Original Article

Coaching school hockey in Malaysia: A exploratory analysis and effect of improvised TGfU pedagogical model on small sided game play

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Published online: December 26, 2015

(Accepted for publication October 26, 2015)

DOI:10.7752/jpes.2015.04109

Abstract:

This study explored anthropometric, speed and accuracy executing general hockey skills, cardiovascular endurance, leg power and 30 meter sprinting among players. Next, the study investigated the effects of improvised Teaching Games for Understanding (TGfU) model on ball control, decision making and skill execution in 5 vs. 5 small sided game play between high-skilled players (HS) and low skilled-players (LS). A total of $n=30$ (age: 14-15 yrs) Malaysian male school field hockey players randomly selected and distributed equally HS and LS group. The findings revealed that the height and weight as well as body structure of mesomorphy of the school players are suitable for nature hockey game. Meanwhile, players performance status in term of speed and accuracy in executing general hockey skills were above average level. However, poor results indicated in term of VO_{2max} , leg power, and sprinting 30 meters. On the other hand, quasi experimental findings indicated no significant difference in term of ball control, decision making and skill execution in 5 vs. 5 game play between HS and LS after intervention, however both group improve from pre-test to post-test in term of mean score. Future study, reexamining the improvised TGfU model is encouraged.

Key words: TGfU, Anthropometric, General hockey skills, Physical-motor abilities, Game play

Introduction

Generally coaches and trainers pay much attention in the area of skill development, anthropometrics, skill developments, physical-biomotor abilities psycho-psychology, sports injuries, periodization and biomechanics that can influence training to enhance sports and game performance. However, these practitioner to certain extent undermine the importance of pedagogical approaches that plays crucial role in helping the players to learn tactics and skill development that inter-relate with games performance. On the other hand, the central aim of pedagogist highly interested in teaching and learning processes in term of achieving education objectives of physical activities and lifestyle, motor skills and uplifting attitude whereas optimizing performance were given less consideration. Therefore, a partnership between coaching and teaching philosophy between is essential as to optimize performance as well as to achieve educational standard

Now withstand, physical educationist, sports pedagogist, sports theory generator very much into implementing GBAs (Game Base Approaches) such Teaching Games for Understanding (TGfU) model, Tactical Game Model, Game Sense as a instructional and curriculum approach in teaching students to learn game and as well as upgrading game performance.

GBA's approach such TGfU gaining momentum internationally across the globe and is a superior model for teaching and coaching games compared to a technical-lead skills-based model (Burler & Griffin, 2010; Grehaigne, Godbout & Bouthier, 2001; Grehaigne & Godbout, 1995). Skilled-based approach is considered too structured, with warming-up activities and skill drills as the main components but they deprive students of opportunities to engage in game play. (Kirk & Macpail, 2002; Hopper, 2002; Rink, 2002; Turner & Martinek, 1999). Detected information via TGfU research indicated through questioning strategy and problem solving activities able to develop tactical creativity and tactical game intelligence during the early stages of youth sports development in team sports like soccer, basketball, hockey, and handball (Mommert, Baker & Bertsch, 2010; Wein, 2006). TGfU model and Tactical Game model (TGM) promote a high level of game creativity and intelligence among players. The revised TGfU model by Kirk and Macphail (2002) which incorporate elements of thinking strategically, cue perception in solving game problem under the situational learning perspective. Furthermore by adding pedagogical principles (sampling, modification-representation, modification-exaggeration, tactical complexity) in six steps of original TGfU model (Holt, Streat & Bengoechea (2002) grounded positively as educational games teaching underpinning theory

However, Rink (2010) expressed to be cautious in celebrating TGfU as a global games' pedagogy. As TGfU still lacks of underpinning elements to be grounded as pedagogical approach for teaching and coaching context. Eventhough TGfU has been strengthen with partnership ecological constraints led theory. In spite of that TGfU approach has been criticized by motor learning experts as it is still lacks of unified theoretical

underpinnings especially in term of perceptual-motor learning perspective (Miller, 2015; Chow, Davids, Button, Shuttleworth, Renshaw & Araujo, 2007). Furthermore, the present writer, feels if TGfU to be relevant and grounded solidly for coaching context, players individual attributes such as anthropometric and fitness to be asses first prior to plan the TGfU coaching units/lesson with different constraints level.

Number of detected anthropometric literature revealed that suitable physique plays a predominant role for success in games and sports. Similarly research in field hockey, players' game configurations and outcome performance were affected by body composition, somatotyping and physical motor-ability. Apart from tactical decision making and skill execution, anthropometric of a lean body, sprinting capability of 50 - 60 meters, cardiovascular fitness ($VO_{2\max}$), agility, leg power, speed, strength and anaerobic capacity are the characteristics that significantly influence game configurations and performances in the field hockey (Mannal, Khanna, Dhara, 2004; Sharma, Tripathi, & Koley, 2012; Wassmer & Mookerjee, 2002). Hence TGfU practitioners dealing games coaching need to consider these attributes as it is crucial in game play such hockey. Especially the non-European hockey-playing countries such as Malaysia, India, Pakistan, South Korea. South Africa and Kenya predominantly utilizes direct instruction of skill-based or technique-led teaching (Kirk & Macphail, 2002) coaching or teaching style, should consider game based approach (GBAs) such TGfU, TGM, Game Sense or Play Practice (Light, 2003; Light & Faws, 2003), in schools during physical education lessons or in a high performance training session in coaching context as to improve their countries international rankings

