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THE EFFECTS OF BADMINTON SPECIAL SPEED TRAINING METHOD TOWARD SUCCESS SCORE AND TIME PERCEPTION PREDICTIVE SKILLS PERFORMANCE OF BADMINTON PLAYERS

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SU ZHAN GUO

FACULTY OF SPORTS SCIENCE AND COACHING
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FULFILLMENT OF THE REQUIREMENT FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY (SPORTS SCIENCE)

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ABSTRACT

Main aim of this study is to investigate the effects of badminton special speed training method (BSSTM) on Success Score (SS) and Time Perception Predictive Skills Performance (TPPSP) of landing of badminton players. Thirty badminton players were randomly divided into experimental group (G1) (n=15) and control group (G2) (n=15). The G1 adopted BSSTM, with G2 maintained badminton traditional speed training method (BTSTM). The intervention length was 3 months. Badminton serve machine was used to launch the shuttlecocks consistently, with stopwatch used for TPPSP. Between-group ANOVA for SS showed that between-subjects effects were reached at very significant level, that is F (5, 84) = .84, p = .01. The LSD for SS showed between G1 and G2 during pre-test was p = .93. The LSD for SS showed there were significant difference from G1 than G2 at posttest 1 (p = .03), during within G1 from posttest 1 to pre-test (p = .02), which was improvement effects during BSSTM toward SS. There was the retentive effects during BSSTM toward SS from within G1 posttest 1 to posttest 2 (p=.80). The TPPSP used MANOVA with Roy's Largest Root showed that there is a very significant multivariate effect for TPPSP between G1 and G2, that is, F(5, 84)=11.28^{c}, p =.000 < .001. LSD for TPPSP showed there were no significant difference following between G1 and G2 at pre-test (p >.05), and within G1 from posttest 1 to posttest 2 (p >.05), which was the retentive effect of BSSTM toward TPPSP. There were significant difference were following G1 than G2 during post-test 1 (p <.05), within G1 from pre-test to post-tests (p <.05), which was improvement effects during BSSTM toward TPPSP. It can be concluded that BSSTM showed superior training effect in comparison to BTSTM toward success score and time predictive of badminton landing.

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KESAN LATIHAN KHAS KELAJUAN BADMINTON TERHADAP SKOR KEJAYAAN DAN PERSEPSI MASA JANGKAAN PRESTASI KEMAHIRAN PEMAIN BADMINTON

ABSTRAK

Matlamat utama kajian ini adalah untuk mengkaji kesan latihan khas kelajuan badminton (BSSTM) ke atas Skor Kejayaan (SS) dan Persepsi Masa Jangkaan Prestasi Kemahiran (TPPSP) mendarat pemain badminton. Tiga puluh pemain telah dibahagikan secara rawak kepada kumpulan eksperimen (G1) (n=15) dan kumpulan kawalan (G2) (n=15). G1 mengadaptasi BSSTM, dengan G2 mengekalkan kaedah latihan kelajuan tradisional (BTSTM). Tempoh masa intervensi adalah 3 bulan. Mesin servis badminton digunakan untuk melancarkan bulu tangkis secara konsisten, dengan jam randik digunakan untuk TPPSP. ANOVA antara kumpulan untuk SS menunjukkan bahawa kesan antara-subjek telah dicapai pada tahap signifikan, iaitu F (5, 84) = .84, p = .01. LSD untuk SS menunjukkan antara G1 dan G2 sewaktu pra-ujian adalah p = .93. LSD untuk SS menunjukkan terdapat perbezaan signifikan daripada G1 berbanding G2 pada pasca-ujian 1 (p = .03), sewaktu di kalangan G1 daripada pasca-ujian 1 ke pra-ujian (p = .02), dimana kesan peningkatan sewaktu BSSTM kepada SS. Terdapat kesan pengekalan sewaktu BSSTM terhadap SS daripada kalangan G1 pasca-ujian 1 kepada pasca-ujian 2 (p=.80). TPPSP menggunakan MANOVA dengan Roy's Largest Root menunjukkan terdapat kesan signifikan pelbagai variasi untuk TPPSP antara G1 dan G2, iaitu F (5, 84) =11.28 c, p =.000 < .001. LSD untuk TPPSP menunjukkan tiada perbezaan signifikan antara G1 dan G2 pada pra-ujian (p >.05), dan di dalam G1 daripada pasca-ujian 1 ke pasca-ujian 2 (p >.05), yang mana merupakan kesan pengekalan BSSTM terhadap TPPSP. Terdapat perbezaan signifikan bagi G1 berbanding G2 sewaktu pasca-ujian 1 (p <.05), di kalangan G1 daripada pra-ujian kepada to pasca-ujian (p <.05), yang merupakan kesan peningkatan sewaktu BSSTM terhadap TPPSP. Kesimpulannya BSSTM menunjukkan kesan latihan lebih baik berbanding BTSTM terhadap skor kejayaan dan persepsi masa jangkaan prestasi kemahiran mendarat.

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ABBREVIATIONS

BSSTM: Badminton Special Speed Training Method

BTSTM: Badminton Traditional Speed Training Method

TMOSS: Test Method of Success Score

SS: Success Score

TPPSP: Time Perception Predictive Skills Performance

HR: Heart Rate

RPE: Rating of Perceived Exertion

BPEQ: Basic Physical Education Quality

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APPENDIX

Appendix A: Expert Questionnaire

Part A is Research Instrument A is **BSSTM** Training Intervention
Part B is Research Instrument B is Data Collected Method Instrument of Success Score (**SS**) of Badminton Players
Part C is Research Instrument C is Method Instrument of Data Collected of **TPPSP** of Badminton Players
Part D is Research Instrument D is Data Collected Method of BPEQ

Appendix B: Block Schedule

Section A: Block Schedule of BSSTM Intervention
Section B: Block Schedule of BTSTM Intervention

Appendix C: The Conceptual Framework of Skill Coaching

Section A: The Conceptual Framework of Skill Coaching for BSSTM
Section B: The Conceptual Framework of Skill Coaching for BTSTM

Appendix D: The Basic Physical Education Quality of Badminton Player

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Badminton is one of the most popular sports in the world. Badminton game is both an Olympic game and world championships. Nowadays, badminton is not only a high social popularity but also has a large number of participants. No matter in neighborhoods, primary schools, high school and universities, badminton is the main competition and fitness activity. In the meantime, badminton has high exercise value and strong competition. Badminton spreads the Olympic spirit, principles and sports morality. Such as competition, cooperation, unity, justice, friendship is an indispensable norm and activity of society, and has extensive educational significance. In addition, more and more people think that badminton is way of healthy sports. Although badminton has become a popular sports, due to its exquisite skills, fast flying speed and rhythm, drop points of difference route are uncertain characteristics (Xiao, 2005). So, badminton players need to have the physical education quality of reaction speed, action speed and moving speed. However, these physical quality is developed in teaching and training course. The special speed quality be regarded as the core content of physical education quality of badminton players. The special speed quality include reaction speed, action speed and movement speed. The fast reaction speed and movement speed is to finish the condition of the batting action. Badminton players completed the quality of striking action came from the rapid reaction speed. However, each sport has own sports characteristics. Especially displacement speed and

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movement speed are closely related to characteristics of self-sports (Zhang, 2005).

