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Effect of Teaching Games for Understanding in 5 versus 5 mini game play, cardiovascular fitness, leg power and 30m running speed among Malaysian School elite players

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Abstract

This study investigated the effect of Teaching Games for Understanding (TGfU) in coaching contexts of elite Malaysian school hockey players as they have problems in terms of game play of ball control, decision making, skill execution with players on the ball, as well as supporting player's role without ball in 5 versus 5 mini game situation as well as cardiovascular fitness, power and speed components among the players. The study was a quasi-experimental equivalent pretest-posttest control groups design whereby sports school players and district level hockey players (14-17 years old) randomly assigned to experimental groups of TGfU, (n= 15), and control group known as SDT (skill drills and technical model), (n=15). The TGfU model was exposed to tactical coaching approach, while the control group of SDT underwent technical model of skill-based coaching in hockey. The effectiveness of these two models was measured by Game Observation Instrument for 5 vs. 5 mini game play, Multi-Stage Fitness Test (MSFT), Standing Broad Jump, 30m flying start were used to measure fitness components of cardiovascular, explosive leg power and 30 m speed. ANOVA was used to analyze the data, followed with analysis of covariance (ANCOVA) if the pretest results yielded significant difference. The results indicated that there were significant difference as TGfU seems to be a better model compared to traditional approach of SDT on players ball control in 5 versus 5 mini game play $F(1,28) = 4.25$, $p<0.05$ and cardiovascular fitness $F(1,28) = 11.72$, $p<0.05$. Whereas SDT, indicated significantly better model for improving leg power among the players. Conclusion: more research has to be done to validate these two models in Malaysia in coaching context in term of game play and fitness components

Keywords: Teaching Games for Understanding, Technical model of SDT, Coaching

Introduction

Recent development in the field of teaching as Teaching Games for Understanding (TGfU) seem to be dominant model across many parts of the world in teaching and coaching games, research pertaining the comparison between TGfU model and the Technical model considered almost outdated or irreverent. However in contrast , TGfU seems to be at early stage of implementation in Malaysia in term of coaching and teaching context. On the other hand, based on many anecdotal observation Malaysian coaches' and school teachers fancied the technical model of coaching via demonstration, command, skill-drills and practice styles (Sanmuga & Nagendralingan, 2012). As a result, elite school and senior hockey players seems to be performing badly, comparing more advance country's players who have better and sound performance in term of speed and accuracy executing skills, cardiovascular fitness, power and better ball control, decision making on 'what to do and how to do', players with the ball able to execute skills well in game situations and as well as players without ball able to support players with ball in game situations. Therefore, it's inevitable and still relevant research of comparing TGfU and Technical model of skill-based has to be done in Malaysia as TGfU at early stage of implementation in coaching and teaching context.

The origin of TGfU was made know by Bunker and Thorpe (1982) in 1982 as an alternative to traditional approach or skill based of technical model in teaching and learning games. Ever since then, TGfU has attracted widespread attention from teachers, coaches, and researchers (Kirk & MacPhail, 2002) and in Malaysia , TGfU model picks up its momentum after research conducted by Sanmuga (2007). The TGfU, was suggested as a better model of coaching and teaching games compared to a technical lead skills-based model (Hopper, 2002) . The technical model lessons are considered too structured, with warming up activities and skill drills as the main components and students lack of chances to play in game play. The emphasis of this technical model is on acquiring technical skills for game play, while the cognitive skills essential for effective participation in games are often undermined (Tuner & Martinek, 1999). As a result, it is suggested that students fail to transfer the skill and knowledge, tactical decision making elements of game performance to game plays. Proponents of the TGfU model suggest that exposing students to game like experiences early in the teaching-learning process helps them acquire substantive declarative and procedural knowledge, thereby facilitating tactical decision making during game play (Crespo, Reid & Mileyo, 2004; Grehaigne & Godbout, 1995; Mitchell, Griffin & Oslin, 1994; Turner, 1996; Turner & Martinek, 1999; Werner, Thorpe & Bunker, 1996).

Research finding using technical model coaching and teaching research indicated that it only improved players' general skills and fitness level in games like soccer, hockey but players failed to transfer the skill in a real game situation. Whereas research findings using tactical model or Teaching Games for Understanding model (TGfU) indicated players able to make right game decision as well as in improving their declarative and procedural game knowledge but in contrast findings also indicated that they' lack execution of skill in game situation.