Number of research and anecdotal evidence revealed coaches, teachers and practitioner face heavy challenge to teach and coach players to learn games, has it involves complex skills (Light, 2003; Light, & Fawns, 2003; Grehaigne, Godbout, & Bouthier, 2001). Coaches do face challenges to develop game intelligent among the players be it high skilled players or low skilled players. Coaches face challenge to coach the players to learn on how to solve game problem of tactics-skills via discussion using guided wh questions such as, "what to do", "where to do", "when to do", "how to do" to utilize tactics and skills to solve the game problem. Coaches and physical educationist, ought to realize that players learn better with visual aids that supports solving game problems. However the original TGfU model, to certain extent overlooks the above mentioned aspects. The original TGfU model advocates, "what to" and "how to do" to make right decision and skill execution. However, by knowing declarative and procedural knowledge (Bunker & Thorpe, 1986) strategically thinking knowledge (Kirk & Macphail, 2002) still insufficient, players need to be asked more w/h question example "where" and "when to do" to utilize tactics-skills with speed and accuracy at the right time, right place in a game play situations. The complexity and the nature of games require the players to be equipped with high order thinking skills too, however not many research able to address the issue of high order thinking learning process and how it influence the high-skilled and low skilled players or students. With this in mind, extensive research in the area of high order thinking process and game performance needs to be explored among varying skills level. In particular, how the guided discover of wh questioning of "how to do", "when to do and where to do" effect on learning skills, tactics and how the learning influence tactical game decision making among varying skill levels need to be addressed. Another questions arise, how the coaches going to develop high thinking players and able to solve game problem through fast thinking on tactics -skills "how to do", "when to do and where to do" as their training routines predominantly focus on skill development.

The game learning model of TGfU was first initiated at Loughborough University, England in the late 1960s, in response to concerns that children were leaving school TGfU model, contains, student-centered constructivism philosophy of learning, which is a form of cognitive learning theory and deeply too underpins humanistic philosophy ((Bunker & Thorpe, 1986; Martin & Gaskin, 2004; Kidman & Lombardo, 2010). This theory contends that learners use not only use their knowledge to foster an understanding and solve game tactical problems. As matter of fact a part from solving tactical game problem, executing game skill, skillfully in game situation to large extent boils down to physical attributes such cardiovascular fitness, leg power, body composition-anthropometrics, as such tactical decision making of movement too depends on body agility to some extent. Historically, the original TGfU emphasize on tactics to skill components. TGfU is a cyclical approach which places skill learning within the context of a game and enables students to understand the relevance of skills to game situations. It does this in order for them to comprehend how to play the game and creates a better model (Bunker & Thorpe, 1986; Mitchell Griffin & Oslin, 1994; Hopper, 2002; Nathan, Sharif & Salimin, 2014).

The TGfU model as shown in Figure 1 below, was originally proposed by Bunker and Thorpe (Bunker & Thorpe, 1986) as a step-by-step model for students or players to become more skillful players. The model consists of six steps: step 1: understanding game form; step 2: game appreciation; step 3: tactical awareness; step 4: making appropriate decisions, what tactics to use and how to do it; step 5: how to execute skill execution; and step 6: upgrading game performance. The original TGfU model was later simplified with Tactical Game Model (TGM) which advocates the invasion game framework of scoring, preventing scoring and restarting play by players (Mitchell *et al.*, 2005; Nathan, 2010). In early millennium a number improvised TGfU version were highlighted: revise model (Kirk and Macphail, 2002) and Butler & McCahan (2005), improvised model (Holt, Strean & Bengoechea, 2002) and SET pedagogical style (Nathan & Haynes, 2013) and others Souza & Mitchel (2010), has done some preliminary work in coaching process. Chow *et al.*, (2007) proposed TGfU can be further grounded strong by using motor learning via constraints-led theory.

Fig. 1. Original TGfU model (Bunker & Thorpe, 1986)

TGfU model generator and researcher argued that the common practice of traditional coaches and teachers incline to skill mastery approach which is also known as the direct instructional approach (Metzler, 2005). It is characterized by a coach or teacher-centered approach where learners undertake directed engagement patterns. In this approach, (1) the coach has a clear set of learning goals, (2) the coach presents the players with the desired movement, skill or concept, and (3) the coach organizes the activities into blocks of time that are arranged to provide high rates of feedback during practice. This approach focuses on giving the students as many practice opportunities as possible so that the coach or teacher can observe the skill attempts and provide frequent and appropriate feedback (Metzler, 2005; Turner & Martinek, 1999; Turner, 1996). However, as per suggested earlier, the TGfU model still lacks of physical abilities and body anthropometric construct as skill execution very much depends on these parameters. This argument in supporting the earlier notion forwarded by motor learning experts via constraints-led theory (Chow *et al.*, 2007). Motor learning theory generator advocates the importance of constraints-led perspective for acquisition of movement skills and game play knowledge. As the motor learning proponents argue that the constraints-led framework can help physical educators to built their teaching and learning instruction using task, performer and environmental constraints to explain on how learner acquire movement skills and decision making behaviors. Actually constraints-led approach is developed based on ecological psychology and dynamical system. The constraints –led theory as Figure 2, is divide into three categories : performer, environments and task as these factors interacting that shape students behaviors as created by Newell (1986) to as to provide a framework for understanding how movement patterns emerge during task performance.

Fig. 2. Constraints –led theory (Newell, 1986)

As in figure 2, performer represents functional characteristics of learners and factors related to their physical, physiological, cognitive and emotional. Whereby learners morphology, fitness level, technical abilities and psychological factors like anxiety and motivation may shape the way individuals approach a movement task. (Renshaw, Chow, Davids & Hammond, 2010; Newell, 1986). Research on using the TGfU model shows that this model has been effective in teaching hockey, tennis and basketball especially in upgrading game components of ball control, tactical decision-making, and upgrading players game knowledge of declarative and procedural (Crespo, Reid & Miley, 2004; Harvey, 2006; Turner & Martinek, Nathan 2008). Findings indicated hybrid pedagogical model of SBT, SET and SHT (whereby TGfU model are combined with teaching styles of B, E and H of Mosston Teaching style) able to improve varying young players (high-skilled, medium-skilled and low-skilled) hockey players performance outcome in term of speed and accuracy executing general hockey skills, ball control, decision making (passing, tackling, dribbling and shooting) and skill execution (passing, tackling, dribbling and shooting) in 3 vs. 3 game play. (Nathan, 2008). Findings too indicated SHT pedagogical style suits the high-skilled (HS) players (Nathan, 2008; Nathan, 2010). In another study, the author of this study

compared TGfU to traditional approach of SDT (Skill Drill Technical) reported shown improvement performance among elite young Malaysian hockey players in term of ball control and cardiovascular fitness. Whereas, research conducted in India using young elite hockey players using TGfU seems to a better model compared to SDT (Skill Drill Technical) in term of ball control in mini games, tactical game decision making in mini games, as well as skill execution in mini game situations too and on top of that TGfU model able to upgrade students cardiovascular fitness level (Nathan *et al.*, 2013; Nathan & Khanna, 2013).