The technical factors of badminton include body position, stroke position, batting point and basic batting action. The body position and batting position are main factors that affect the batting quality. Whether to choose the correct batting point and the body position is directly related to the batting quality. The batting point depend on time-space predicting and fast footwork movement. Badminton players need to predict the time of dropt point from shuttle flies speed, and then fast starting, the footwork movement, and make fast action of striking. On the other hand, the completion of technical action also depends on the ability to predict the landing point. So, it is a very important that the time predictive of badminton players was improved through training intervention. In the badminton competition, some outstanding players show the technical and tactical characteristics of winning quickly. Fast attack has become the key technical style of winning badminton competition. Therefore, coaches should grasp the core element of badminton special speed training, badminton training methods should grasp the characteristic of techniques and tactics to build training contents. At the same time, the key points of teaching and training should be combined with the special technical characteristics of badminton. The research on badminton project is mainly manifested in the characteristics of badminton athletes' physical fitness and sports technology (Zhan, 2003). In China, the technical style of badminton is defined as "fast, hard, accurate and alive" as these four words. Fast speed is the soul, in a sense, speed quality is the core of badminton special physical fitness training. Badminton competition is to decide the victory or defeat with different forms of speed competition. Badminton player must start fast, move fast, hit the ball fast, and occupy the favorable return position. In order to winning create good conditions of successful score. Therefore, the special speed quality training mainly revolves around the improving the reaction speed, displacement speed, batting action speed and endurance speed (Wang, 2011). Badminton is carried out in a certain space range. Badminton players must maintain a certain balance, the essence of which is the balance of time. If one side keeps speeding up, and the other keeps the same speed, then the one who keeps the original speed is forced to keep up with the other side. With the rapid development of badminton technology, the demand for increasing speed is more prominent. As offensive technology has been widely used and continuously improved, and the style of

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technology has developed in a rapid and comprehensive way. It is an important problem in badminton training to study how to improve badminton special speed (He, 1999).

The researcher investigated the current situation of athletes' physical quality in university in China, the results found that many coaching still adopted the traditional speed training method on badminton course teaching. Face with the deficiency of badminton teaching and training in Chinese university, this study puts forward the importance of the effect of badminton specialized speed training on success score and time perception predictive skills performance of drop point of badminton players. In the meantime, previous studies on the timing and special prediction of badminton landing point are almost blank. In order to further investigate how to develop badminton players' success score and time perception skills performance, the author puts forward the research proposition of the effect of badminton special speed training method on success score and time perception predictive skills performance of drop point of badminton players. The aim is to investigate what training methods can improve badminton players' ability of success score and time prediction of drop point. In the current research, a new badminton special speed training method is constructed. The training process is focused on the combination training of fast footwork movement and hitting the ball to the landing position. On the one hand, and for the development of badminton players hit the ball control ability and the favorable time and position, on the other hand is the development skills of time prediction of drop point of badminton players. So, study on the skills performance of drop shot time predicting of badminton players has been become a hot issue.

1.2 Background of the Study

In recent years, the development of the concept of new curriculum reform in Chinese university. It particularly emphasizes the educational concept of "health first" and "student-based". The physical education teaching reform have also become an important part of the curriculum reform in Chinese universities. The new physical curriculum reform should mainly emphasize the teaching and training method reform. Firstly, the physical education method reform emphasize the improvement of the

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teaching and training effect, and the improvement of the successful score of the special sports quality. Secondly, the physical education method reform emphasize the improvement of the innovative spirit and practical ability of students in the process of the physical teaching and training. Therefore, at present, the creation of new teaching and training methods in teaching reform will become one of the key tasks of teaching reform (Yang & Zhang, 2008).

In order to overcome the deficiency of the traditional physical education teaching and training method in development of the effect of the cultivation of dimension consciousness, emotion, attitude, the perception predictive ability and sports control ability. Teacher or Coach should create new teaching methods and design teaching content in class depend on the characteristics of sports technique and tactics. At the meantime, the tradition physical teaching and training ignore an important to train the time perception predictive ability in the process of sports technology teaching and training. So, in the current course of the new curriculum reform needs to be a comprehensive renovation in the educational method. In particular, it is necessary to develop athletes' speed quality, sports skills performance in combination with the characteristics of special sports (Wang & Li, 2002). This study carried out the effect of badminton special speed training method on successful score and time perception predictive skills performance of drop point of badminton players. The following parts focus on the background of this study and the present development of badminton special training methods.

In recent years, with the popularity and development of badminton, the research on training method of badminton is more and more extensive, which is mainly represented in badminton special speed training method. However, judging from the present situation of badminton education in primary and secondary schools, the level of badminton sports skills of universities students, there is a serious lack of combination of badminton special speed and badminton special technical training in teaching (Wang, 2008). The researcher needs to change ideas, research topic should base on the characteristics of badminton special speed, which be developed the research boundary from the research dimension. So, this study carried out the effect of badminton special training method on score success and time predicted skills performance of drop point

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of badminton players. Main purpose of study is to investigate whether there is a significant effect of badminton special speed training method on success score and time perception predictive skills performance of drop point of badminton players. In addition, a high-level badminton game, the athletes have to complete a variety of fast start and stop, turn around, fast movement, jump, swing racket and stroke in the process of attack and defense (Grice, & Grice, WA, 2008). These fast speed skills action must be realized through the badminton special speed training. So the skills performance of badminton special speed become an important influence factor on success score of badminton players. In the meantime, the outstanding results of badminton players also dependent on time-space predicted of drop point of badminton shuttle flying. But, in fact, the performance ability of badminton special speed and time predicted skills must depend on the long-term systematic special speed training.

Nowadays, badminton have become an important course in college and university. At the same time, the badminton teaching and training in universities has become one of an important ways to promote the development of sports, which is also the guarantee of implement the national fitness (Zhang, 2012). However, there are few researches on badminton training method in universities. Colleges and universities have not established a three-dimensional teaching and research system. In actually teaching, people often ignore the important of training method on the starting speed, speed of footwork movement and batting of badminton players. In this case, Insufficient special speed training can lead to the slow of starting reaction and moving pace in the formal match, which makes his body unable to move to the favorable position of the return shot, resulting in the deformation of the arm movement when hitting the ball, and then the decline of the batting quality (Xiao, 2005).

