closing space in volleyball 3 vs. 3 gameplay through SEM,  $F(2, 93) = 10.054$ ,  $p < 0.05$ ,  $\eta^2 = .178$ .

**Conclusion:** The findings of this study provide a strong justification for implementing SEM in teaching and facilitating physical education games since it may enhance student's cognitive ability especially in tactical decision-making in opening and closing space and selection of skills. Advancement in cognitive ability may enhance student's capacity to mastery of in-game skills.

**Keywords:** Teaching Games for Understanding (TGfU), Sport Education Model (SEM), Hybrid TGfU-Sport Education Model (HTGfU-SEM), cognitive domain, decision making.

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## INTRODUCTION

The transformation of the secondary school curriculum has taken place in conjunction with a 21st-century education. The Secondary Integrated Curriculum (KBSM) was implemented in 1989. Further, starting from 2014, the Ministry of Education (MOE) was introduced the Secondary Standard Curriculum (KSSM). It was implemented onto Form One students in 2017. This strategy was in line with the Malaysian Education Development Plan (PPPM) 2013-2025 and National Education Philosophy (FPK) to enhance student's potential physically and mentally [1]. This phenomenon proved that physical education is categorized as a compulsory subject in the Malaysian education system.

Physical education plays a vital role in developing student's capabilities and potential. Based on a previous study of physical education, it found that physical education may improve student's ability in terms of psychomotor, cognitive, affective, social and emotional domains [2]. To ensure the strategies and objectives of physical education can be achieved successfully, MOE has introduced Curriculum and Assessment Standard Document (DSKP), Annual Lesson Plan (RPT), Daily Lesson Plan (RPH), pedagogy (TGfU) and assessment.

To strengthen the physical education system, MOE has incorporated the 5E Learning Model (i.e., engagement, exploration, explanation, elaboration, and evaluation) in the TGfU as a teaching and facilitating strategies [3]. Although this model may enhance teaching and facilitating strategies, its implementation procedures should be clear. It is very important to avoid misunderstanding among teachers as an implementer. Implementation of the 5E Learning Model by MOE was detected since 2011 [4][1]. However, the implementation of TGfU is not sufficient to fulfill the learning model.

The TGfU Model-based pedagogy introduced by Bunker and Thorpe (1982). This model has been adopted in KSSR and KSSM. This model uses small game modifications in the teaching and learning process. Teachers act as a facilitator and students as active learners (student-centered) with game modifications and questioning techniques by teachers during teaching and learning. This helps students make quick and accurate decisions based on their learning situations [5].

In the current study, the TGfU was used because it was a student-centered model instruction and the focus of instruction now needs to focus more on the process of instruction that can effectively engage students [6]. As a student-centered approach, it aims to provide students with an understanding of the technical and tactical skills necessary to achieve success in a variety of games and create ongoing engagement [7]. The original model proposed by Bunker & Thorpe (1982) suggests six steps in-game instruction namely game, game appreciation, tactical awareness, making appropriate decisions, skill execution and performance. While in the TGfU instruction, there

are four pedagogical principles: sampling, representation, exaggeration and tactical complexity suggested by Bunker and Thorpe (1992) [8].

TGfU by Bunker and Thorpe is a great way to introduce students to games and develop tactics, decision making, problem-solving, and skills at the same time [9][10]. The maximum involvement of students regardless of the level of mastery of the skills, can be assessed through the TGfU. It enables them to practice skills, makes tactical decisions about finding open space and closing space, makes decisions using skills and affective aspects that focus on acceptable behaviors, and nonverbal behaviors acceptable in-game situations.

López, Práxedes, and Villar (2016) analyzed the effect of using TGFU teaching model on student's tactical behavior in physical education in high school found that students taught using TGFU achieved higher procedural knowledge instead of technical implementation is closed, significant improvements in both groups after the intervention program in the procedural knowledge, technical and tactical implementation of students measured in real game situations [11].

Whereas Siedentop introduced sports education in 1994. It is a curriculum and model of instruction designed for teaching and facilitating physical education to engage competent, literate and enthusiastic students [12]. According to Siedentop (1994), the Sport Education Model has six main features: seasons, affiliation, formal competition, culminating event, record keeping and festivities. The sport education can enhance leadership skills among students when they are given roles such as team manager, captain, coach, referee, managing statistics while sports are rotated seasonally [13].

Hastie (1998) noted that the advantage of students participating in SEM is that they actively increase their involvement in physical education [14]. Further, it may increase the level of learning within the game unit and increasing the opportunities for potential students to be left out. Active student engagement means students become more skilled, increase their level of responsibility in an environment of interpersonal behavior and enjoyment with friends, and can make decisions without waiting for teacher instruction. Besides that, Mahedero, Calderón, Arias-Estero, Hastie, and Guarino, (2015) have suggested future studies examining in more detail the progress of assignments and learning experiences that are embedded in teaching approaches using sports education [15]. These findings have gained strong support from Hastie and Curtner-Smith (2006), Sports Education Model (SEM) and Teaching Games for Understanding (TGfU) are two curriculum models that have been developed to provide opportunities for students to engage fully in the game and to enhance their cognitive development from tactical aspects and mastery of skills. TGfU and SEM share several pedagogical objectives and processes [16]. Further, Gil-Arias, Harvey, Cárcel, Práxedes, and Del Villar (2017) state that the TGfU and the SEM share several objectives

and four TGfU pedagogical processes namely sampling (game), game presentation, modification (exaggeration) and tactical complexity that has a positive impact on improving student skills [17].