Interestingly enough through anecdotal evidence and observations, the problem in Malaysia or some other hockey giant such as India, Pakistan teaching and coaching lessons in games emphases given to the mastery of skills. In another word, it is called the skilled-based or approach or the technical-led model, which is a direct teaching style or coaching style utilized and fancied by coaches or teachers. As the whole teaching or coaching instructions unit is controlled by the teacher or coach and seldom the players were allowed to solve game problems. Each teaching unit or coaching unit begins with a structural lesson comprising warming up, followed by skills teaching via demonstration and skill drills, mini game play towards the end of training unit and finally limbering down activities. Most Malaysian school hockey player's especially junior ones are unable to make the correct decisions on tactics and weak in utilizing skills in game situations, perhaps fitness could be the problem. To date limited Malaysia researcher or coach has developed and investigated the effectiveness of the attributes in improvised TGfU model for invasion game such as hockey in coaching context which emphasizes not only using tactics-skills of six steps from the original TGfU model (Bunker & Thorpe, 1986). Therefore, attributes in the improvised TGfU model proposed in this study that builds around invasion game strategy framework scoring, defending scoring and restarting game strategy in solving game problem as coined by Mitchel *et al.* (2005). Again, the improvised model being strengthen by elements of questioning 'when to do' and "where to do", which guides the players to thinking in details to solve game problems. The prime attributes added up in this improvised element of body anthropometric and physical abilities to investigate the varying skilled players (high-skilled and low-skilled) players in hockey. The improvised model as illustrated in Figure 3

Fig. 3. Improvised TGfU model for invasion

Therefore, the problem of this study indicated limited or almost no exploratory research was conducted to explore school players status of anthropometric, physical motor-ability of cardiovascular endurance, leg power and 30 meter sprinting before TGfU intervention been done. Secondly limited research investigated the effect of improvised model for invasion game in term of of ball control, decision making (pass, dribble, tackle and scoring) and skill execution (pass, dribble, tackle and scoring) in 5 vs. 5 small sided hockey game play between high skilled (HS) and low-skilled (LS) players. The purpose of study was to explore and assess status of body anthropometric, speed and accuracy executing general hockey skills, physical motor-ability of cardiovascular fitness, leg power and 30 meter sprinting among Malaysian school hockey players Secondly to investigate the effects the improvised TGfU model in terms of ball control, decision making (passing, dribbling, tackling and scoring) and skill execution (passing, dribbling, tackling and scoring) in 5 vs. 5 small sided game plays between high-skilled players (HS) and low skilled-players (LS).

Research questions

The following questions were developed to pertain to coaching hockey using school players. (i) What is the status of among Malaysian school hockey players in term of body anthropometric composition, speed and accuracy executing general hockey skills, cardiovascular fitness

($\dot{V}O_{2\max}$), leg power and 30 meter sprinting? (ii) Is there a difference between HS and LS players in term of ball control and decision making in term of passing, dribbling, tackling, scoring as well as regarding skill execution (passing, dribbling, tackling and scoring) in 5 vs. 5 small sided game play performance

Material & methods

The study employed descriptive method to explore status of body anthropometric, general hockey skills of speed and accuracy, physical motor-ability of cardiovascular endurance, leg power and 30 meter sprinting among selected randomly $n=30$ school hockey players. Secondly, this research employed Quasi-experimental pre-and post-test design (Gay & Airsan, 2002) to investigate the effect of ball control, decision-making in particular passing, tackling, dribbling, shooting and skill execution of passing, tackling, dribbling, shooting the framework suggested by Turner and Martinek (1999) using in 5 vs. 5 small sided game play situation between high-skilled with low-skilled school hockey players. The whole research took 7 weeks with five (5) weeks of intervention of 12 hockey units via improvised TGfU model for invasion game. The improvised TGfU model was developed based on components of TGfU original model by Bunker & Thorpe (Bunker & Thorpe, 1986) with six steps of teaching as well as utilizing scoring, prevention of scoring and restarting game strategy by Mitchel, Oslin & Griffin (Mitchel *et al.*, 2005). Besides that, the improvised TGfU model for invasion game is further value added with following guided discovery approach using wh questions method in term of, "what to do" "when to do", "where to do", and "how to do" pertaining tactics and skills. Game play performance involves skills, fitness and tactics, therefore these attributes depends on body anthropometric structure and physical abilities too. The conceptual framework of this is reflected in the following Figure 4, which represents dependent variables (DV) and independent variables (IV) of the study

Figure 4. Conceptual framework of the study

Participants

The sample consists of $n = 30$ players (14-15 years old) all male school hockey players across two state in Malaysia whom were selected randomly out of a total $n = 45$ players and all the $n= 30$ samples took part in first phase of descriptive research to assess anthropometric, general hockey skills of speed and accuracy, physical motor-ability of cardiovascular endurance, leg power and 30 meter sprinting. While the next phase of study investigated the effect of improvised TGfU model in terms of ball control, decision making and skill execution among HS and LS players. Furthermore, Henry Freidel Field Hockey Test (H.F.F.H.T) for general hockey skills for speed and accuracy (Nathan, 2008; Nathan & Khanna, 2012, Turner & Martinek, 1999) was carried out to disturbed $n= 30$ samples equally based on their skill level achievement to high skilled (HS) group, $n=15$ and low-skilled group (LS), $n=15$. As for ethical consideration, permission was obtained from all the players and their parents or guardians that involved in this study through their teachers. Precautions were taken to minimize the injury level, as briefing was given by qualified sport teachers who doubled up as sports rehabilitation expert related to injury in line with ethical principles when using people in research. Next ethical consideration, as this research supported and approved by ethical and proposal panels (Malaysian Education Ministry), reference number: KP(BPPDP) 603/5/JLD.9, 52). A qualified and experienced hockey school teacher cum coach was selected to coach the participants using improvised TGfU model for high skilled players (HS) and low skilled-players (LS). In order to maintain proper implementation of this improvised model, the following steps were taken. A briefing session was conducted by the principal researcher on how to implement these models which translated in modules for HS and LS groups. A pre-training stint was conducted by the researcher on implementing these interventions and the method for measuring the required tests as. A pre-interview was conducted by the principal researcher to ensure this teacher cum coach conducted the coaching or training units correctly.