Badminton is a combination of athletes, rackets and shuttle, which has its own characteristics compare to others sports events. The space speed of badminton flying is very fast on a limited badminton court. Therefore, badminton players should not only have good speed quality but also have the ability to predict the time of landing. At present, the research on the training method of badminton speed has been developed in sports field. With the popularization and development of badminton, badminton has become a necessary course in colleges and universities. On the one hand, the

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development of badminton research has become one of the main tasks in current physical education teaching and training system construction (Gao & Kang, 2009). On the other hand, it is a very important work to design a set of the effective badminton special speed training methods. Colleges and universities should fully combine the characteristics of sports, construct a new training content system from the dimension of teaching methods and training methods, and constantly improve the teaching and training effect. In the training content, the special quality and the technical action study are combined to improve the practice effect. At the same time, the teaching and training contents should also be combined with the training method of space-time perception prediction.

1.3 Problem Statement

Badminton is not only one of the most popular sports but also one of the fastest developing sports in the universities. Therefore, the development of badminton special training course in colleges and universities has become one of the tasks of the development of physical education in colleges and universities. Recently, many researchers had been conducted in badminton (Lee, J., et al., 2019 & Nadzalan, A.M., et al., 2018). Among those, the research of badminton special speed training method has become a hot topic in current sports research. Firstly, Badminton special speed training method is the guarantee to improve successful score and time perception predictive skills performance of badminton players. Among the factors that affect the success score, badminton special speed is one of the key factors of affecting sports success score and time perception predictive skills performance of drop point of badminton players (B, L., 2015). Secondly, the quality of badminton special speed is also the guarantee to win the competition and achieve excellent results. At the same time, watch from content of badminton special speed training, the main way of badminton special speed training is through improving visual-auditory reaction speed、displacement speed and action speed of badminton players (Xiao, 2005). Therefore, badminton special speed training plays a very important role in the development of badminton technology and the improvement of badminton players' success score. However, unfortunately, universities physical teaching and training have still adopted the traditional training method for badminton speed quality. The importance of badminton

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special speed training has been neglected in badminton teaching and training in colleges and universities. Especially, there is a lack of systematics in the content of the training methods, and there is no agreement between the special speed and the special technology. This situation results will be show in slow reaction speed, footwork movement speed and slow striking speed during training and games. In the meantime, due to poor footwork movement, badminton players could not achieved the favorable position and timing to strike the shuttlecock (Grice, T., 2008). Therefore, the establishment of special quality training methods in physical education teaching and training in colleges and universities has become an urgent problem to be solved.

In badminton game, the special speed quality is the core factor to win (Xu, B., 2015 & Chandrakumar, N. et al., 2015). Special Speed include Audio-visual reaction speed, displace speed and action speed. The special speed quality needs to be displayed in the complete technical realization. Therefore, the badminton training task should be realized through the combination of special speed and striking technology. On the other hand, from the level of decision-making, the factors that badminton players get excellent results not only depend on the combination of speed quality and technology, but also need good space-time prediction ability (Poliszczuk, T. and C. Ramesh, 2009). However, the investigation and analysis of the previous research literature shows that whether the badminton special speed training method can improve the success score and the performance of landing time prediction skills is a blank in the field of research. So, this study further put forward the effects of badminton special speed training method on success scores and time perception skills performance of drop point of badminton players. Main aim is to discuss whether there are significant differences in the effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on success score and time perception predictive skill performance of drop point of badminton player

1.4 Objectives of the Study

The purpose of the study is the starting point and foothold of thesis. The purpose of thesis writing is also the specific purpose to be achieved at the end of the subject. It is

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also the predetermined goal to be achieved in this paper. In other words, the research goal is based on the target positioning of the research topic. In the process of determining the expected purpose of this study. First of all, the effect of badminton special speed training method on success score should be investigated. This study expects whether the newly established badminton special training method is more effective than the traditional speed training method. In order to provide practical and theoretical guidance for the future badminton special speed training system. Next, the effect of badminton special speed training method on the time perception predictive skills performance of badminton players should be investigated. This study expects whether the newly established badminton special training method is more effective than the traditional speed training method. The realization of this expected research goal can improve the constructive practical guiding value of how badminton training methods can develop athletes' time prediction ability in the future.

After setting the expected objectives for this study. The author understood the current situation of badminton special speed quality training of university students in Xi'an city, Shan Xi province. In China University, the research on the training method of badminton special speed is still insufficient, the application of the badminton special speed training method is unsystematic in university. Therefore, this study puts forward title of the effects of badminton special speed training method on badminton scoring success and the time perception predictive skills performance of badminton players. In terms of the training intervention of badminton special training method，this study to achieve research objectives, this study takes the badminton special speed training method as the research object, evaluates contents included the success score and time prediction skill performance of drop point of badminton players. The experimental subject is elite badminton player who is randomly sampled, and the experimental object is tested for the basic sports quality in the pre-test, and the conditions of the experimental object are strictly controlled. Meanwhile, this study adopted that comparison research method, through the mean of successful score of the experimental group compare with control group at pre-test and posttest, and further investigate the effect of badminton special speed training method on success score of badminton players. It provides the reference value for the construction of badminton special speed training method system in the future. In addition, through the mean of through the mean

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of time perception predictive skills performance of drop point of the experimental group compare with control group at pre-test and posttest. It is expected that the results of the study will be able to enough to investigate the effect of badminton special speed training method on the threshold of landing time prediction. In order to investigate the degree of maintaining effect of badminton special speed training on success score and the time prediction of drop point of badminton players, two post-tests were used in the expected results of the study. In view of the above description, the specific objectives of the currently study 1 and study 2 is stated follows.

1.4.1 Objectives of Study 1

1.4.1.1 To investigate whether there is significant differences in the effect of badminton special speed training method (BSSTM) on success score of badminton players from pre-test to posttests.

1.4.1.2 To investigate whether there is the retentive effect of the badminton special speed training method (BSSTM) on successful score of badminton players from posttest 1 to posttest 2.

1.4.2 Objectives of Study 2

1.4.2.1 To investigate whether there are significant differences in effects of badminton special speed training method (BSSTM) on time perception predictive skill performance of drop point of badminton players from pre-test to posttests.

1.4.2.2 To investigate whether there is the retentive effect of the badminton special speed training method (BSSTM) on time perception predictive skill performance of drop point of badminton players from posttest 1 to posttest 2.