Based on many anecdotal evidence and observations, the problem of most coaching lessons in Malaysia were carried out using structural lesson or technical model format based structural lesson of warming up, followed by skills teaching, mini game play and finally with limbering down and authoritarian approach of coaching. As most of Malaysian hockey players especially the junior players unable to make right decision on using right tactics and skills in game play. Not many Malaysian researchers and coaches have developed and investigated the effectiveness of TGfU model which emphasizes game play compared to Technical model which focused on structured lesson and skills-based approach in their coaching to upgrade game play and fitness components among Malaysian elite school hockey

players . The problem of this study is reflected in conceptual framework figure 1 using TGfU approach compared Technical model as a control group

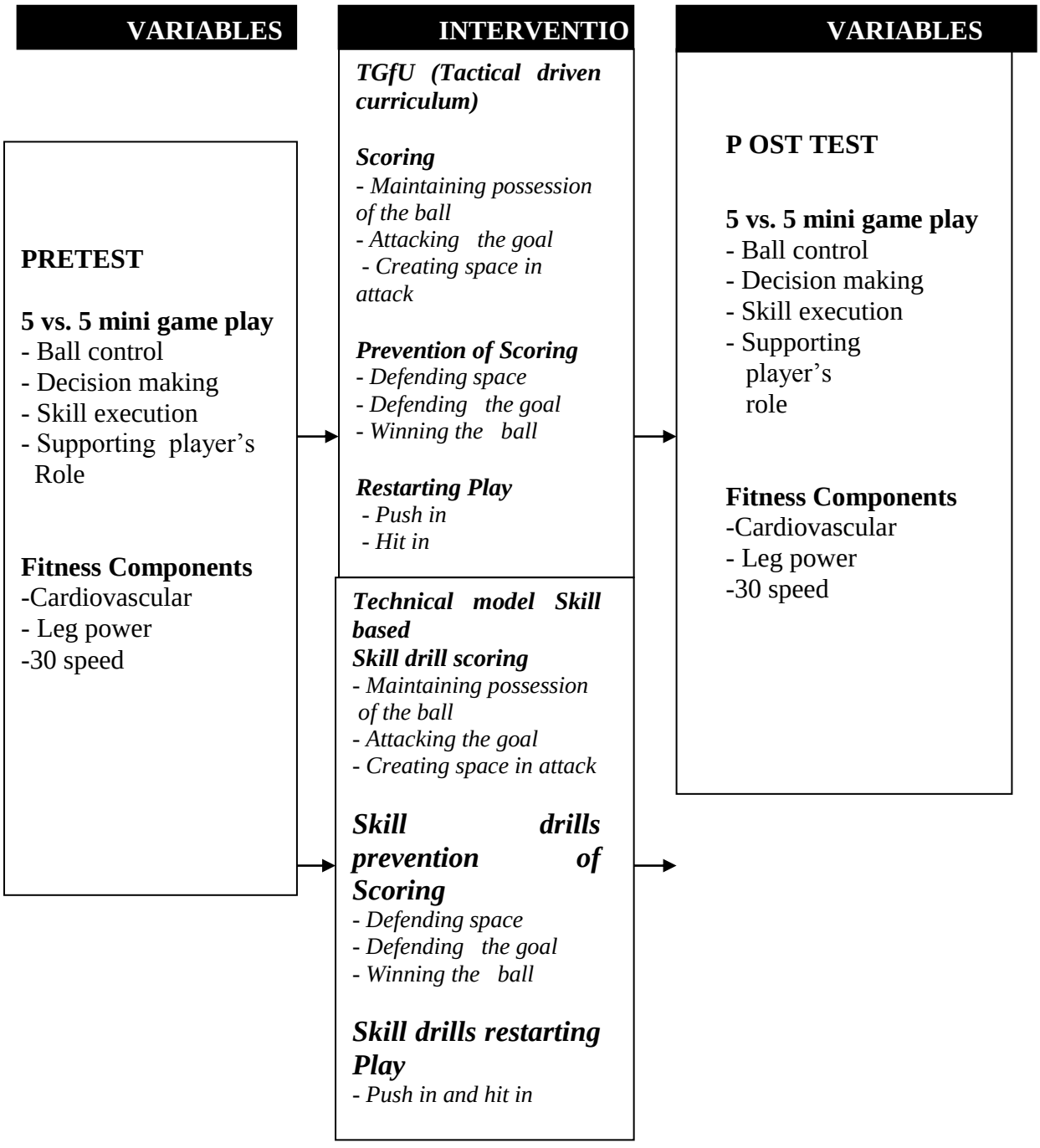


Figure 1. Conceptual Framework TGfU and SDT (Skill drill Technical Model)

The purpose of this study is to investigate the effect of TGfU coaching model compared to skilled based Technical model of training on players in 5 versus 5 mini game play of ball control, decision making (passing, dribbling, tackling and scoring), skill

execution (passing, dribbling, tackling and scoring) with players on the ball, supporting role player without ball and among; cardiovascular, leg power and 30m speed as well among Malaysia's elite school hockey players after 12 units of coaching interventions. The study specially addresses the following research questions:

Is TGFU compared to Technical model effective in ball control in 5 versus 5 mini game performances?

Is TGFU compared to Technical model effective in decision making (passing, dribbling, tackling and scoring) in 5 versus 5 mini game play?

Is TGFU compared to Technical model effective in skill execution (passing, dribbling, tackling and scoring) in 5 versus 5 mini play?

Is TGFU compared to Technical model effective in role of supporting player 5 versus 5 mini game play?

Is TGFU compared to SDT model effective in cardiovascular fitness ($V0_2$ max), leg power and 30m speed among school hockey players?