The improvised TGfU Intervention

The coaching units (lessons) in the quasi experimental intervention was built using the following components. The questioning strategy to solve tactical-skill game problems was extended from on “what to do” and “how to do” as proposed in the original model to “when to do” and “where to do” – via the guided discovery approach using improvised TGfU model. The improvised model too adapted scoring, defense and restarting play strategy from TGM (Bunker & Thorpe, 1986; Mitchel *et al.*, 2005). The content of TGfU improvised model, advocated high order thinking skills in each lessons, “example of high order thinking questions: what tactics and skills do you employ in situations such as your opponent attacking through their wingers. When and where do you use the poke tackle, and how do execute the poke tackle?”. As these to be discussed and answered by high skilled (HS) players with high game tasks to solved. Whereas the LS players also will be questioned too with high thinking skills but with simpler questions and corresponding with less complex tasks. The coaching (training) units were carried in the following sequence over 5 weeks: firstly, warming up session (10-12 minutes); secondly, short briefing on tactics, continuing with game situation 1 (12-14 minutes); thirdly, short briefing with short recovery, followed by game situation 2 (12-14 minutes); and finally, cooling down and reflection activities (7-10 minutes). The TGfU lessons were carried out using the tactical approach of scoring, prevention of scoring and restarting of play via a guided problem-solving method. These coaching (training) units were divided into scoring tactics, prevention of tactics and restarting play tactics. Each training unit utilized the guided discovery method and wh questioning approach, “what to do” “when to do”, “where to do” and “how to do” pertaining tactics and skills “. How the players learn and train using TGfU model as intervention for HS and LS school hockey players follesd some principle in sports training and motor learning principles (Fitts & Posner, 1967; Bomp & Half, 2009)

Measurements and Instrumentations

Somatotyping and physical motor-ability through field test

The following measurements were used in this study: (i) The classification of somatotyping of endomorph, mesomorph and ectomorph involved instrumetation of ten anthropometric dimensions are needed to calculate the anthropometric somatotype: stretch stature, body mass, four skinfolds (triceps, subscapular, supraspinale, medial calf), two bone breadths (biepicondylar humerus and femur), and two limb girths (arm flexed and tensed, calf) as stated in Somatotype Instructional Manual (Carter, 2002). (ii). Henry Freidel Field Hockey Test (H.F.F.H.T) adapted from Turner and Martinek (Nathan, 2008, Nathan & Khanna, 2012; Turner & Martinek. 1999) was used to measure general field hockey tests in speed and accuracy of executing hockey skills. This test incorporated the skills of ball control, dribbling, tackling, evading an opponent and shooting. The reliability using H.F.E.H.T in Malaysian environment (secondary school boys) was calculated using Cronbach’s alpha at .81 for speed of execution and .72 for accuracy of executing skill (Nathan, 2008; Nathan & Khanna, 2012). (iii). Multi-Stage Fitness Test (MSFT), developed by Leger & Lambert (Legar & Lambert,1982) was to monitor the development of the players’ maximum oxygen uptake ($\text{VO}_2 \text{ max}$). (iv) AAHPERD standing broad jumps (Miller, 2006) to measure explosive leg power. The test is high on face validity and reliability coefficients reported ranging from .83 to .99. (v). 30 meter flying start, the main objective of testing 30m hockey player is to monitor the development of the players ability to effectively and efficiently build up from acceleration to maximum speed (Mackenzie, 1999; Nathan & Khanna, 2012).

Game play observational instrument

This study adopted the game play observational instrument (Turner & Martinek, 1999; Mitchell, *et al.*, 2005; Nathan & Khanna, 2012). Players’ ball control, decision-making and skill execution were evaluated using the Game Observation Instrument. The dependent variables of ball control, decision-making, and skill execution were coded 5,4,3,2 (5-very effective performance; 4-effective performance, usually; 3-moderateely effective performance, sometimes; 2-very weak performance and 1-very weak performance, never). An experienced and qualified Malaysia Sports School hockey coach was trained to code all the dependent variables using the game play observational instrument by watching all the video-taped 5 vs. 5 game play situations. With reference to inter coder reliability, based on the 20 players participating in three 5 vs. 5 game scenarios, the agreements between the coder and principal researcher were 78% for ball control, 81% for decision-making and 88% for skill execution (Nathan & Khanna, 2012)

Data Collection and Analysis

Somatotyping and physical ability-motor attributes

The height of players taken using height scale, as for body mass (weight) the players were measured using weight and recorded to nearest tenth of a kilogram. As for skinfolds were taken at appropriate players sites to the nearest 0.1 mm using Harpenden caliper Carter (2002). Skeletal diameters were use to measure appropriate players sites using a broad blade antropometer where the circumferences were measured to nearest cm using 2.0 meter flexible steel tape The Health-Carter (1975) method of somatotyping in which anthropometry was utilized to estimate criterion somatotype as to identify somatotypes of hockey players Carter (2002).. As for general hockey skill performance in term of speed and accuracy executing general hockey

skills was calculated based on speed score represented in time and accuracy was a total score out of nine marks (Nathan, 2008,; Nathan & Khanna, 2012). As for cardiovascular fitness was calculated through VO_2 max, based on the Bleep test performance in term of level and number of shuttles completed at that level by the hockey players when they are withdrawn (Lambert1982). As for leg power, the hockey players perform three standing broad jump correctly, the best jump was recorded in meters and centimeters out of three trial . Meanwhile as for 30m running speed was analyzed based on time (sec).The test is conducted 3 times, however the fastest recorded time was use to assess the players' 30m sprint performance (Miller, 2006). Descriptive statistics of mean and SD were used to analyzed all the collected data.