Therefore, the objective of the study was to evaluate the effects of TGfU, SEM, and HTGfU-SEM instruction on the aspects of the tactical decision-making aspect of opening and closing space and selection of skills using volleyball 3vs3 gameplay at the pre-test and post-test.

## METHODOLOGY

The main research design in this study is using quasi-experimental pre-posttest. A total of 96 students aged 13 years old were chosen intactly and distributed equally into three groups, with 16 girls and 16 boys. The control group is TGfU while the treatment groups are SEM and HTGfU-SEM. Treatment groups and control groups were selected randomly. The teaching component of each game is for three weeks involving five sessions in which each teaching and facilitating session is conducted within an hour (60 minutes). All models will use the Annual Lesson Plan (RPT) from the Assessment Curriculum Standard Document (DSKP) KSSM Form One provided by MOE for volleyball [1].

The research instrument used in this study were adapted from the Game Performance Assessment Instrument (GPAI) with the validity value ( $r = .81$ ). These modified instruments are used to assess the cognitive aspects of volleyball gameplay. The Mean, SD, ANOVA, ANCOVA, MANOVA and post-hoc test are used to analyze the cognitive data.

## RESULTS

**Table 1: Min Score Pre-test and Post-test in Decision Making Volleyball Cognitive Game Play**

Model	Decision Making	Pre-test			Post-test		
		M	SD	N	M	SD	N
TGfU		1.84	.628	32	2.47	.567	32
SEM	Open space	1.84	.628	32	2.78	.608	32
HTGfU-SEM		1.59	.499	32	2.66	.602	32
TGfU		1.62	.660	32	2.59	.499	32
SEM	Close space	1.53	.507	32	2.91	.689	32
HTGfU-SEM		1.56	.504	32	2.28	.457	32
TGfU		1.81	.738	32	2.66	.483	32
SEM	Using skills	1.78	.553	32	3.03	.740	32
HTGfU-SEM		1.75	.440	32	2.78	.608	32

\* Teaching Games for Understanding (TGfU)

\* Sport Education Model (SEM)

\* Hybrid Teaching Games for Understanding – Sport Education Model (HTGfU-SEM)

Table 1 shows pre-test and post-test TGfU, SEM and HTGfU-SEM mean score analysis for tactical decision-

making ability of opening and closing space and selection of using volleyball skills. The post-test of SEM as treatment group showed high overall mean scores for open space ( $M = 2.78$ ;  $SD = .608$ ), close space ( $M = 2.91$ ;  $SD = .689$ ), and using skills ( $M = 3.03$ ;  $SD = .740$ ) compared to the TGfU and HTGfU-SEM instructions.

**Table 2: Multivariate Test at the Volleyball Game Pre-test**

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial eta <sup>2</sup>	
Group	Wilks' Lambda	.930	1.129 <sup>b</sup>	6.000	182.000	.347	.036

The findings of the pre-test showed that there was no significant difference between instruction models of TGfU, SEM and HTGfU-SEM in cognitive aspect, namely making tactical decision on opening space and closing space and on deciding of using skills for digging, setting, blocking, spiking in volleyball game ( $F(6,000, 182,000) = 31.129<sup>b</sup>, p < .05$ ; Wilk's  $\Lambda = .930$ , partial  $\eta^2 = .036$ ).

**Table 3: Univariate tests of cognitive ANOVA Decision Making on the Volleyball Game Pre-test**

Dependent Variables	df	F	Sig.	Partial eta <sup>2</sup>
Open space	2 93	1.928	.151	.040
Close Space	2 93	.231	.794	.005
Decision making using skills	2 93	.090	.914	.002

ANOVA's univariate results too of these on three models on tactical decision making opening space ( $F(2,93) = 1.928$ ;  $p > .05$ , partial  $\eta^2 = .040$ ), closing space ( $F(2,93) = .231$ ;  $p > .05$ , partial  $\eta^2 = .005$ ), decision making using skill ( $F(2,93) = .090$ ;  $p > .05$ , partial  $\eta^2 = .002$ ), also indicated no significant difference at pre-test as reflected in Table 3.

**Table 4: Multivariate Test at the Volleyball Game Post-test**

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial eta <sup>2</sup>	
Group	Wilks' Lambda	.747	4.761 <sup>b</sup>	6.000	182.000	.000	.136

Table 4 shows there was overall significant differences between TGfU, SEM and HTGfU-SEM on decision making at post-test using multivariate test  $F(10,000, 178.00) = 4.761, p < .05$ ; Wilk's  $\Lambda = .747$ , partial  $\eta^2 = .136$ .