Methodology

The main methodology that proposed in this research is Quasi-experimental pre and posttest balanced control group design to determine the effect on 5 versus 5 in mini game performance of ball control, decision making (passing, tackling, dribbling, shooting), skill execution (passing, tackling, dribbling, shooting), cardiovascular fitness, explosive leg strength and 30m running sprint performance. The study was carried out over a period of 7 weeks

Participants

The samples consists of n = 30 players of district and sports school players (14-17 years old) that were selected out of total 45 players using simple random technique and assign equally into groups of TGfU, n = 15 and SDT model, n = 15. The players had some experience playing hockey using skill based approach. Informed consent was obtained from all 30 samples and their parents or guardians through their coaches.

Two qualified and experienced hockey coaches were selected to train the samples using the two models (refer appendix 4 for clips of intervention). In order to maintain the fidelity in implementation of these models, following steps were taken. A simultaneous briefing session was conducted on how to implement these two different models, by the principal researcher. The two coaches were given modules and checklist on implementing two training models. A pre training stint was conducted by researcher on implementation of these training intervention and method on carrying out all the required test of measures. A preliminary interview was conducted by the principal researcher to make sure these teachers conducted the training units accordingly.

The players underwent three training session per week (2 hour per session) for five weeks (5) as training intervention, on the other hand 1st week and 7th were allocated for pretest and posttest activities. Group A has undergone TGfU model using guided discovery, players centered, and tactical approach of training, while group B has gone through SDT model (Skill drill+ Technical model), a skill-based approach, coach centered training regime. The TGfU model uses mini games situations as main activities to improve student's tactical strategy, physical conditioning and skill components of the game. Whereas SDT model undergo skill drills method and mini game towards end of each lesson. The implementation of these two models was based on sports training principle and motor learning principle (Bompa, 1999; Fitts & Posner, 1967). The study adapted game play observational instrument used by Turner and Martinek (1999) and adapted by permission from Mitchell, Oslin and Griffin

(2005). Game Observation instruments to measure the effect of interventions on all the dependent variable of game play (ball control, decision making, skill execution and role of supporting players without ball) was used. The dependent variables for 5 versus 5 game play for ball control, decision making (passing, dribbling, tackling and scoring) and skill execution (passing, dribbling, tackling and scoring) players without ball and role of supporting players (players without ball) were calculated with total marks based on successful and unsuccessful responses (5-1 mark range) for each dependent variable of game play.

The study used Multi-Stage Fitness Test (MSFT), developed by Leger & Lambert (1982), is to monitor the development of the athlete's maximum oxygen uptake (VO2max). Standing Broad (AAHPERG, 1976a) was also used to measure explosive leg power) as the test is high on face validity and reliability coefficients reported ranging from .83 to .99. Finally the study utilized 30m flying start instrument to measure 30m running speed as a valid instrument (Mackenzie, 1999 The effect of the TGfU and SDT training model at pretest and posttest were analyzed using SPSS version 19, using ANOVA. In addition ANCOVA (as pretest score was used as covariate) and were used to confirm the results when there were significant difference at base line level. While hypotheses testing with alpha set at 0.05 was carried out.

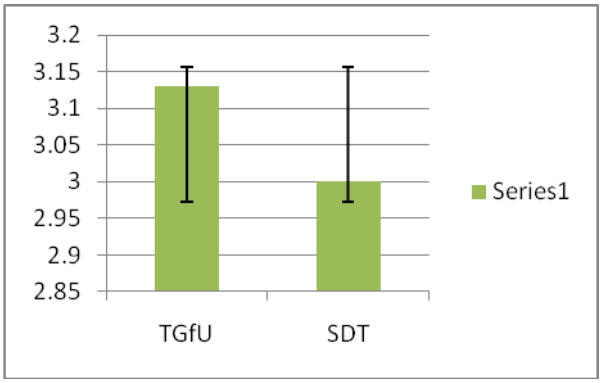
Results and Discussion

Univariate ANOVA test indicated there was no significant difference between TGfU with SDT training model on ball control in 5 versus 5 game play at pretest, $F(1.28)= .651$, $p>0.05$ (TGfU, *M/SD*: 3.13±.351, $n = 15$ and SDT, *M/SD*: 3.00±.534:, $n=15$). However posttest result indicated significant difference between TGfU (M/SD: 3.53±.516) and SDT model (M/SD: 3.10±.593), $F(1,28)=4.25$, $p<0.05$. Table 1 illustrates the results mean and SD for ball control. Figure 2 and 3 indicated the mean and SD for ball control at pretest and posttest level, TGfU seems to be significantly better training model after training intervention based on mean score, TGfU: 3.53±.516, SDT: 3.10±3.10 at posttest level.