5 vs. 5 small sided game play

The dependent variables of ball control, decision-making (passing, dribbling, tackling and scoring) and skill execution (passing, dribbling, tackling and scoring) in 5 vs. 5 small sided field hockey game play were calculated based on successful and unsuccessful responses (5-1 mark range) for each dependent variable. The effect of the improvised TGfU model on HS and LS school hockey players performance or outcome at pre-test and post-test were analyzed using the SPSS software version 21, via statistical analysis of ANOVA. In addition, analysis of covariate or ANCOVA was utilized to confirm the results whenever there was significant differences occurred at pre-test.

Results

Descriptive statistics of anthropometric, general hockey skills of speed and accuracy, physical motor-ability of cardiovascular endurance, leg power and 30 meter sprinting among Malaysian school hockey players are illustrated in Table 1. While, Figure 5, also illustrate descriptive statistics of anthropometric, general hockey skills of speed and accuracy, physical motor-ability of cardiovascular endurance, leg power and 30 meter sprinting among Malaysian school hockey players in term of Mean and SD

Table 1.Body anthropometric, hockey specific skills, physical motor-abilities parameters

Parameters	Mean/SD	N
Height (HT)	167.36±7.37	37
Weight (WT)	60.22±11.76	37
Endomorphy (Endo)	3.20±1.13	37
Mesomorphy (Meso)	3.90±.96	37
Ectomorphy (Ecto)	2.77±1.21	37
Speed of executing general hockey skill (SGS)	10.74±1.55	37
Accuracy of executing general hockey skill (AGS)	9.05±.83	37
Cardiovascular endurance (VO_2 max)	30.86±5.47	37
Leg power (LP)	1.68±.47	37
Sprinting 30 meters (S30m)	5.28±.41	37

Fig. 5. Body anthropometric, hockey specific skills, physical motor-abilities parameters

Ball Control in 5 vs. 5 game play

Univariate ANOVA test indicated there was no significant difference between HS with LS groups on ball control in 5 vs. 5 small sided game play at pre-test, $F(1,28)= 1.60$, $p>0.05$ (HS: 1.73±1.33) and (LS:1.20±.941). After intervention, the post-test results indicated no significant difference too between HS (4.20±3.53) and LS (3.10±.593), $F(1,28)=2.93$, $p<0.05$. As Table 2 illustrates the results' in term of *Mean* and *SD*, *SE*, as well as *P* value for ball control in 5 vs. 5 small sided game play

Table 2. Pre-test and post-test score for ball control

TGfU	Mean	SD	SE	N	P	
Pre-test						
HS	1.73	1.33	.34	15	.216	$F(1,28)=1.60, p>0.05$
LS	1.20	.941	.24	15		
Post-test						
HS	4.20	1.69	.43	15	.296	$F(1,28)=2.93, p>0.05$
MS	3.53	1.72	.44	15		

Decision-making in 5 vs. 5 game play

As for overall decision-making in term of passing, dribbling, tackling and scoring), ANOVA indicated no significant difference between the HS (5.00 ± 2.74) and LS (4.40 ± 1.88). group at pre-test, $F(1,28)=1.95, p>0.05$. However, detected overall post-tests results for decision-making too indicated there no significant difference between the HS (7.33 ± 3.43) and LS (8.60 ± 4.37), group $F(1,28)=2.66, p>0.05$. The following Table 3 illustrates the results' Mean and SD, SE, P value for decision making in 5 vs. 5 small sided game play

Table 3. Pre-test and post-test score for overall decision making

TGfU	Mean	SD	SE	N	P	
Pre-test						
HS	5.00	2.74	.71	15	.174	$F(1,28)=1.95, p>0.05$
LS	4.40	1.88	.49	15		
Post-test						
HS	7.33	3.43	.89	15	.114	$F(1,28)=2.66, p>0.05$
LS	8.60	4.37	.80	15		

Skill execution in 5 vs. 5 game play

Univariate ANOVA revealed $F(1,28)=3.05, p<0.05$ indicates that for overall skill execution (passing, dribbling, tackling and scoring) at pre-test results recorded no significant difference between the HS (3.33 ± 2.16) and LS (2.13 ± 1.55). Furthermore pos-tests results too reveals no significant difference for overall skill execution with $F(1,28)=1.59, p>0.05$ between the HS (6.67 ± 4.30) and LS (4.87 ± 3.50). This illustrate as in Table 4 in term of Mean and SD, SE, P value for skill execution in 5 vs. 5 small sided game play

Table 4. Pre-test and post-test score for overall skill execution

TGfU	Mean	SD	SE	N	P	
Pre-test						
HS	3.33	2.16	.56	15	.092	$F(1,28)=3.05, p>0.05$
LS	2.13	1.55	.40	15		
Post-test						
HS	6.67	4.30	1.10	15	.217	$F(1,28)=1.59, p>0.05$
LS	4.87	3.50	.90	15		

Discussion

It has been observe in these present findings the scholl hockey players composure in term of heights (167.36 ± 7.37) and weights (60.22 ± 11.76) level indicated favorable characteristic for young hockey players. This reveals that school right fully channeled suitable players to take hockey as their suitable sports. As for somatotype mean score, findings from this present study indicated the hockey players were high on mesomorphy ($3.80\pm.96$), moderate onendomorph (3.20 ± 1.13) and to be low on ectomorphy (2.77 ± 1.21). The present findings support the earlier finding of Demuth, Czerniak, Krzykała, Wieliński & Ziółkowska-Lajp (2007) investigated the morphological diversification of field hockey players from the national teams of China ($n=18$), Malaysia ($n=18$), Poland ($n=20$) and Switzerland ($n=16$), during men's field hockey qualifying competition in Poland. Their findings indicated field hockey players were shorter, slimmer and their skeleton heavier. Furthermore, most of all the groups players were on mesomorphic and body build, and the Chinese payers had the highest values of mesomorphic. In comparison the Swiss players were the last, had the lowest values of mesomorphic. The important findings revealed that the morphological characteristics differences of individual teams effect to their final position in the competition ranking. Therefore, China was in top position and Switzerland was last in ranking (Demuth *et al.*, 2007)