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1.5 Research Questions

Choosing a research problem is the starting point of a research activity. It is more important to put forward a research problem than to solve a research problem, because it requires creative imagination to raise new problems and marks the true progress of science. The research problems put forward in this study are based on the theory of badminton special speed training and the theoretical model of time perception prediction. At the same time, the research proposition is also closely related to the success of the previous research. In the my master study stage, the author once studied the topic "experimental study on long jump technology teaching by spatial-temporal cognitive teaching method and procedural teaching method", which laid a certain practical foundation for the current research proposition.

Research questions refer to the specific questions that educational research needs to answer. When determining the research problem, we should first make clear the operation and feasibility of the study variables. In this study, the independent variables included badminton special training method and badminton traditional speed training method, and the dependent variables evaluated included badminton players' success score and landing time prediction skill performance. At present, whether there is an influence relationship between the research variables, through the investigation of the previous research status, the previous research on the impact of badminton special speed training on the success of the game has made some progress. Previous studies found that badminton special quality training can improve the competition result of badminton players. In addition, previous studies on the time mechanism of tennis players found that the time prediction of expert tennis players was better than that of novice players. Although some research results have been obtained the progress, but, there are some defects in research design and research condition control. At present, in this study, the definition variable of badminton success score is put forward for the first time. In this study, the success score refers to the number of successful times that badminton players hit the target position, and the research variable of successful score is innovative and feasible. As long as the study can control the serve, the problem can be solved. Of course, the serve machine or an expert serve is used in the successful score variable test, and the number of times the player hits the target position is recorded

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within the specified time. This test method has controllability, thus ensuring the reliability of the data collection of the research variables. In the test of predicting the skill performance of badminton landing time, the self-observation method of the experimental object is adopted. The reliability of the data collection method for the prediction of landing time is proved. Therefore, the collection of variable data in this study is authentic and reliable. In other words, the variables in this study are operable.

In determining the feasibility of the study variables, the evaluation variables of the study are further clarified. At present, the evaluation variables include badminton player's successful score and time prediction skill performance of drop point of badminton players. Therefore, the current research is divided into study 1 and study 2. Based on the purpose of the current research and the determination of research variables. In this study 1 and study 2, the following research questions have been raised.

1.5.1 Research Questions of Study 1

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RQ1. Is there an significance difference in the effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method on successful score of badminton players at pre-test and posttest?

RQ2. Is there an significance difference in the retentive effect of badminton special speed training method (BSSTM) on successful score of badminton players from posttest 1 to posttest 2?

1.5.2 Research Questions of Study 2

RQ1. Are there any significance difference in the effect of the badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on time perception predictive skill performance of drop point of badminton players at pre-test and posttest?

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RQ2. Are there any significance difference in the retentive effect of the badminton special speed training method (BSSTM) on time perception predictive skill performance of drop point of badminton players from posttest 1 to posttest 2?

1.6 Research Hypotheses

The operational hypothesis of the study refers to the predictive judgment or assumption of the characteristics of the subjects and the relationship between imaginations, which is a tentative solution to the problem. The function of operational research hypothesis is first of all to guide the investigation and research. With the research hypothesis, the focus and main direction of the study can be clarified, the research task can be concrete, and the data to be collected can be clarified. The research hypothesis can also provide the basis for research design and sampling. Secondly, the hypothesis can associate abstract concepts (or variables) with concrete empirical facts. The hypothesis of the study is a tentative explanation of the specific relationship between these concepts. Third, the research hypothesis can explore new theoretical knowledge.

The hypothesis is made up of concepts that are stated in a testable form and predict specific relationships between two variables. The operational hypothesis proposition of this study is mainly based on the previous research results, and proposes the causal relationship between independent variables and dependent variables, in which the independent variables are badminton special speed training methods and badminton traditional speed training methods, and the dependent variables are success scores and time perception to predict skill performance. At present, the hypothesis is that independent variables have significant differences on dependent variables.

Based on previous research findings collected the result: (a) A preliminary study on the training method of badminton athletes' special speed (Li. & H. 2011). This previous study have selected 40 badminton professional athletes for experimental subjects, intervention method adopt the badminton special training method. Training length was one semester, method of special speed training was used the reaction speed, displacement speed and speed endurance. The results of research have found that the

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special speed quality of badminton players were improved greatly significant. In the meantime, previous study have found that badminton players achieved excellent game score in the school badminton games. So, the previous study have shown the speed is the key factor in winning in badminton games. (b) Study used the fixed line of training method of striking ball in badminton teaching course (Ma, 2016). In this master's thesis, the results have shown that the fixed pace training improves the displace speed, batting action speed.

This study based on the results of previous study, theory of special speed training method and theoretical model of time perception. The current study is assumed that badminton special speed training method has a significant influence on success score, and it is also assumed that the special speed training method of badminton has a significant effect of prediction skill performance of drop point of badminton players. In addition, it is suggested that the hypothetical badminton special speed training method has the effect of maintaining the intervention results of success score and time perception prediction skill performance of drop point. So, the current study put forward four operational hypothesizes in the study 1 and the study 2. The specific research assumptions are described as follows:

1.6.1 Operational Hypotheses of Study 1

H_0 (1). There is a significance difference in the effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on successful score of badminton players at pre-test and posttests.

H_0 (2). There is the retentive effect of badminton special speed training method on successful score of badminton players from posttest 1 to posttest 2.

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1.6.2 Operational Hypotheses of Study 2

$H_{o\ (1)}$. There are a significance difference in the effect of the badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on time perception predictive skills performance of drop point of badminton players at pre-test and posttests.

$H_{o\ (2)}$. There are the retentive effect of the badminton special speed training method (BSSTM) on time perception predictive skill performance of drop point of badminton players from posttest 1 to posttest 2.