Table 1

Pretest and Posttest score for ball control

Model	*Mean*	*SD*	*N*	*P*
Pretest				
TGfU	3.13	.351	15	$F(1,28)= .651$, $p> 0.05$
SDT	3.00	.534	15	
Posttest				
TGfU	3.53	.516	15	$F(1,28)= 4.25$, $p< 0.05$
SDT	3.10	.593	15	



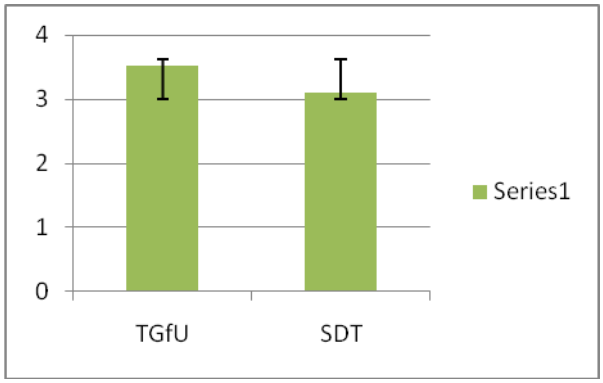


Figure 2
Posttest Mean/SD for ball control

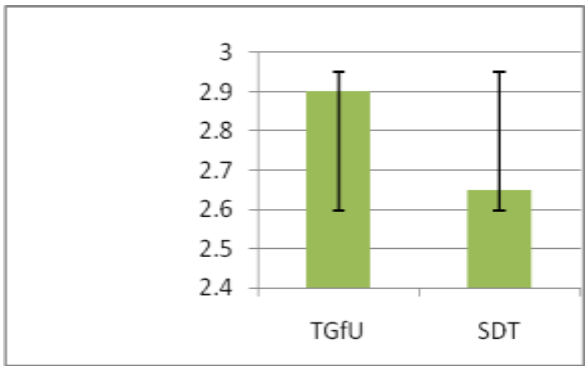
Figure 3
Posttest Mean/SD for ball control

As far as overall decision making indicated univariate ANOVA indicated significant difference between TGfU and SDT model at pretest, $F(1,28)=5.32$, $p<0.05$ (TGfU, *M/SD*: 2.90±.311, $n = 15$ and SDT, *M/SD* : 2.63±.281, $n=15$). However overall posttests, result for decision making indicated there was no significant difference between TGfU, (*M/SD*: 3.28±.311,$n=15$) and SDT model (*M/SD*: 2.96±.461), $n = 15$ $F(1,28)=1.64$, $p>0.05$.Table 2 illustrates the results mean and SD for decision making. Figure 4 and 5 indicated the mean and SD for decision making at pretest and posttest level.

Table 2

Pretest and Posttest score for decision making

Model	*Mean*	*SD*	*N*	*P*
Pretest				
TGfU	2.9	.351	15	$F(1,28)= 3.32$, $p> 0.05$
SDT	2.65	.398	15	
Posttest				
TGfU	3.28	.311	15	$F(1,28)=4.85$, $p< 0.05$
SDT	2.96	.461	15	



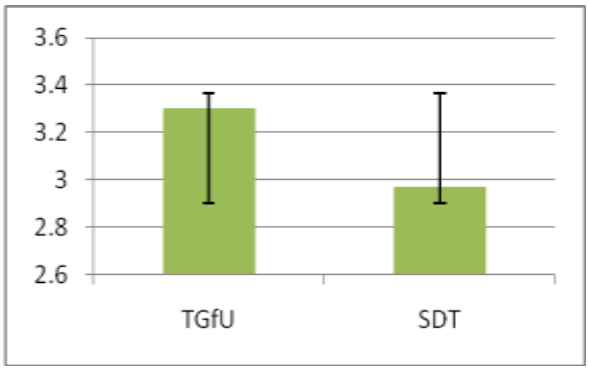


Figure 4
Pretest Mean/SD for decision making

Figure 5
Posttest Mean/SD for decision making

Univariate ANOVA, $F(1,28)=.5.32$, $p<0.05$ indicated for overall skill execution (passing, dribbling, tackling and scoring) at pretest indicated significant difference between

TGfU (M/SD:2.90 ±3.11) and SDT training model (M/SD:2.63±.281). Univariate Anova, indicated no significant difference for overall skill execution at posttest (1,28) =1.64, p>0.05 between TGfU (M/SD: 3.30±.330) and SDT training model (3.11±.45). Table 3 illustrates the results mean and SD for skill execution. Figure 6 and 7 indicated the mean and SD for skill execution (passing, dribbling, tackling and scoring) at pretest and posttest level. This result was confirmed using analysis covariate (ANCOVA), the results too indicated no significant difference between these two models in for skill execution, $F(2,27) = 0.15$, p>0.05. The results of ANCOVA presented in table 4 and the estimated marginal means for posttest skill execution presented in table 5.

