

NORMATIVE DATA OF POTENTIAL YOUNG MALAYSIAN ATHLETE FOR
TALENT IDENTIFICATION DECISION SUPPORT SYSTEM

KAMARUZAMAN BIN SOEED

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In dedication to Mak (Kalthom Hj Ismail), my lovely wife (Salimah Mohd. Rashid)
and my beautiful angel, Dahlia.

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ABSTRACT

This study focused on the development of normative data of potential young Malaysian athlete for the Sports Talent Identification Decision Support System (STIDSS). The system helps to smoothen the process of the sports talent identification program in order to produce potential future athletes in Malaysia. Current approaches of talent identification programs only focused on physical and psychological attributes. The newly developed STIDSS focuses on four main attributes which include physical, physiological, psychological and sociological components. Basically, assessment of these attributes is the main focus of this study and acts as part of the objectives of the study, in line with the evaluation of the effectiveness of STIDSS. Four related anthropometric measurements and nine field tests were used to assess the ability of an individual's physical fitness. The 20 m multistage shuttle run test was used to test maximum oxygen uptake (VO_{2max}) for physiological while the mental toughness and the level of parental support tests were used to investigate psychological and sociological attributes. A total of 537 ball sports, racket sports and target sports junior athletes, aged 13 years old were selected from the Malaysian Sports School and State Sports School to be involved in the field testing. A total of 85 participants was involved in the testing of the usability of the system and 374 junior athletes were tested to evaluate the accuracy of the system based on physical and physiological characteristics. Three sets of questionnaires were used to test the level of mental toughness, the level of parental support and the usability of STIDSS. Findings showed that for ideal anthropometrics characteristics, only male racket sports and female ball sports achieved superior standard. This study developed a new norm based on the total population of junior potential national athletes which covered both Malaysian sports school and nine state sports schools. Speed, agility, reaction time and cardiovascular endurance did not contribute directly to the performance of target sports but it significantly contributed to ball sports and racket sports. This study found that measurement of VO_{2max} uptake is not a priority element for target sports. Most junior athletes have moderate mental strength, however there were big differences between the target sports and the racket sports in term of reboundability, pressure, concentration, confidence and motivation. This study also found that very few parents strongly supported their children to be involved in high level competitions. Majority of respondents were satisfied with the usability of the developed STIDSS and the accuracy test was satisfactory. Thus, the use of STIDSS is proven to be appropriate in the process of selecting young talent to match specific sports. Future research may include wider variety of sports to improve the system.