1.7 Theoretical Framework of Research

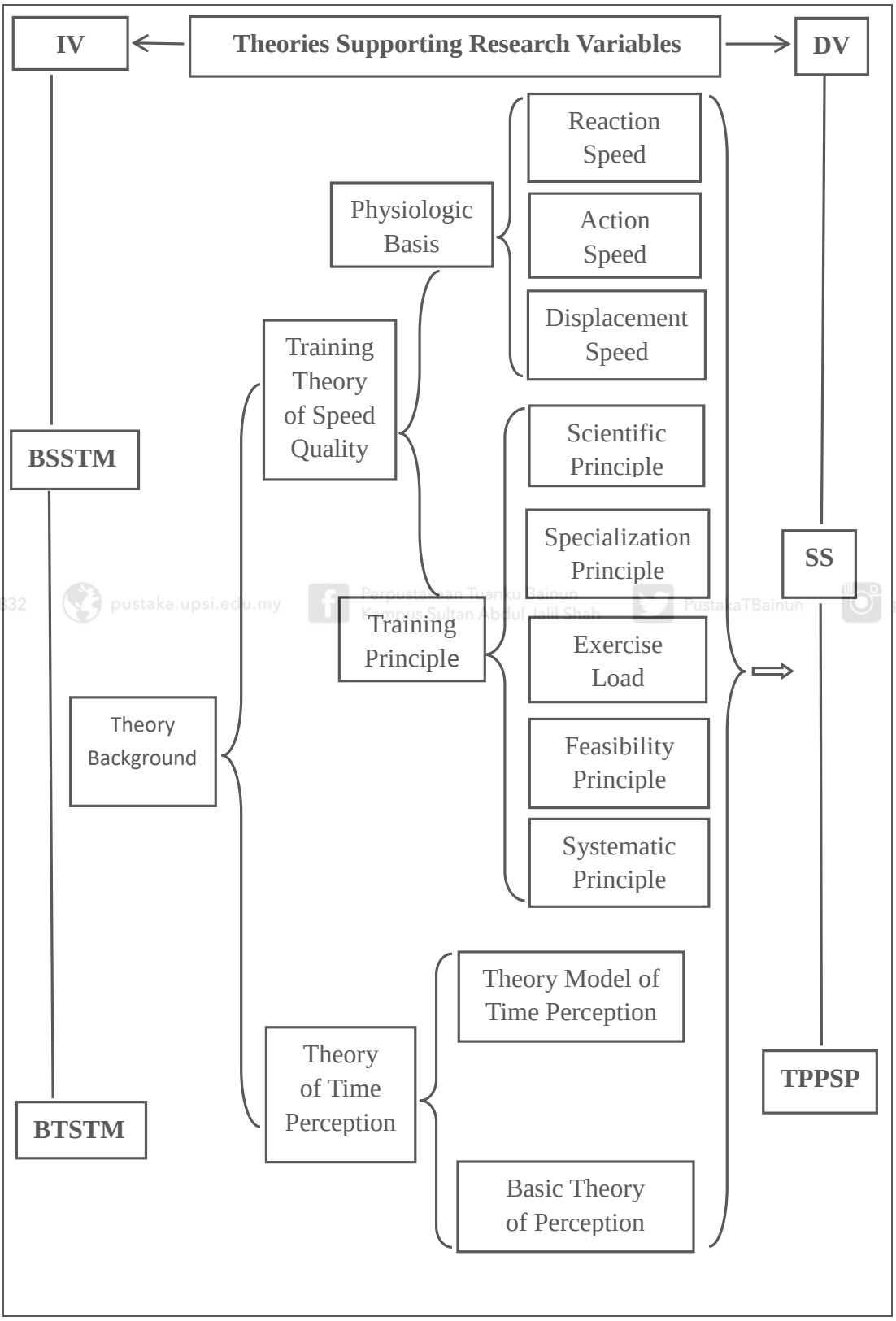
The theoretical framework is usually used to support research variables and the study itself; further arrive to solve research objectives and to build method dimensions to measure Success score and time perception predictive skill performance from these theoretical framework. Past study of various researchers such as theory of badminton special speed training method. Theoretical framework of the relative this thesis include training theory of Speed quality and time perception theory model (Zakary & Block, 1997). Training theory include the physiological basis of speed quality and training principles of speed quality. Time perception theory model include the biological model, cognitive model and time distance model of time perception; besides, research variables is independent variables and dependent variables. Independent variances is badminton special speed training method and badminton traditional speed training method, dependent variances include success score and time perception predictive skill performance (Wang, 2012) of badminton player. Theoretical background included theory of speed training and time perception predictive skills performance that all play vital roles in the development of this model on this current study (shown in Figure 1.1).

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Figure 1.1

Theoretical Framework Supporting Research Variables



Note：SS = Success Score，TPPSP = Time Perception Predictive Skills Performance

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1.8 Conceptual Framework of Research

Based on the theoretical Framework supporting research variables in Figure 2.3, the conceptual framework for this study was established and shown in Figure 2.4. The conceptual framework for this study integrated badminton special speed training method (BSSTM), badminton traditional speed training method (BTSTM), Chinese elite badminton players, three test points (pretest, posttest 1 and posttest 2), success score (SS) and time perception predictive skills performance (TPPSP). On the other hand, the study 1 of current study really objects to investigate whether there are significant difference in the effect of badminton special speed training method compare to badminton traditional speed training method on success scores (SS) of Chinese elite badminton players at three different test time points; The study 2 of current study really objects to investigate whether there are significant difference in the effect of badminton special speed training method compare to badminton traditional speed training method on time perception predictive skills performance (TPPSP of drop point of serve to rear court, smash and drop shot) of Chinese elite badminton players at three different test time points.

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In this study, the experimental subjects are 30 boys of Chinese elite badminton athletes in China sports university, 30 boys will be divided to 15 boys of experiment (group 1) and 15 boys of controlling group (group 2). The independents are two different training intervention methods of badminton special speed training method (BSSTM) and the badminton traditional speed training method (BTSTM). Dependent of study 1 is success scores, dependents of study 2 are time perception predictive skills performance (TPPSP) - time perception predictive skills performance (TPPSP) of serve to rear court, time perception predictive skills performance (TPPSP) of smash and time perception predictive skills performance (TPPSP) of drop shot. The length of the intervention training was 12 weeks and passed three different test time points (pre-test, post-test 1 and delayed post-test 2). Consequently, as it can be comprehended from Figure 1.2, the dependent variables are success score and time perception predictive skills performance of Chinese elite badminton players. Independent variables are described as the main factors that training intervention method of badminton special speed training method (BSSTM) and badminton traditional speed training method