Table 3

Pretest and Posttest score for skill execution

Model	*Mean*	*SD*	*N*	*P*
Pretest				
TGfU	2.90	.311	15	$F(1,28)= 5.32$, $p< 0.05$
SDT	2.63	.281	15	
Posttest				
TGfU	3.30	.330	15	$F(1,28)= 1.64$, $p> 0.05$
SDT	3.11	.45	15	

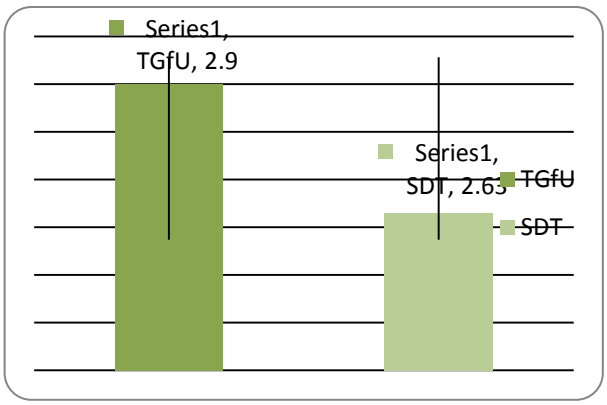


Figure 6
Pretest Mean/SD for skill execution

Figure 7
Posttest Mean/SD for skill execution

Table 4
Analyses of covariance summary for skill execution

Source	Sum of Squares	df	Mean Square	F	Sig.
Model	.002	1	.002	.015	.904

Table 4
Analyses of covariance summary for skill execution

Source	Sum of Squares	df	Mean Square	F	Sig.
Model	.002	1	.002	.015	.904

**p<0.05

Table 5
Estimated marginal means for skill execution

			95% Confidence Interval	
Model	Mean	SE	Lower Bound	Upper Bound
TGfU	3.22[a]	.095	3.02	3.41
SDT	3.20[a]	.095	3.00	3.39

As for supporting player variable, Univariate ANOVA indicated there was significant difference TGfU model (M/SD:3.40 ±, .632, n=15) with SDT model (M/SD:2.67±.817, n=15) at pretest level, $F(1,28)$ =7.56, P<0.05. As for posttest, findings indicated, there was significant difference between TGfU (M/SD: 3.67±.488, n=15) and SDT model M/SD: 3.20±.676, n=15),$F(1,28)$ =4.70, P<0.05. Table 6 illustrates the results mean and SD for role of supporting players. Figure 8 and 9 indicated the mean and SD for role of supporting players at pretest and posttest level. This result was checked again using analysis covariate (ANCOVA), the results indicated no significant difference between these two models in role of supporting players, $F(2,27)$ =.644, p >0.05. The results of ANCOVA presented in table 7 and the estimated marginal means for posttest supporting players role without ball presented in table 8

Table 6

Pretest and Posttest score for supporting players

Model	*Mean*	*SD*	*N*	*P*
Pretest				$F(1,28)=$ 7.56,
TGfU	3.40	.632	15	$p<$ 0.05
SDT	2.67	.817	15	
Posttest				
TGfU	3.67	.488	15	$F(1,28)=4.70$
				$p<0.05$
SDT	3.20	.676	15	

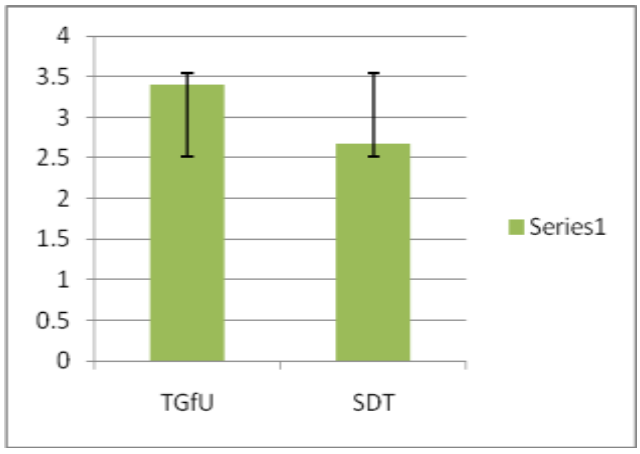


Figure 8

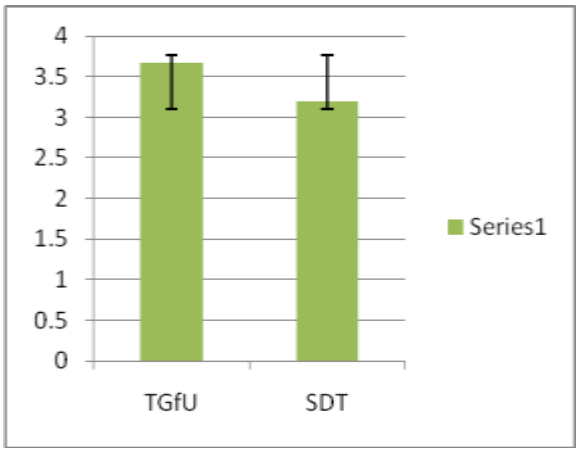


Figure 9

Pretest Mean/SD for supporting players Posttest Mean/SD for supporting players

Table 7

Analyses of covariance summary for supporting players

Source	Sum of Squares	df	Mean Square	F	Sig.
Model	.175	1	.175	.644	.429

***p*<0.05

Table 8

Estimated marginal means for supporting players

			95% Confidence Interval	
Model	Mean	SE	Lower Bound	Upper Bound
TGfU	3.52[a]	.143	3.23	3.81
SDT	3.35[a]	.143	3.05	3.64