ABSTRAK

Kajian ini memberi tumpuan kepada pembangunan data normatif atlet muda Malaysia yang berpotensi bagi Sistem Sokongan Keputusan untuk Pengenalpastian Bakat Sukan (STIDSS). Sistem ini membantu melancarkan proses program pengenalpastian bakat sukan bagi melahirkan atlet berpotensi pada masa depan di Malaysia. Pendekatan terkini program pengenalpastian bakat hanya memberi tumpuan kepada pengujian ciri-ciri fizikal dan psikologikal. Pembangunan STIDSS yang baru memberi tumpuan kepada empat komponen utama iaitu fizikal, fisiologikal, psikologikal dan sosiologikal. Pada dasarnya, penilaian ciri-ciri ini merupakan fokus utama kajian ini dan bertindak sebahagian daripada objektif kepada kajian ini, selari dengan penilaian terhadap keberkesanan STIDSS. Empat pengukuran berkaitan antropometri dan sembilan ujian lapangan digunakan untuk menilai keupayaan kecergasan fizikal seseorang individu. Ujian *20 m multistage shuttle run* digunakan untuk menguji kadar pengambilan oksigen maksimum (VO_{2max}) bagi ciri fisiologikal manakala ujian tahap kekuatan mental dan tahap sokongan ibu bapa digunakan untuk mengkaji ciri-ciri psikologikal dan sosiologikal. Seramai 537 atlet junior sukan bola, sukan raket dan sukan sasaran, berusia 13 tahun dipilih dari Sekolah Sukan Malaysia dan Sekolah Sukan Negeri. Sejumlah 85 peserta terlibat dalam ujian kebolehgunaan STIDSS dan 374 atlet junior telah diuji untuk menilai ketepatan STIDSS berdasarkan ciri-ciri fizikal dan fisiologikal. Tiga set soal selidik telah digunakan untuk menguji tahap kekuatan mental, tahap sokongan ibu bapa dan kebolehgunaan STIDSS. Dapatan kajian menunjukkan untuk ciri-ciri anthropometrik yang ideal, hanya sukan raket lelaki dan sukan bola perempuan mencapai standard unggul. Kajian ini membangunkan data normatif baru berdasarkan jumlah populasi atlet junior kebangsaan yang berpotensi merangkumi dua Sekolah Sukan Malaysia dan sembilan Sekolah Sukan Negeri. Kelajuan, ketangkasan, masa tindak balas dan daya tahan kardiovaskular tidak menyumbang secara langsung kepada prestasi sukan sasaran tetapi ia ketara menyumbang kepada sukan bola dan sukan raket. Kajian ini mendapati bahawa pengukuran pengambilan oksigen maksimum (VO_{2max}) bukan elemen keutamaan untuk sukan sasaran. Sekumpulan besar atlet junior mempunyai kekuatan mental yang sederhana, namun terdapat perbezaan ketara antara sukan sasaran dan sukan raket dari segi kebolehbalian, tekanan, tumpuan, keyakinan dan motivasi. Kajian ini juga mendapati bahawa hanya sekumpulan kecil ibu bapa amat menyokong anak-anak mereka untuk terlibat dalam pertandingan peringkat tinggi. Majoriti responden berpuas hati dengan kebolehgunaan dan ketepatan STIDSS yang dibangunkan. Oleh itu, penggunaan STIDSS terbukti sesuai dalam proses pemilihan bakat muda mengikut padanan sukan spesifik. Kajian akan datang boleh diperluaskan kepada sukan-sukan lain untuk penambahbaikan sistem.

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CHAPTER 1

INTRODUCTION OF THE STUDY

1.0 Introduction

The measurement of physical fitness and sports skills should be implemented in schools to cultivate a healthy lifestyle among students. Besides that, the implementation of the measurement can also help in identifying students' talents in sports. The measurement should not just focus on active students, but also on sedentary and inactive students. This is essential to uncover the hidden talents and potentials of a student in physical activities and sports skills in order to help them expand their talents to the fullest.

The hidden talents and potentials of a student in physical activities and sports skills can be identified through Talent Identification. Talent identification is a process that involves making judgments on a performer's quality and offering that individual an opportunity to do something for which he or she is suited. Talented youngsters must be identified on their future abilities to be the best players, not on their current abilities (Gould & Carson, 2008; Meylan, et al., 2010; Davids et al., 2000). There are four common phases that should be considered in talent identification program which are Talent Detection, Talent Identification, Talent Selection and Talent Development (Willian and Franks, 1998).

Talent is a marked innate ability defined as artistic accomplishment, natural endowment or an ability of a superior quality. Talent can also be defined as any internal capacity that allows an individual to show a high performance in a domain

that requires skills and training (Malina, 2010). According to Meylan et al., (2010), talent is a quality or substance that a person or group has, that sets them apart from other people, usually in reference to a single subject.

In sports, talent can be defined as an individual's special aptitude that is above average of a normal aptitude and the special aptitude can be categorized into functional, expressive or athletic (Hoffmann and Wulff, 2015). In relation to talent that are linked to physical activity, talent in sports is described as the ability in sports skill that is more than the normal standard and those skills are not yet developed or polished (Williams & Franks, 1998). Pinder et al., (2013) stated that individuals with talents in sports will exhibit specific characteristics which could lead to achievement in future performances. Therefore, it is important to carry out programs related to identifying potential talent to find young talented athletes as coatings in the future.