**Table 5: Univariate tests of cognitive ANOVA Decision Making on the Volleyball Game Post-test**

Dependent Variables	df	F	Sig.	Partial eta <sup>2</sup>
Open space	2 93	2.255	.111	.046
Close Space	2 93	10.054	.000	.178
Decision making using skills	2 93	3.043	0.52	.061

However based on Table 5, ANOVA's univariate results indicated there were no significant difference among the models in terms open space ( $F(2,93) = 2.255; p > .05$ , partial  $\eta^2 = .046$ ) decision making skills of digging, setting, blocking and spiking in 3 vs 3 game play. However there was significant and improvement for decision making on closing space with SEM ( $F(2,93) = 10.054; p < .05$ , partial  $\eta^2 = .178$ ).

Post-hoc comparative test results based on adjusted mean Bonferroni for cognitive aspect of tactical decision making in volleyball for opening space shows no significant difference between TGfU with SEM,  $p = .626 (p > .05)$  no significant difference between TGfU with HTGfU-SEM,  $p = .113 (p > .05)$  also no significance and HTGfU - SEM with SEM,  $p = 1.000 (p > .05)$ . The cognitive aspect of volleyball of closing space TGfU with HTGfU - SEM,  $p = 0.82 (p > .05)$  no significant, TGfU with SEM,  $p = .082 (p > .05)$  also no significant while HTGfU - SEM with SEM,  $p = .000 (p < .05)$  shows a significant difference. Next the cognitive aspect decision; making on the selection of volleyball skills shows the findings of TGfU with HTGfU - SEM,  $p = 1.000 (p > .05)$  indicated no significant, TGfU with SEM,  $p = .052 (p > .05)$  also no significant and HTGfU - SEM with SEM,  $p = .329 (p > .05)$  also indicated no significant too.

## DISCUSSION

The findings of the cognitive study for tactical decision making in open and closed spaces and decision-making skills in digging, setting, blocking and spiking in 3 vs 3 volleyball gameplay indicate that there are significant differences especially in the improvement of the lid aspect through SEM. In the SEM instruction students were allowed in cognitive thinking to make tactical decisions and increase for playing and managing the game. This helps to increase the cognitive aspect of tactical decision making in opening space, closing space through tactical options. By this SEM instruction, facilitators able to assist in the learning process by throwing questions and commenting on the game. When opportunities are created for students, they have the freedom to think and make the right tactical decisions in the close and open space with the choice of skills that the cognitive process has taken place.

The findings showed that the level of skill and mastery of the game is low, medium and good. The PS Model can help improve the ability of low-skilled students to make and implement open-ended tactical decisions, free up space and more cooperative skills choices based on their learning through teammates who have mastered a wide range of skills [18]. The results of this study are in line with the study of Mesquita, Farias & Hastie, (2012); Mahedero et al. (2015) show that teaching using TGfU's hybrid model and sports education provides students with opportunities to improve the implementation of their skills and to make tactical decisions [19][15].

The use of GPAI on cognitive aspects of tactical decision-making and choice of skills in current studies, support the research by Harvey, Cushion, Wegis, & Massa-Gonzalez,

(2010) as they conducted a study on the use of Game Performance Assessment Instrument (GPAI) via TGfU instruction. The TGfU learning and teaching led to quick response and faster response in-game situations whereby the current study findings showed increased in space-gap tactical decision-making with SEM and increased in decision making on closing space volleyball. Therefore, GPAI is more sensitive and robust in measuring game performance changes [20].

Therefore this finding supports the theory of Constructivism and Complex Learning theory that underlies these two theories of Constructivism Theory by Jean Piaget and Lev Vygotsky emphasize the development of knowledge through the process of interdependence between previous learning and related new learning [21]. The emphasis of these theories can be interpreted through the planning of student strategy game planning, decision-making skills in the game and making a reflection on learning. Complex Learning Theory by Davis and Sumara (2003) has highlighted the importance of Complex Learning Theory to solve problems or to carry out tasks, and facilitate the transfer of what has been learned for task and problem situations. This theory underlines integration of knowledge, skills and attitudes as competence in deciding the solution of a problem involving the formulation of tactical games and facilitating the transfer of something learned by the diversity of situations during the game [15].

## CONCLUSION

21st-century education requires an emphasis on the cognitive development of students. To achieve this goal, the emphasis on various instruction can enhance the student's thinking and personal development more holistically. Therefore, the DSKP KSSM physical education for Form 1 student needs to be revised to incorporate higher-order thinking skills (HOTS) elements such as game analysis to guide teachers in transferring these elements into student's cognitive development through the actual game and game modifications. In conclusion, the findings of the SEM and the HTGfU-SEM provide a strong justification for implementing SEM in teaching and facilitating physical education games since it may enhance student's cognitive ability especially in tactical decision-making in opening and closing space and selection of skills. Advancement in cognitive ability may increase student's capacity to mastery of in-game skills.

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