Cardiovascular Fitness

Pretest results indicated there was no significant deference between TGfU(44.83±4.98 ml/kg/min) and SDT model (40.51±6.95ml/kg/min) in cardiovascular fitness ($V0_2$ max) using bleep test (MSFT) that converted into $V0_2$ max., $F(1,28) = 3.81$, $p>0.05$. As for posttest results there was significant difference between TGfU (54.18±4.32ml/kg/min) and SDT model (48.55±4.63ml/kg/min) in term of cardiovascular fitness, $F(1,28) = 11.72$, $p<0.05$. Table 9 illustrates the results mean and SD using V02 max. Figure 10 and Figure 11 indicated the mean and *SD* cardiovascular fitness ($V0_2$ max) at pretest and posttest level, This result was confirmed using analysis covariate (ANCOVA) however the results indicated significant difference between these two models in for cardiovascular fitness ($V0_2$ max), $F(2,27) =31.06$, $p>0.05$. The results of ANCOVA presented in table 10 and the estimated marginal means for posttest cardiovascular fitness presented in table 11.

Table 9

Pretest and Posttest score for cardiovascular fitness

Model	*Mean/SD $V0_2$ max ml/kg/min*	*N*	*P*
Pretest			
TGfU	44.83±4.98	15	$F(1,28)=3.81$, $p> 0.05$
SDT	40.51±6.95	15	
Posttest			
TGfU	54.18±4.32	15	$F(1,28)=11.77$, $p< 0.05$
SDT	48.55±4.63	15	

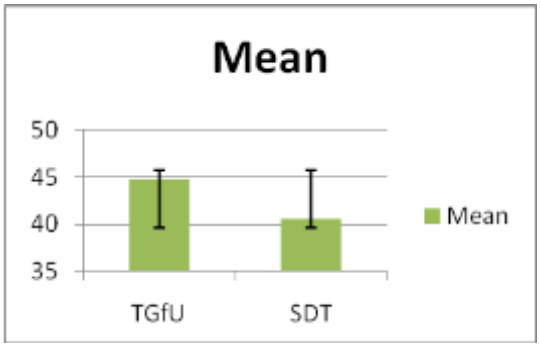


Figure 10

Pretest Mean/SD for $V0_2$ max

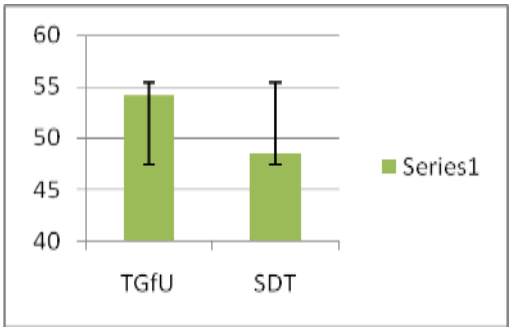


Figure 11

Pretest Mean/SD for $V0_2$ max

Leg Power

As for leg power using standing board jump, the detected results indicated no significant difference between TGfU (1.87±.166) and SDT model (1.90±.155) at pretest, $F(1,28) = 3.50$, $p > 0.05$. While the posttest results indicated significant difference between TGfU (1.94± .141) and SDT models (2.03±.099), $F(1,28)=9.36$, $p < 0.05$, whereby based on mean score SDT model seems to be better model in enhancing leg power for hockey players. Table 12 illustrates the results mean and SD for power. Figure 12 and Figure 13 indicated the mean and *SD* for leg power at pretest and post-test level.

Table 12

Pretest and Posttest score for leg power

Model	*Mean*	*SD*	*N*	*P*
Pretest				
TGfU	1.87	.166	15	$F(1,28)= .350$, $p > 0.05$
SDT	1.90	.155	15	
Posttest				
TGfU	1.94	.141	15	$F(1,28)=9.36$, $p < 0.05$
SDT	2.03	.099	15	

Figure 12

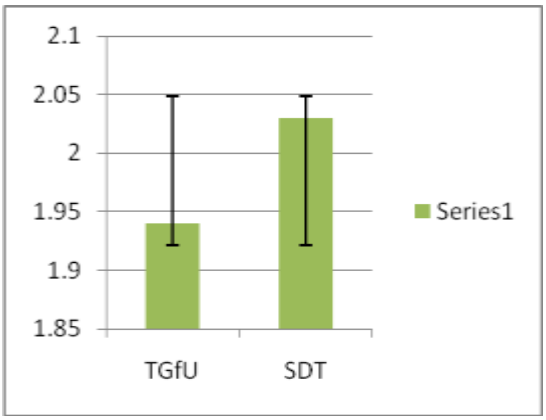


Figure 13

Pretest Mean/SD for leg power Posttest Mean/SD for leg power

30 meter running speed

As for pure 30m pure speed, the detected results indicated no significant difference between TGfU (5.22±1.12) and SDT model (5.39±.36) at pretest, $F(1,28)=.355$, $p>0.05$. While the post-test indicated no significant difference between TGfU (5.37± .713) and SDT models (5.10±.28), $F(1,28)=2.14$, $p> 0.05$. Table 13 illustrates the results mean and SD for running speed of 30 meter.