The identification of talent in sports traditionally had been associated with individual sports that have discrete physical and physiological requirements, such as cycling, running, rowing, and etc. However, research in team sports such as basketball (Hoare & Hunt, 1999a and Hoare & Hunt, 1999b), men's soccer (Hoare, 1999a), netball (Hoare, 1997) and women's soccer (Hoare, 2000), have successfully isolated the contribution of selected anthropometric and physiological attributes to sport performance.

Sports talent identification begins in the early 60's in Russia and a few other western countries (Vaeyens et al., 2008). In the late 1960s and early 1970s, most East European countries realized the weakness of the traditional talent identification programs and attempted to develop methods of identification which could be underpinned by scientific theory and evidence (Bompa, 1999). Bulgaria was one of the countries that had developed methods of identification and the results of the methods were astounding as eighty percent of Bulgarian medalists in the 1976 Olympic Games were resulted from the talent identification process. Similar results were demonstrated by Romania and East German athletes in the 1972, 1976 and 1980 Olympics (Bompa, 1994).

Bompa (1994) also stated that the effectiveness of the implementation of sports talent identifying program was also proven through the victory of small countries such as Romania in getting medals in the Olympics and this showed that small countries can be on par with bigger countries. During that time, a group of scientists and rowing specialist in Romania, in 1976 had scientifically selected 100 young girls to form a rowing team. The initial 100 girls were selected from 27,000 teenagers. By 1978, the group had been reduced to 25 persons and most of them were participating in the Moscow Olympics. The result was 1 gold, 2 silver and 2 bronze medals. Another group selected in the late 1970s produced 5 gold and 1 silver medal during the 1984 Olympic Games in Los Angeles and 9 medals at the Seoul Olympic Games. The best achievement in Sydney Olympic Games, Romania contingent won 11 gold, 6 silver and 9 bronze medals (www.olympic.org).

To-date, sports talent identifying program is widely conducted in Malaysia. Multiple ministries and parties are involved in making this program a success. The National Sports Council, the National Sports Institute, the Ministry of Youth and Sports along with the Ministry of Education are working together in executing this program to aim for excellent sports performances at an international level. Therefore, teachers and coaches in schools, clubs and sports associations can make use of the program in order to attain excellent sports performances at any scales; interschool, interstate, national or international competition.

1.1 Background of the Study

Due to systematic and scientific sports talent identifying programs, many countries had done well in the sports arena. Countries such as Russia (Malina, 2010), Australia (Green, 2007 and Tomkinson et al., 2003), Japan (Houlihan & Green, 2007), South Korea (Ko et al, 2003), Germany (Kozel, 1996) and China (Wu, 1992) excelled in sports as a result from such programs. Nonetheless, documented results showed that these countries had been implementing this program for quite a while before achieving its goal.

Malaysia had begun searching for talents in sports thoroughly when Kuala Lumpur was announced as the host for the Commonwealth Games in 1998. Following the selection, actions were taken to ensure that Malaysia would not only be the host for the prestigious sports event, but also succeed and performed in the participated sports. The success of the sports talent search program was proven from the outstanding achievements in the 1998 Commonwealth Games. As the western countries achieved successful results through sports talent identifying program, Malaysia had introduced the same program for children and young athletes. This confirms that small countries can be on the same level with the big nations in the sports arena through this systematic and planned program.

This program has proven to contribute to Malaysia's excellent performance in the Commonwealth Games in 1998. Consequently, this has also strengthened the needs of the implementation of the talent identifying program thoroughly at all levels, states and associations. Sports talent identification should be done in schools to attain excellence in sports performance and not just merely relying on financial support, facilities and coach/teacher's expertise. This is because excellence in sports can also be accomplished through scientific and systematic sports talent identification program.