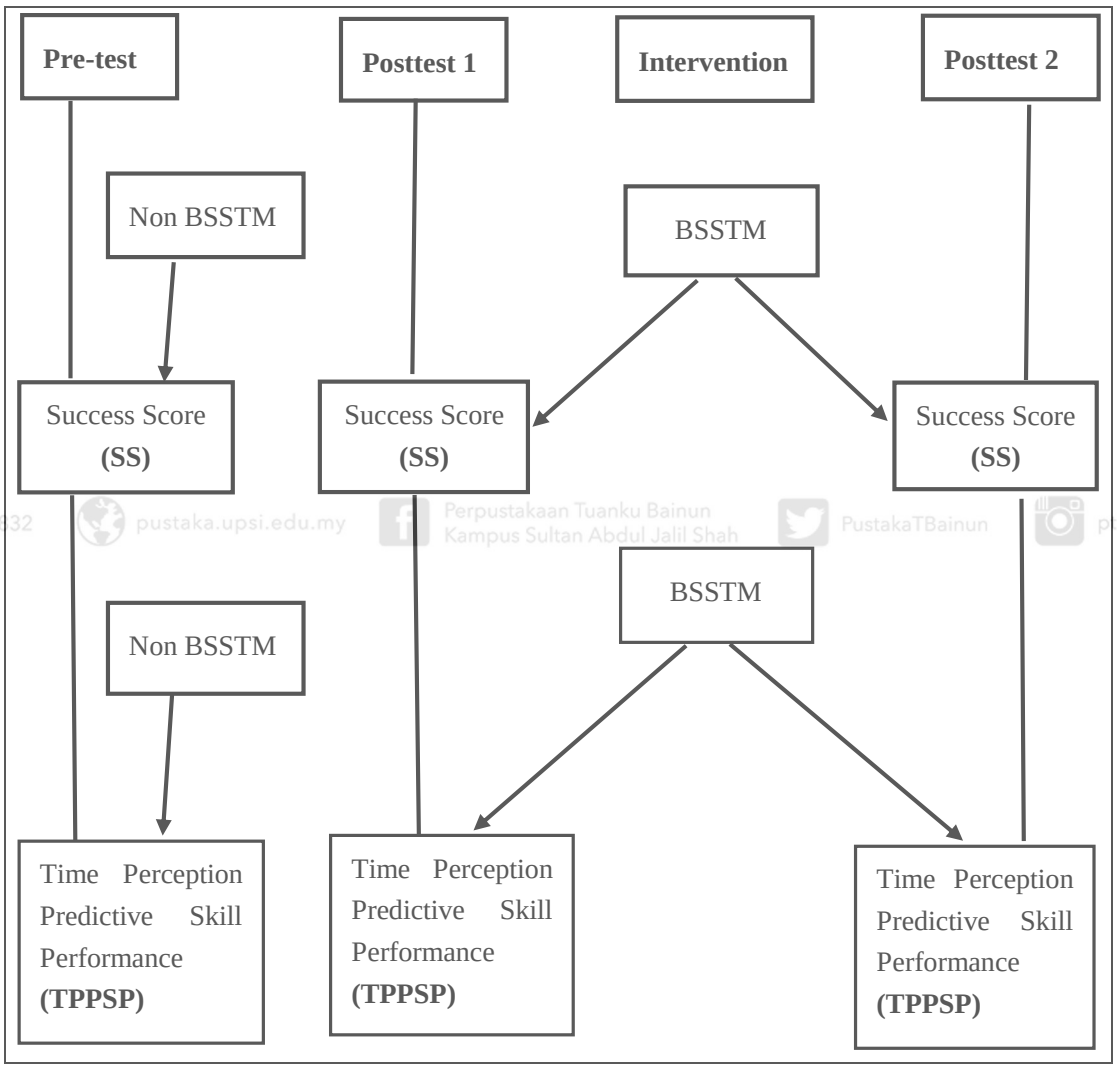
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(MTSTM) of Chinese elite badminton players to improve and develop their success score (SS) and time perception predictive skills performance TPPSP of drop point of badminton players.

Figure 1.2

Conceptual Framework of the Study



1.9 Research Significant

Combined with problem statement, proposes assessments variables include success score and time perception predictive skills performance. So, based on contents of the assessment variables, and proposes two studies. The first study could discussed the

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effect of badminton special speed training method on success score of badminton players. The second study could discussed the effect of badminton special speed training method on time perception predictive skills performance of drop point of badminton players. In addition, the effect of badminton special speed training method (BSSTM) training intervention compare to badminton traditional special speed training method (STSTM) on success score and time perception predictive skills performance. On the one hand, this study can further reveal the research theory and practical significant of badminton special speed training method. The results of study can show the practice guidance value for the teaching and training method in the future. On the other hand, the research of badminton special speed training method can promote the development of badminton teaching and training practice. The difference between these two training methods on time perception predictive skills performance will further be discussed in research findings. The research of badminton special speed training method can improve and develop theory system of badminton training.

This study combines the uncertain characteristics of badminton. The design of training content is based on the effect of speed training method on success score and prediction of landing time of badminton players. Badminton special speed include audio-visual reaction speed, displacement speed and action speed. Badminton special techniques include a variety of footwork technology and a variety of batting techniques. In training intervention methods of this study, coaches should grasp the key techniques, adopted the effective training methods of badminton special speed, and further improve to success score and time predictive ability of landing point of badminton players. First of all, this study discussed the effects of badminton special speed training method compare to traditional speed training method on success score, and further confirm the intervention effect of badminton special speed training method on success score. The research provided practical and theoretical guidance for the construction of training method system. Secondly, through the comparative study of badminton special speed training method and traditional speed training method to predict badminton landing time, through the combination of hitting to landing point position and various batting techniques, the results further confirm the influence of badminton special speed training method on the landing time prediction.

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1.10 Delimitation of the Study

Each project has its own research boundary. In this study, the boundary of this study is to determine the variables of research question and the reasonable employment of the researcher method. In the implementation process of the study to determine the boundary is a indispensable, because the determining the boundary of research can impact the research variables, further affect the expected the research purpose and results.

The boundary of this research paper is to determine the factors of research problems and research variables. According to social skills and academic achievements (Fabio & Del, 2012). In the research topics, independent variable is the training method of badminton special speed, the dependent variable is badminton success score and time perception predictive skills performance, time perception predictive skills performance include three kinds of variables, that of them is the predictive time of the landing point of service to rear court, smash and drop shot. At same time, the experimental research procedure is also further determine research subjects, this study subjects are elite badminton players of Chinese physical university, the experiment subjects will sample from population of physical university, the experiment subjects be divided the experimental group and controlling group. Badminton special speed training method be adopted on the intervention of the experimental group, badminton traditional speed training method be adopted on the intervention of the controlling group. Research design adopted three test point, that is pre-test, posttest 1 and delay posttest 2, through the mean comparison of success scores and time perception predictive skills performance of three test points, the study find that whether there are significant difference of the effect of badminton special speed training method compare to badminton traditional speed training method on success scores and time perception predictive skills performance.

1.11 Operational Definition

The definition of operation is to define and explain variables or indicators with

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perceptual, measurable things, events, phenomena and methods. In order to ensure the understanding of the definitions in the research process of thesis, all operational definitions based on the context of the study are listed below:

1.11.1 Badminton Special Speed

Badminton special speed refers to the ability of the muscles perform in their reaction action, batting action and displacement action in the shortest possible time. Badminton special speed is one of the most important sports abilities in badminton sports or badminton game. It usually shows the three forms of reaction speed, action speed and displacement speed (Uffe & Søren, 1990).

(i) Reaction Speed

Reaction speed refers to the ability of human body to respond quickly to various signal stimuli. Such as the response speed of badminton footwork starting, defense conversion speed.

(ii) Action Speed

Action speed refers to the ability of the human body complete a single action quickly. Such as speed of the batting clear and the return the ball, stroke speed and footwork starting speed, action speed of smashing and action speed of dropping shot to complete.