Table 13

Pretest and Posttest score for pure 30m speed

Model	*Mean*	*SD*	*N*	*P*
Pretest				
TGfU	5.22	1.12	15	$F(1,28)= .355$, $p> 0.05$
SDT	5.39	.36	15	
Posttest				
TGfU	5.38	.713	15	$F(1,28)=2.14$, $p> 0.05$
SDT	5.10	.28	15	

Discussion

These findings show that TGfU model compared to SDT was significantly mor effective at the posttest for ball control in 5 versus 5 game plays. One of the reasons for thi improved performance in ball control as suggested from the model application of player centered mini game, which advocated guided discovery method assist the players to improv tactical decision making and improve how they execute passing, dribbling, scoring hocke skills in 5 versus 5 game plays.

This finding supports that the TGfU model is an important model for learning as it develops higher order of thinking and training motor skills in decision making, (Bunker & Thorpe, 1986) and Light (2003). Playing to learn games via TGfU improved players decision making in 5 versus 5 game based on the content knowledge were taught "what to do" and "how to do" in their 5 weeks training with TGfU model, as the fourth step in teaching the TGFU model. This finding was parallel and further supports motor learning theory framework that suggests that there is linear relationship between motor performances of ball control with acquisition of game knowledge a through the mini game (Denis, 1993; Anderson, 1976). The present findings on ball control improvement through TGfU in 5 versus 5 among sports school players were parallel with previous findings in soccer and hockey (Sanmuga & Khanna, 2012; Sanmuga, 2008; Harvey, 2003; Light & Fawns, 2003;; Turner & Martinek, 1999) and badminton (French, Werner, Taylor, Hussey, & Jones, 1999).

As for overall decision making and skill execution of passing, dribbling, scoring and tackling indicated no significant difference between using TGfU, compared SDT model. However based on mean score TGfU seems to be more effective compared to SDT. This findings supports the findings of field hockey (Turner & Martinek, 1999), badminton (Lawton, 1989), soccer and volleyball (Mitchell, Oslin, & Griffin 1995). As role of supporting players findings indicated no significant difference between TGfU and SDT, probably due to too short intervention period. This finding similar with previous findings by Sanmuga and Khanna (2012) using Indian junior hockey team detected no significant difference between TGfU and Technical model. However these findings are in contrast with findings by Pritchard & Hawkins, Wiegand, & Metzler (2008) using n =20 volley lesson

indicated Sport Education Model showed significant improvement in supporting in adjust their position to support their teammate. Therefore, the role of supporting players (players without ball) in providing opening up for teammate to pass ball, need longer period of training to improve their performance especially positioning, timing tactics and skill execution too. Game player whether players with ball or supporting players without ball needs to undergo learning process about game constitute such as cooperation and understanding during game play in order to improve game performance. This shows that supporting players' role in adjusting their positions to receive ball need longer time period for learning and training within the game situations.

As for cardiovascular fitness, there was significant improvement in cardiovascular fitness using TGfU model with $V0_2$ max 54.18±4.32 ml/kg/min. This compared to SDT training model recorded $V0_2$ max of 48.55 ±4.63 ml/kg/min. Results of this finding supports the earlier finding of research using TGfU training approach among India junior hockey players that recorded V02 max 43.9ml/kg/min which significantly better performance compared to Technical model with

$V0_2$ max 37.2 ml/kg/min (Sanmuga & Khanna, 2012). This research findings using TGfU and SDT model have reached above average level based on norms set at 42.7 $V0_2$ max by (Leger and Lambert, 1982; Mackenzie, 1999). This indicates these two models are especially modeled to improve cardiovascular fitness among hockey players. This finding is in contra with earlier findings of Ghosh, Goswami, Mazumdar, & Mathur. (1991) which indicated using n = 25 Indian junior hockey players (18±0.6 years) mean heart rate during full hockey match was 143.4±15.3 and $V0_2$ max 53.8 ml/kg/min. High intensity game using TGfU in research similar with findings by Boyle, Mahoney and Wallace (1994) using 9 Irish international soccer players (26 ± 4.5 years), indicated mean HR during match play =158.6 ± 8 and $V0_2$ 61.8 ml/kg/min (Lythe, 2008). Therefore to have higher level of cardiovascular fitness level, a longer period than 5 weeks is recommended for future study to improve cardiovascular fitness. However this finding supports the TGfU model as suitable training model in improving cardiovascular fitness for turf hockey.

The findings of this research indicated SDT model indicated significant improvement in players' leg power compared TGfU model. Activities predominantly organized through skills via SDT model probably helped the players to improve the leg strength. Findings in term of 30m sprint, indicated SDT a better approach compared to TGfU in term of mean score of in time (sec). Therefore, there are high correlation between leg power and speed, and SDT model seems to a better model in upgrading speed and explosive power as the components crucial in executing hockey skills with speed and accuracy. Based on this research finding, we support the notion of high correlation between leg power and sprinting abilities, as short sprints crucial for game players. As Chelly *et al*. (2010) findings too indicated sprinting ability is correlated with measures of power and force such as the force-velocity test, and 1 RM half back squat; such measures thus offer useful guidance to soccer coaches who wish to improve the short-distance velocity of their players.