The Sports Talent Identification Program in Malaysia was gazetted by Datuk Seri Mohd Najib bin Tun Abdul Razak in 1997 (Asha et al., 2009). It was set up through the help of expertise from the National Sports Council for the training of young athletes attending the Bukit Jalil Sports School.

In 1998, the National Sports Council successfully published a book related to sports talent identification and the norms of each tests in brief. Data collected on the norms were collected from a group of children between the age of 11-14 years old and also with a group of Malaysian's elite athletes (National Sports Council of Malaysia, 1998). The items that were tested are height, arm's length, sitting height, weight, measurements of skin folds, weight throwing, vertical jump, 40m sprint,

hexagon agility test and shuttle running endurance test or 800m running. However, these tests are still too general and do not include all the components of physical fitness that is the basis of motor skills tests.

This program became less active after Malaysia showed an excellent performance in the Commonwealth Games in 1998. Hence, through the meeting of the Cabinet Committee for Sports Development in 2004, it was decided that the National Sports Institute (ISN) was responsible to expand the system and program-related activities in identifying sports talents in Malaysia. The execution of the sports talents identifying programs and the development of young athletes was based on the implementation of the principles and practices of the appropriate Sports Science (Asha et al., 2009).

In addition, *Program Tunas Gemilang* was put into operation. This program was suggested by former Minister of Youth and Sports, Dato' Azalina Othman Said (National Sports Council of Malaysia, 2007). This program was a collaboration between the National Sports Institute of Malaysia and State Assembly Community Sports Club throughout Malaysia. The purpose of this program was to ensure the participation of all Community Sports Clubs in sports talent identifying programs and also playing a role in developing sports-related activities at the fundamental level. At the beginning of 2005, the implementation of the program and mass sports activities had been expanded and it covered all parliament areas and state constituencies.

Malaysia also had expanded the implementation of its sports talent identifying program for people with disabilities. Starting from 2007, talent identifying tests was performed with these groups to prepare our country for the participation in the Paralympics Games in the regional (ASEAN) and international level. Consequently, athletes with disabilities showed good performances during the 4th Paralympics Games in Korat, Thailand in 2007. At that moment, 180 athletes from Malaysia finished in third place with 83 Gold, 74 Silver and 46 Bronze medals from 222 events participated. The continued excellence in the Paralympics Games,

Rio 2016 with Malaysian contingent won three gold and one bronze medal (www.paralympic.org, 2016).

The sports talent identification program remains a priority. The support from the Minister of Youth and Sports towards this program is strengthening with the collaboration of two ministries; Ministry of Youth and Sports and Ministry of Education in implementing the program (ISN, 2009).

The Ministry of Youth and Sports through the National Sports Council had developed curriculums that are related to the talent identifying program. There were a variety of programs included in the curriculums. Those programs were *Program Tunas Gemilang*, Athletes Foundation Program, General Talent Identifying Test Program, Specific Talent Identifying Test Program and Multi Lateral Program. All of these programs aimed to identify talents among children throughout the nation by using a set of general and specific talent identifying tests according to the age group of 7-9 years old, 10-12 years old and 13-15 years old (ISN, 2009).

The National Sports Institute (2009) had outlined the implementation methods of talent identifying program by sorting out the activities according to phases of tests, assessments and development programs. These phases contained a general and specific talent identifying test manuals, general and specific talent identifying course for the examiner, developing standards and norms of the test performance. It also included the following strategies:

1. Implementations of the general and specific talent identifying test
2. Analysis of test results, evaluation and decisions
3. Organization of talent development camps, development of training center, implementations of research and development activities
4. Establishment of national panels for the talent identifying and development program
5. Appointment of instructors all over the states

Malaysia should implement a comprehensive and systematic talent identification program. Sports professionals also agreed that the sports talent identification program is one of the programs that would lead to successful elite sports (Hoare, 1998). The process of sports talent identifying program had changed from an unstructured process such as talent selected based on results of tournaments to a more structured and systematic process.