Again in term of somatotype, high and weight and age in particular, the present research was parallel to findings of Lal (2005) as he conducted with $n=100$ athletes to find out difference in somatotype among the footballers ($n=50$) and hockey players ($n=50$) during the inter colleges competitions of Himachal Pradesh University. The results indicated that footballers were younger, taller, and heavier than hockey players. It has been also found that footballers were more dominant on endomorph, on the other hand hockey players were dominant on mesomorph and ectomorph compare to the footballers (Lal, 2005). Based on many scientific findings somatotype and body composition do influence players performance in hockey game play in term skill execution with speed and accuracy, Therefore somatotype and body composition should be taken into consideration while planning coaching, learning and teaching games via TGfU. Somatotyping plays important role especially in learning hockey skills especially when the players reach peak height velocity, therefore practitioners and coaches and teachers should plan task constraints or training units considering somatotyping development. Furthermore, the importance of somatotyping should not only to be considered by coaches in coaching the elite players. But to some extent, the physical education teachers in secondary school too should to be far sighted. They must plan their teaching and learning tasks accordingly to player's skill level via pedagogical model for games such hockey, as to place the players who are high in mesomorphic to high-skilled groups especially when the school players reaching peak height of velocity in order to improve hockey standard progressively.

Exploratory findings on speed of executing general hockey skills, the present findings reveals that the school hockey players performance was at average level (10.74 ± 1.55) and on the other hand, accuracy ($9.05 \pm .83$) executing general hockey skills was above average level. Even though their performance was good, the school hockey players need to further upgrade their performance on these components, perhaps with TGfU intervention. Whereby, some local research as well as international findings reveals that TGfU model intervention able to improve speed and accuracy executing hockey skills (Nathan & Khanna, 2012; Nathan *et al.*, 2013; Nathan *et al.*, 2014; Turner & Martinek, 1999). Another exploratory result for cardiovascular fitness, it has been observed the players level of $\dot{V}O_{2\max}$ was at 30.86 ± 5.47 ml/kg/min. This findings indicated below average level based on norms set at 42.7 $\dot{V}O_{2\max}$ by Leger and Lambert (1982), (Nathan & Khanna, 2012; Nathan *et al.*, 2013; Nathan *et al.*, 2014). Furthermore, findings by 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 $\dot{V}O_{2\max}$ 53.8 ml/kg/min. Therefore the school field hockey players had low aerobic capacity, it indicates necessity for the players to design additional continuous small sided activities proposed in TGfU model in training to improve the aerobic capacity and to increase anaerobic threshold for sprinting components Aziz, Chia, & Teh (2000). Previous research shows some proof that TGfU model able to improve players cardiovascular fitness (Nathan & Khanna, 2012; Nathan *et al.*, 2013; Nathan *et al.*, 2014).

In another exploratory findings of 30m sprinting (sec) and leg power, the present findings indicated the school players were poor in these two physical-ability components. As these components are important and inter-related for high hockey performance, therefore players need to improve further on these components. Previous findings reported of high correlation between leg power and sprinting abilities, as short sprints crucial for game players (Chelly *et al.*, 2010). As for leg power and 30m sprinting improvement again notwithstanding using TGfU intervention by local research (Nathan *et al.*, 2013; Nathan *et al.*, 2014). The findings of 5 vs. 5 small sided game play show that improvised TGfU model was effective for ball control, decision making and skill execution based on mean score increment after intervention for HS and LS, even though there was no significant difference between these two groups. However, HS group achieved higher mean score ball control performance compared to LS. This findings supports the findings of Shim, Carlton, Chow & Chae (2005), highly skilled player perform better than novice player in executing tennis skills. The usage of small sided activities with various task constraints enable the players to improve their ball control ability, parallel with earlier findings (Turner & Martinek, 1999; Nathan, 2008; Nathan *et al.*, 2013; Nathan *et al.*, 2014).

This present finding supports that the improvised TGfU model is an important model for learning in as it develops high order of thinking skills in decision making parallel with findings of earlier work (Light, 2003; Light & Fawns, 2003). Both HS and LS able to improve in overall decision making in term of passing, dribbling, scoring and tackling as the TGfU model advocating a guided discovery method of coaching where players have to think and read the game in advance so that they can solve game problems. Besides that as the TGfU model advocates "what to do" and "how to do" as well as "when to do" prompts. and assisted especially LS players to perform better than HS able to make right game decisions for passing, dribbling, tackling and scoring. This findings in contra with earlier findings using TGfU in hybrid pedagogical style of SHT, high skilled players (HS) able to make good decision making (passing, dribbling, tackling and scoring) in 3 vs. 3 mini game situations (Nathan, 2008; Nathan & Khanna, 2012; Turner & Martinek, 1999).

With reference to overall skill execution of passing, dribbling, scoring and tackling in the present findings both HS and LS benefited from improvised TGfU intervention even though there was no significant difference between both group after intervention. The performance of HS player in term of mean score of skill execution fared better than LS, this findings again similar with findings of Shim *et al.* (2005) that highly skilled player perform better than novice player in executing tennis skills. As the improvised TGfU helped HS and LS groups improve their skill execution capacity in 5 vs. 5 small sided game play This finding agrees with previous

findings in badminton, soccer and hockey (French *et al.*, 1996; Harvey, 2003; Light & Fawns, 2003; Turner & Martinek, 1999)