Based on findings of using TGfU original model and Tactical Game model, the study revealed that Malaysian elite school hockey player with tactical and skill understanding of "what to do and how to" which benefited them in term of ball control, decision making (passing, dribbling, tackling and scoring) and skill execution (passing, dribbling, tackling and scoring) as well as cardiovascular fitness (vo_2 max). Therefore, we valued added the original model of TGfU in adding dimensions of, (i) what tactics to use in order to score goals and how to execute scoring skills. (ii), what tactics to use in order to defend goals and how to execute defending skills and (iii). What tactics to use in order to restart game and how to execute restart skills as suggested by Mitchell, Oslins and Griffin (2005) as in figure 14

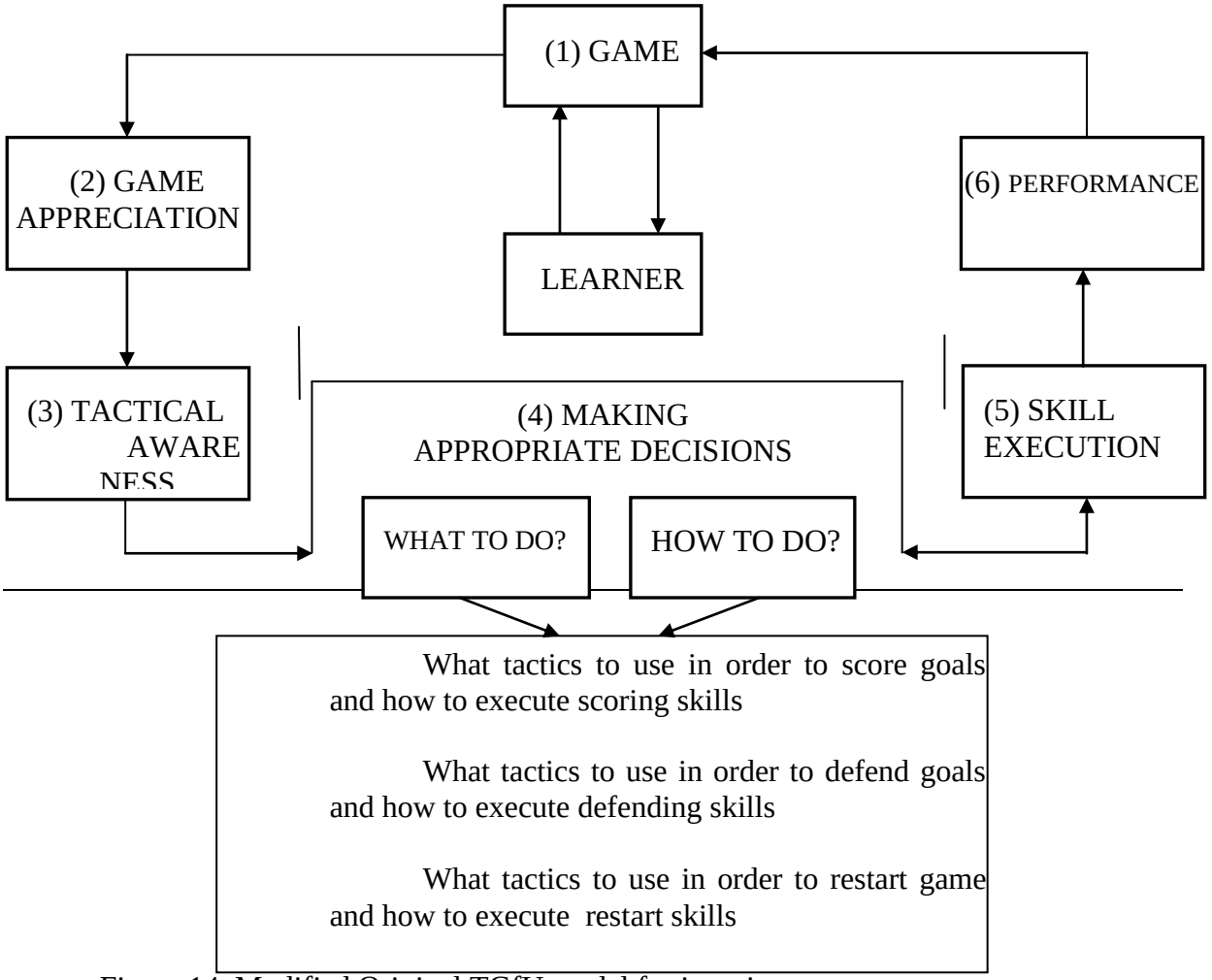


Figure 14. Modified Original TGfU model for invasion game

Conclusion

In conclusion, coaches and teachers should adopt TGfU model with small sided mini game situation such as 3 vs. 3 or 5 vs.5 in training in order to improve ball control and V_{02} max has been proven from this research. TGfU approach with mini game situations seems to be suitable coaching method to train hockey player to meet the present changes the rule of hockey in the case of draw after extra time, whereby the new ruling requires the players to play 1 versus 1 (goal keeper vs. 1 striker). However, more research has to be done on how to TGfU would improve other components of game play especially skill execution, supporting players through players positioning

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