Besides this, the Malaysian Government is very committed and has spent a large amount of budget for sports development. Sports development requires a comprehensive eco-system including infrastructure, administration and coaching, talent building from the early stages as well as the managing the welfare of athletes. Therefore, a total of 239 million Ringgit is allocated for excellence in sports including building and upgrading sports complexes, creating a pilot program of talent identification in primary schools and implement a Future Professional Coach program to hone the skills of potential coaches for selected sports (Ministry of Finance, 2014).

1.2 Problem Statement

Malaysia's involvement in the international sporting arena has been proven even before gaining its independence. Malaysia has participated in the Olympic Games since 1956, Asian Games since 1954, Commonwealth Games since 1950 and Sea Games since 1959. Malaysian athletes have won various medals in all the tournaments back then. To-date, Malaysia has yet to win a single gold medal at the Olympic Games despite winning silver and bronze medals before in Barcelona 1992 Olympic Games, Atlanta 1996, Beijing 2008 and London 2012 in badminton. In Rio 2016, Malaysia contingent won four silver medals and one bronze medal (Olympic Council of Malaysia, 2016). Therefore, now is the best time to seriously conduct a TID program in Malaysia in order to identify new talents that can help in realizing Malaysia's dream of getting a first gold medal in the Olympics Games.

In recent years, we can be proud of the achievements attained internationally and it is proven through the success and excellence gained by our own local champions, Datuk Nicol Ann David in squash (WISPA World Ranking, 2015) and Datuk Lee Chong Wei in badminton (BWF World Ranking, 2016). Both of them are holding the World No. 1 title in their own sports respectively. However, their best performance is still not quite encouraging because until now Malaysia still has not won a gold medal at the Olympic Games. Thus, in order to win a gold medal in the future, a lot of work needs to be done. Various preparations and athlete developments need to be analyzed, re-checked and restructured as soon as possible. Malaysia can not keep putting a burden on Datuk Lee Chong Wei to win a medal in Olympic because his increasing age would affect his performance (ISN, 2016). Therefore, among the steps that should be taken is by developing a new normative data for the specific sport to ensure accuracy in the TID program which will be implemented to seek new talents in youth particularly, to match them into the right sport activities.

Generally, ISN is one of the responsible authorities that carries out research related to sport sciences and also responsible in executing of the talent finding program to search for future athletes. Previously, the TID program focused on the anthropometric measurement, physical abilities and mental toughness assessment for early detection (ISN, 2009). However, it is also crucial to include other attributes in the TID program which include physiological, psychological and sociological components (Höner et al., 2015; Gabbett et al., 2007; Gabbett & Georgiff, 2005). These aspects are fairly important in enhancing the efforts of identifying the potential TID participants, with the intention that they can become elite athletes in the future (Falk et al., 2004). In addition, Hoffmann and Wulff (2015) stresses out that accurate assessment at the TID program will provide long-term positive impact on the development potential of young athletes. Therefore, in addition to the focus on physical, additional attributes such as physiological, psychological and sociological needs to be emphasized. Each has a specific characteristic and test depending on each type of sport.

Nevertheless, there is a limitation for ISN to conduct the specific planned program effectively due to the shortage of staffs and officers. Besides that, the

limitation faced by the ISN is not just the lengthy period taken to conduct the program, but also the higher implementation cost of the tour throughout the country. Therefore, using or inventing a system that can help to increase the efficiency of the process of the sport talent identification program is a need. TID technology is one of the ways that can help in smoothing the process of the sport talent identification program.