Conclusions

The present dimension of research and the components of improvised TGfU model that exposed here may shed some light to strengthen TGfU that underpins unified theories. Furthermore the findings in term of physical motor-ability of cardiovascular endurance, leg power, 30 meter sprinting and ball control, decision making as well as skill execution in 5 vs. 5 small sided game via improvised TGfU model, to a certain extent can address the pedagogic dilemmas associated with TGfU pedagogy in term question strategy, insufficient pedagogical content knowledge as difficulties experienced by cricket coaches detected findings of Roberts (2011). It may be concluded that coaches and teachers especially dealing with invasion game to name few hockey, football and hand ball. Coaches and teachers should comprehend the components coaching and learning: elements such as body anthropometrics, physical motor-ability of cardiovascular endurance, leg power, 30 meter sprinting, game play components and strength pedagogical principle that under pins from teaching perspective as produce knowledgeable, intelligent, skillful and value laden game players. Therefore coaches and teachers should adopt and adapt Game Based Approaches (GBAs) such TGfU, TGM or Game sense, Game Concept or improvised TGfU as proposed in this research. I suggest link it with body anthropometric, physical motor-ability whether in research, teaching or in coaching context. Time has come for coaches and physical educationist, teachers, sports practitioner work in hand to hand with sports researcher and theory generator to upgrade invasion game standard across the globe starting from school level, as Drewe (2000) revealed there is relationship between coaching teaching.

Acknowledgment

The paper presents a part of study that been supported by a small grant provided by Sultan Idris Education University of Malaysia (2011-0036-107-01). The author acknowledges the support of the Education Ministry of Malaysia (KP(BPPDP) 603/5/JLD.9, 52) in permission to use school players and giving ethical clearance. Special thanks and appreciation to Malaysian national school hockey coaches, Dr. John Haynes of University New England, Australia and Prof GL Khanna (Manav Rachana International University, India of research validating support

References

- Aziz, A R, Chia, M, & Teh K. (2000). The relationship between maximal oxygen uptake and repeated sprint performance indices in field hockey and soccer players. *Journal Sports Medicine and Physical Fitness*, 40 (3), 195
- Bompa, T. & Half, G. (2009). *Periodization: Theory and Methodology of Training*. Human Kinetics
- Bunker D, & Thorpe R (1986). A model for the teaching of games in the secondary schools. *The bulletin of physical education*, 19, 5-8.
- Butler, J & Griffin, L (2010). TGfU movement in an international context. In Butler & Griffin, L. (Eds) (2010). *More Teaching games for Understanding moving globally*. Human Kinetics
- Carter J (2002). *The Heath-Carter Anthropometric Somatotype: Instructional Manual*. USA, San Diego: San Diego State University Syllabus Service.
- Chow, J.Y, Davids. K, Button. C, Shuttleworth. R, Renshaw & Araujo, D. (2007). The role of nonlinear pedagogy in physical education. *Review of Educational Research*, 77(3), 251-278
- Crespo M, Reid M, & Miley, D (2004). Tennis: Applied examples of a game-based teaching approach. *Strategies*, 17(4), 27-31.
- Chelly, Souhaïel, Najet, Amar, Ben. M, Hermassi, Souhaïl, Mourad, Bouhlel, Ezdine, Tabka, Zouhair, Shephard & Roy. J. (2010). Relationships of leg power, maximal repetition half back squat, and leg muscle volume to 5-m sprint performance of junior soccer players. *Journal of Strength & Conditioning Research*, 24 (1), 266-271
- Demuth A, Czernia, U, Krzykała M, Wielński D, Ziółkowska-Lajp E (2007). Somatic characteristic of players from chosen national teams of field hockey. *Journal of human movement*. 8 (1), 27-31
- Drewe, S (2000). An examination of the relationship between coaching and teaching. *QUEST. National Association for Kinesiology and Physical Education in Higher Education*, 52, 79-88.
- Fitts P, & Posner M. (1967). *Human Performance*. Belmont, CA; Brooks and Cole Publishing.
- French, K, Werner P, Taylor K, Hussey K, & Jones J (1996). The effects of a 6 week unit of tactical, skill, or combined tactical and skill instruction on badminton performance of ninth-grade students. *Journal of Teaching Physical Education*, 15, 439-463.
- Ghosh A, Goswami A, Mazumdar P. & Mathur. (1991). Heart rate and blood lactate response in field hockey players. *Indian journal of medical research*, 94, 351-356
- Gay, L., R. & Aisan, P. (2003). *Educational Research. Competencies for analysis and applications*. Merrill Prentice Hall.