(iii) Displacement Speed

Displacement speed refers to the ability of human body to move quickly in unit time. Such as the displacement speed of footwork movement and displacement speed of batting action of badminton (Yu & Zhao, 2012).

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1.11.2 Badminton Special Speed Training Method (BSSTM)

In this study, the badminton special speed training method (BSSTM) refers to an effective speed training method combined with badminton special skills (Xiao，2005 & John Edwards, 1977). That is to say, in the training process of badminton special speed, badminton special speed training method is mainly embodied in the audio-visual reaction speed, starting speed, batting speed, changing direction speed and displacement speed.

1.11.3 Badminton Traditional Speed Training Method (BTSTM)

Badminton traditional speed training method (BSSTM) refers to an effective speed training method combined with the general sports speed quality of badminton players. The general sports speed quality do not combine the sports special skills, it commonly embodied the training method of displacement speed. In the training process of badminton traditional speed training method, badminton traditional speed training method mainly include the training method of the starting running reaction speed the footwork displacement speed. Such as the training method of exercise speed of various running and jumping (Li, 2015 & Lei, 2017).

1.11.4 Badminton Success Score (SS)

Success score of badminton players refers to the successful scores that the athlete completes of the number times of goal of technical action under the requirements of the test rules. The successful score is mainly affected by the requirements of the test rules and the skill level of the athlete himself（Grice，2008). For example: 30 good forehand short serves = 10 points. The number times of successful scores of badminton players is different from that of badminton player’s game achievement. The results of badminton competitions are determined by the match rules, the competitive level of the opposing athletes and the performance level of the athletes themselves. But, the success scores of badminton players only depends on the athlete's own technical performance level and the requirements of the test rules. In this study, the successful scores is the successful times of the athlete batted ball

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to target position under the requirements of the test rules. The details of the success score are stated in Chapter 3.

1.11.5 Time Perception

Study on the temporal and spatial perception is always a hot topic in field of psychology, especially in recent years, it has also been the research of physical sports science attention. The general definition of the temporal perception refers to the perception ability of time perception of athlete's on the continuity and sequence of objective things and events. In the psychology study, time perception is relative with activities, people's emotions, and motivation attitude, also related to the sports properties and the scene with excitement. The existing research on time perception divided the tow definitions that of them are time perception and time judgment. In previous studies, Fraisse (1984) pointed out what characteristics of time perception, he believes that time perception should be less than 5 seconds in the perceived time points. At the same time, he thinks the background of time judgment is the characteristics of time perception formed in long time memory, and time perception is in working memory of the psychological processes. Through search the literature that from 2000 to 2015 in the literature. The research content about the time perception there have been some changes, including introduction of the new scientific research. In this study, research of time perception predictive skills performance of badminton players accepted the opinion that Fraisse believes that time perception should be less than 5 seconds in the perceived time points. By consulting a large number of previous literature and research literature in nearly ten years, it is founded that there are two kinds of definitions of "time perception": "time perception" and "time estimation" or time judgment. Among which, the representative research literature is psychology principle put forward by William James at the earliest. James called perception of "Present" as" Specious Present", which can last for a few seconds. In addition, Fraisse put forward the concept of time perception in 1981, he believed that time perception mainly processes the time within 5 seconds, while processing of the time longer than 5 seconds involves the memory processing, belonging to time estimation. After Chinese scholars: Chen and Huang (2010) of proposed the concept of time interval perception and sequence perception. They

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believed that time perception is the temporal interval perception and temporal order perception of the individual's continuity when an objective time that simultaneously acts on sense organs directly. Temporal order perception refers to the individual's sequential perception of the objective event directly acting on the sense organ, while the time interval perception refers to the duration of an individual to two consecutive object events or an event in no more than five seconds.

All in all, in this study, the time perception research paradigm adopts the time point within 5 seconds. Single flying of the badminton is deemed as a continuous dynamic event, and the badminton games is deemed as the overall stimulate information source.

1.11.6 Time Perception Predictive Skills Performance (TPPSP)

Time perception predictive skills performance of athletes refers to the ability of athletes accuracy estimate time on dropping point of moving objects or the displacement time of moving objects. In this study, time perception predictive skills performance of badminton players refers to the predictive time of badminton players on the landing point of service to rear court, smash and drop shot. Second, the performance of athletes' time perception prediction skill refers to the ability of the athletes to judge the landing time of the moving objects in advance. In previous studies, it was found that the time perception prediction ability of the expert athletes had an advantage phenomenon, that is, the prediction time of the expert athletes was significantly shorter than that of the novice athletes (Wang, 2012). The study 2 will investigate whether there is a significant effect of badminton special speed training method on TPPSP of elite badminton players.

1.12 Summary

The main features of badminton games are uncertainty and rapid change (Michael & Guillaume, 2015). Such as badminton flight speed and falling position are uncertain. Therefore, it is important that badminton special speed training method be adopted on

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elite badminton players. Badminton special speed training method can improve the reaction speed, action speed and displacement speed, the athletes' special speed quality is the important factor that affect successful score and the accurate prediction of the ball's landing time. Moreover, people pay more attention to the training practice of the badminton special speed quality training method and the time perception predictive skills performance. In particular, the effect research of badminton special speed training method (BSSTM) on successful score and time perception predictive skills performance of badminton players has become a hot topic in current research. Main aim of this study is to investigate whether there is the difference of the effect of the training intervention of the newly building badminton special speed training method (BSSTM) compare with badminton traditional speed training method (BTSTM) on success scores and time perception predictive skills performance of Chinese elite badminton players. This chapter mainly have been stated the researcher background, researcher questions statement, researcher objectives, researcher significant, operational hypotheses, operational definition, delimitation of study and current conclusion. The following chapter will elaborate on related theoretical framework and literature review of the research.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter summarizes and comments on the theoretical basis and the practical progress of badminton special speed training method and time perception. The first section of this chapter summarizes and comments on the current research situation of badminton speed quality training theory and time perception theory model. The training theory of speed quality include the physiological basic of speed quality (the physiological basis of reaction speed, action speed and displacement speed) and the principles of speed quality training (the scientific principle, specialization principle, increasing exercise load principle step by step, feasibility principle and systematic principle of special speed training). Theory of time perception include theory model of time perception (biological model, cognitive model, perceptive model) and the basic theory of perception was stated in theoretical framework supporting research variables. The second section of this chapter summarizes and comments on the current research progress of badminton speed quality training method and time perception theory. Research progress of time perception mainly illustrated the influencing factors of time perception, the research paradigm of time perception and the research progress of time perception in physical education practice.