From the development aspect of the TID technology, Malaysia is still lagging behind compared to other established countries that had achieved good reputations internationally in sports. Those countries developed a technological system which has the purpose of identifying talents in various types of sport activities. The system also produces a convenient way of processing and analyzing the data. This shortens the time required for the implementation/execution of the TID program. For instance, Australia is using E-TID as the TID program software while Croatia uses The Expert System for Sports Talent Detection. Alternatively, Namibia is working with the Proactive TID and Slovenia is currently using the Sports Measurement Management System (Rogulj et al., 2006). However, these developed system only focused on the physical attribute such as physical abilities, morphological and functional test. However, these systems developed only focused on the physical attributes such as physical abilities, morphological and functional test. In addition, these systems are developed based on the suitability of the local population and normative data referred to not focus on the particular age of the target group.

Therefore, the researcher has now come out with the suggestion to develop a new normative data for specific sports based on the physical and physiological attributes. Whereas, the psychological and sociological attributes also be used as an indicator to the evaluation process. Then, the Sports Talent Identification Decision Support System (STIDSS) will be developed to make the determination based on the analysis of these characteristics and finally matches young people to their suitable sports based on the performance of their physical and physiological attributes and also can find out the level of mental toughness and the level of parental support.

1.3 Importance of the Study

This research is crucial in aiding and simplifying the execution and management of TID in Malaysia in terms of data keeping and analyzing the results of the tests and determination of the individual's talent towards the appropriate sports. At present, there is no practical and efficient data process system used in simplifying the analysis process for the collected raw data (ISN, 2012). The data collection is focused only on the anthropometric measurement and the motor skill abilities which are done separately through physiological and psychological tests according to certain phase. With the development of Sports Talent Identification Decision Support System (STIDSS), the process of evaluating the talent of an individual can be analyzed and interpreted objectively based on physical, physiological, psychological and sociological basic attributes.

Besides that, STIDSS also serves to reduce time consuming and the execution cost of the TID program in this country. With STIDSS in practice, ISN and the Ministry of Education under Sports, Arts and Co-curriculum Division especially the TID's unit will be able to identify and develop Malaysia's future sporting talent. Simultaneously, the application of STIDSS will enable teachers to operate TID in schools and get instant data processing and all data processed will store in the database.

STIDSS is a secure and systematic system where database application is included in this system. Only authorize individuals can access the data in the database to prevent misuse of the data. Using the database, the data are stored in one place where all the data can easily be filtered according to users need. This STIDSS also can be upgraded depending on changes in technology and based on the user's feedback from time to time. Lastly, this system is in line with all schools in this country. As a result, only the most talented individuals were selected scientifically and directed to the appropriate sport.

1.4 Objectives of the Study

The aim of this study is to develop an interactive computer software known as the Sports Talent Identification Decision Support System (STIDSS). Through the development of the software, young and new talented teenagers can be easily identified based on their performance of physical, physiological, psychological and sociological assessments.

In order to achieve the above aim, the following objectives have been identified:

- i) To investigate an anthropometric characteristic and develop specific normative data for general physical fitness characteristics of young athletes for ball sports, racket sports and target sports category.
- ii) To develop the specific normative data for maximum oxygen uptake demand of young athletes for ball sports, racket sports and target sports.
- iii) To analyze the level of mental toughness of Malaysian junior elite athletes in ball sports, racket sports and target sports.
- iv) To identify the levels of parental support among Malaysian junior elite athletes.
- v) To develop the STIDSS.
- vi) To evaluate the effectiveness of the STIDSS.

1.5 Research Questions

The purpose of the study is to develop the Sports Talent Identification Decision Support System (STIDSS). The study concerns the following research questions:

- a) What is the anthropometric characteristics of young athletes for ball games, racket sports and target sports?
- b) What are the specific normative data of general physical fitness for ball sports, racket sports and target sports?
- c) What are the specific normative data for estimated vo2max uptake for ball sports, racket sports and target sports?
- d) What is the level of mental toughness among Malaysian junior elite athletes?
- e) Is there any significant differences between ball sports, racket sports and target sports based on mental toughness sub-constructs; reboundability, pressure, concentration, confidence and motivation?
- f) What is the level of parental support among Malaysian junior elite athletes?
- g) What is the usability of the STIDSS?
- h) What is the accuracy of the STIDSS based on the physical and physiological evaluation?