- Grehaighe J, Godbout P, & Bouthier P (2001). The teaching and learning of decision making in team sports. QUEST. National Association for Kinesiology and Physical Education in Higher Education, 53: 59-75
- Grehaighe J, & Godbout P (1995). Tactical knowledge in team sports from a constructivist and cognitivist perspective. QUEST. National Association for Kinesiology and Physical Education in Higher Education, 47, 490-505.
- Harvey S (2003). *A study of U19 college soccer players improved in game performance using the game performance assessment instrument*. Proceedings of the Second international conference: teaching sports and physical education for understanding. University of Melbourne, Australia: 11-14 December 2003
- Hopper T (2002). Teaching games for understanding: The importance of student emphasis over content emphasis. *Journal of Health, Physical Education, Recreation & Dance*, 73(7): 44-48.
- Holt, N. L., Streat, W. B., & Bengoechea, E. G. (2002). Expanding the teaching games for understanding model: New avenues for future research and practice. *Journal of Teaching Physical Education*, 21, 162-176.
- Kirk, D., & MacPhail, A. (2002) Teaching Games for Understanding and Situated Learning: Rethinking the Bunker-Thorp Model. *Journal of Teaching in Physical Education*, 21 (2), 177-192.
- Lal, M. (2005). Comparative study of somatotype between football and hockey players. *Indian journal of applied research*, 5(5), 712-713
- Leger L. & Lambert J (1982). A maximal multistage 20m shuttle run test to predict VO₂max. *European Journal of Applied Physiology*, 49: 1-5
- Light, R. (2003). The joy of learning: Emotion and learning in games through TGFU. *Journal of Physical Education New Zealand*, 36(1):93-103.
- Light, R., & Fawns, R. (2003). Knowing the game: Integrating speech and action in games teaching through TGFU. QUEST. National Association for Kinesiology and Physical Education in Higher Education, 161-176.
- Mannal., I, Khanna G, Dhara. P. (2004). Effect of training on anthropometric, physiological and biochemical variables of elite field hockey players. *International Journal of Sports Science and Engineering*, 4(4), 229-238
- Mackenzie, B. (1999). *Flying 30 meter Test*. Available from: <http://www.brianmac.co.uk/flying30.htm> [Accessed 23/7/2012]
- Martin A, & Gaskin, J. (2004). An Integrated Physical Education Model. *Journal of Physical Education New Zealand Te Kotuku Rerenge*. 2004, 37, 61-69.
- Memmert, D, Baker, J., & Bertsch, C. (2010). Play and practice in the development of sport-specific creativity in team sports. *High Ability Skills*, 21(1): 13-18
- Metzler M (2005). *Implications of models-based instruction for research on teaching: A focus on teaching games for understanding*. In Griffin, L. & Butler. J. (2005). (eds.), *Teaching games for understanding: Theory, research, and practice*, Champaign, IL: Human Kinetic
- Miller, A. (2015). Games centered approaches in teaching children adolescent: Systematic review of associated student outcomes. *Journal of teaching physical education*, 34, 36-58
- Miller, K. (2006). *Measurement physical educator, why and how*, (5th Ed). Mc Graw Hill. Boston
- Mitchell A, Oslin L, & Griffin L. (2005). *Teaching sport concepts and skills: A tactical games approach*. Champaign: Human Kinetics
- Mitchell S, Griffin L, & Oslin, J. (1994). Tactical awareness as a developmentally appropriate focus for teaching of games in elementary and secondary physical education. *The Physical Educator*, 51: 21-27.
- Nathan, S. (2008). *The effects and sustainability of training programmers' using Teaching Games for Understanding (TGfU) with different teaching style on students with varying hockey skill levels*. A paper presented at the 1st Asia Pacific Sport in Education Conference, Adelaide, South Australia.
- Nathan, S. (2010). *A study on effectiveness of SET and SHT Teaching Modules in acquiring general skills, knowledge and game play among students of varying skill levels in hockey* , "Congreso de la Association(International Association of Physical Education in Higher Learning) AIESEP - presiding paper , Altorendimiento, Spain: 26-29 de Octubre de 2010
- Nathan, S. & Khanna G. (2012). A comparison Study of TGfU with Technical Training Model in Mini Game Performance, Speed and Accuracy among Junior Hockey players. *Pan-Asian Journal of Sports & Physical Education*, 4(1), 23-37
- Nathan. S, Hashim, A , Boon, K., Sharif, A Madon, M & Rayid, N. (2013). 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. *British Journal of Arts and Social*, 11, 2046-9578.
- Nathan S. (2013) The Effect and Sustainability of Hybrid Training Styles on Speed, Accuracy, Knowledge Acquisition among Varying School Hockey Players. *Journal of Sustainable Society*. 2 (2): 49-58
- Nathan, S., & Haynes, J. (2013). A move to an innovative games teaching model: Style E Tactical (SET). *Asia-Pacific Journal of Health, Sports and Physical Education*, 4(2), 287-302

-
- Nathan S, Sharif A, R & Salimin, N. (2014). The effect of teaching games for understanding coaching context on elite Malaysian school player's in general hockey skills and mini game play. *International Journal of Humanities, Arts, Medicine and Sciences*, 2(4), 15-24
- Nevett M, Rovegno I, Babiarz M, & McCaughtry. (2005). Changes in basic tactics and motor skills in an invasion type game after a 12-lesson unit of instruction. *Journal of Teaching Physical Education*, 20, 352-369.
- Renshaw, Chow, JY, Davids, Keith, W & Hammond. (2010). A constraints-led perspective to understanding skill acquisition and game play: a basis for integration of motor learning theory and physical education praxis? *Physical Education & Sport Pedagogy*, 1-40
- Rink J. (2010). *TGFU: Celebrations and cautions*. In Butler & Griffin, L. (Eds) (2010). *More Teaching games for Understanding moving globally*. Human Kinetics
- Rink J. (2002). Teaching physical education for learning. (4th ed.). New York: McGraw Hill;
- Rink J, French K, & Graham, C. (1996). Implications for practice and research. *Journal of Teaching Physical Education*, 15, 490-502.
- Rink J, French, & Tjeerdsm. (1996). Foundation for the learning and instruction of sport and games. *Journal of Teaching Physical Education*, 15, 399-417.
- Robert, S. (2011). Teaching Games for understanding: the difficulties and challenges experience by participation cricket coaches. *Physical education and sports pedagogy*, 16(1), 33-48
- Sharma A, Tripathi V, & Koley S. (2012). Correlations of anthropometric characteristics with physical fitness tests in Indian professional hockey players. *Journal of Human Sport & Exercise, University of Alicante*, 7(3), 698-795
- Shim, J., Carlton, L, Chow, J & Chae, W. (2005). The use of anticipatory visual cues by highly skilled tennis players. *Journal of motor behavior*, 37(2), 164-175
- Siedentop, D. (2001). *Introduction to physical education, fitness, and sport* (4th ed.). Los Angeles, CA: Mayfield Publishing Company
- Souza & Mitchell, S. (2010). TGFU as a Coaching Methodology. In Butler & Griffin, L. (Eds) (2010). *More Teaching games for Understanding moving globally*. Human Kinetics
- Turner, A. (1996). Teaching for understanding: Myth or reality? *Journal of Physical Education, Recreation and Dance*, 67(4): 46-48.
- Turner A, & Martinek T (1999). An investigation into teaching games for understanding: Effects on skill, knowledge, and play. *Research Quarterly for Exercise and Sport*, 70(3), 2142.
- Wein, H. (2004). Developing game intelligence in soccer, Auburn. Michigan Wassmer D, & Mookerjee, S. (2002). Descriptive Profile of Elite U.S. Women's Collegiate Field Hockey Players. *Journal of Sports Medicine and Physical Fitness*, 42(2), 165-171