1.6 Scope of the Study

This study focuses on developing a Sports Talent Identification Decision Support System (STIDSS) to help the process of evaluating the talent of an individual and the system can be analyzed and interpreted objectively based on physical, physiological, psychological and sociological attributes. In addition, this study only involved Malaysian and state sport schools children and focused on 3 categories of sport which are ball sports, racket sports and target sports. This study was started by identifying those basic attributes, followed by developing the system, testing the system and lastly examines the effectiveness of the system.

1.7 Limitation of the Study

All research conducted has limitations in order to avoid unreachable objectives. In this research, four limitations have been set. Firstly, this research only involves stage of detection and identification in TID phases. Second, nine sports that are selected were football, rugby, netball, hockey, badminton, squash, tennis, archery and ten pin bowling. Third, the age of subject selection should be 13 years old and they are young potential athletes that could become national elite athletes. Lastly, the testing component involves physical attributes that include anthropometry, a general motor skill component of physical fitness and flexibility. Physiological attributes cover on estimated vo2max intake, psychological attributes focus on mental toughness and finally sociological attributes looked into parental support.

1.8 Operational Definitions

Below are the operational definitions that will be used in this study. The definitions stated below are also functioned to differentiate the operational definitions in this study with other definitions that may be used in other studies.

1.8.1 STIDSS

Sports Talent Identification Decision Support System (STIDSS) is a new system for sports talent identification and was developed in this study.

1.8.2 Ball sports

Ball sports or ball games, or any form of the game or sport which feature a ball as part of the play. In this study, ball sports refer to football (soccer), rugby, netball, and hockey.

1.8.3 Racket sports

A racket or racquet is a sport consisting of a handled frame with an open hoop across which a network of strings or catgut is stretched tightly. It is used for striking a ball in games. In this study, racket sports refer to squash, tennis and badminton.

1.8.4 Target sports

Also as known as precision and accuracy sports. Target sports whose objective is to hit a target of various shapes and sizes (such as a pocket, hole, jack or bowling pin) using various means (such as a bow, firearm, billiard cue, ball or club). In this study, target sports refer to archery and ten pin bowling.

1.8.5 TID

TID refers to Talent Identification. It is the process of identifying sports talent which is a method of pursuing excellence in sports by using a scientific method through a few phases of tests and selections. There are four main phases in the process of identifying sports talent which are detection, identification, selection and development.

1.8.6 ISN

The National Sports Institute of Malaysia (ISN) role is supporting the comprehensive sports science development process in Malaysia. The Institute is equipped with the latest technology including the Sports Medical Clinic, medical laboratory, radiology unit, physiotherapy, injury rehabilitation gymnasium, conditioning gymnasium, biomechanics hall, training hall, physiological laboratory, nutrition facilities, sports technology and sports massage and sauna.

1.10 Summary

This chapter had discussed on the background of the study, problem statements, the important of the study, research objective and research questions, the scope and limitation of the study and operational definition. The next chapter will look into the literature review of previous research that relates to this study.

sports for every test battery that were used to measure physical abilities whereas estimated vo2max uptake was used to serve as a guide in assessing the junior athletes performance.

Recommended future research can include a wider variety of categories of sports such as athletics, combat sports and so on to allow this system to have a wide selection of sports. Also consider a few more added tests to the test battery based on specific sports requirements based on the nature of the sport itself. Further, it can be expanded to various age groups to get more young talents. Thus, with this addition, the criteria of specific normative data can be issued according to the type of sport or sports category. To strengthen the implementation of the TID program in Malaysia, researchers could include the next phase in TID which is talent selection and talent development. In terms of system development, this system needs to be improved in terms of usability in which is in line with the speed of the revolution in technology to provide a more efficient system.

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