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2.2 Theoretical Basis

The theoretical background described in this paper includes the theory of speed quality training, the physiological basis of speed quality, the training principle of speed quality, the theoretical model of time perception and basic theory of perception. These theoretical background mentioned in this paper is described in detail as follows: section 2.2.1, section 2.2.2 and section 2.2.3.

2.2.1 Training Theory of Speed Quality

Based on the theory of adaptation and development of speed training (), the physiological basis of speed quality is discussed in this paper from the aspects of reaction speed, action speed and displacement speed (Zhao, 2010). At the same time, in the speed quality training theory basis of badminton special speed training principles are expounded. The details are as follows:

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2.2.1.1 Physiological Basis of Speed Quality

(a) Reaction Speed

The response rate depends on the time it takes for the excitation to pass through the reflex arc, which is related to the excitability and flexibility of neuromuscular tissue (Xia et al., 2010). The reflex arc consists of five segments: 1 receptor, 2 efferent nerve, 3 nerve center, 4 efferent nerve, 5 effector. The conduction velocity of afferent nerve and efferent nerve has little change in these five links, so the reaction speed mainly depends on the sensitivity of the receptor (the excitatory threshold) and the excitability of the effector (muscle tissue).

The reaction speed is closely related to the exciting state of the central nervous system, such as shortening the reaction when the athletes are in good pre-competition state. Previous studies have shown that when the body is in a certain state of muscle

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tension, it can be shortened by seven, and the speed of reaction also depends on the degree of consolidation of conditioned reflexes, as the skilled reaction speed of motor skills becomes shorter. By training, the response rate can be reduced by 11 to 25 percent.

The training method of reaction speed: usually using various audiovisual signals to stimulate or watch gestures to make pre-designed movements, sometimes coaches take pre-designed commands, athletes hear the commands and quickly make pre-specified actions, For example: (a) Badminton Audio-visual signal start pace exercise. (b) Audio-visual signal change running practice: jogging when you hear the signal or see the signal, sprint in a specified direction immediately, resume jogging after hearing the signal again, and practice over and over again (Liu, 2015).

(b) Action Speed

The speed of movement depends on: (a) the percentage and area of muscle fiber type. The larger the ratio of fast muscle fiber, the thicker the fast muscle fiber, the faster the muscle contraction speed. (b) Muscle contraction strength. The greater the muscle strength, the faster it can overcome the internal and external resistance of the muscle. (c) Excitability of muscle tissue. The excitability of muscle tissue is high and the intensity of stimulation is low and the time of action is short. (d) The degree of consolidation of conditioned reflex. The stronger the conditioned reflex, the more skillful the movement, the faster the action speed. (e) The action speed and nervous system to the active muscle, synergistic muscle and the coordination ability of anti-muscle is related. At the same time, the speed of action is closely related to the anaerobic metabolism of muscle in the complete movement (Xiao, 2005).

Training methods of action speed: It is be usually combined with the characteristics of sports, do some rapid strength training consistent with the characteristics of the specific sports, can use light equipment or hands-on exercise. For example, the badminton action speed training may take the continuous swing racket practice, Player jumps killing the ball in two corners of the backcourt, 2 minutes Continuous kill fast ball in forecourt of the net, continuous batting ball to get into the

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target, batting Continuous ball training on the wall, running quick and touch the target, starting action practice, footwork moving action practice, run fast practice, the uphill slope and the downhill dash run practice (Tang, 2004).

(c) Displacement Speed

For example, the displacement speed of shuttlecock movement depends on the step length and frequency, and the speed of stopping and turning around. A single step speed depends on the step size and frequency, and the step size and frequency are restricted by a variety of biological factors. Step length is related to leg length, muscle strength and coordination; coordination is related to motor skill proficiency and muscle relaxation; step frequency is related to fast muscle fiber area, nerve flexibility and coordination. In addition, the running speed is also affected by the coordination of various centers. Improved coordination can increase muscle contractile strength, thereby increasing the speed of action.

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The training method of displacement speed: the straight line running practice of different distance, the sprint running practice of 10m / 30m / 60m / 100m, the round / round running practice: 5 m / 10m / 12m distance; badminton displacement speed training usually adopted the training method: The quadrangle touch badminton practice in badminton court; forward footwork and backward footwork with visual or auditory signals; fast a lunge into the forecourt and the left forecourt and so on.

2.2.1.2 Training Principles of Speed Quality

The speed quality of badminton players developed earlier, and the young period was an important period for the development of badminton speed quality (Xiao, 2005). At this time, the speed training is based on the basic speed quality training, focusing on the development of the athletes' rapid reaction ability, the ability of the fast starting and changing direction movement and the ability of the fast batting. When it comes to youth, we should combine the characteristics of the special sports techniques and tactics, and

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adhere to the following principles in the selection of training contents and in the course of the training implementation:

(a) Scientific Principle of the Special Speed Training

The quality of the special speed is very important to success of the athletes. The special speed training conforms to the scientific law, athlete's competitive ability can be improved rapidly, and the athlete's technical and tactical ability can be guaranteed. In the training of badminton speed quality, it is necessary to scientifically arrange the content and load of speed quality training according to the characteristics of current physiological development and the ability to bear the load of the athletes according to the characteristics of badminton technology and tactics. First of all, the selection of training content should be combined with the physiological age characteristics of athletes, grasp and follow the law of the sensitive period of speed quality development, which is an important guarantee for the speed quality training to achieve good results. For example: 5-12 ages children's time is the key period of developing the frequency and rhythm of sports speed. The training focus should be the development speed quality, flexibility, coordination and sensitivity. In the training of speed quality, it should be practiced by hands - free exercise or auxiliary light device. The training intensity and density should not be too large. The training method should focus on the speed frequency and the action rhythm (Den, 1999).

(b) Specialization Principle of the Special Speed Training

The special speed training means that in the method of speed training, it adopts the same way as badminton sports characteristics and technical movements, supplemented by special speed training methods, to improve badminton speed quality ability. Badminton special speed quality mainly includes three aspects: reaction speed, displacement speed and action speed. In general, the basic speed training method is adopted, and the basic speed training method is more perfect than the special speed training method. However, the content of special speed training has not yet formed a

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more perfect system, and even some sports special speed training methods and contents need to be re-constructed, which should be combined in the concrete construction process. Technical and tactical characteristics of sports and training tasks. In the selection of training methods, we should not only consider the overall improvement of speed quality, but also highlight some aspect of speed quality. For example, in the training of badminton special speed, the training contents should be selected from three aspects: fast reaction speed, fast displacement speed and fast batting speed, combining with the technical and tactical characteristics of badminton. At the same time, according to the speed quality training specific tasks, to develop a certain aspect of speed quality. For athletes who need to increase their starting speed, the training of starting reaction speed should be strengthened (Xiao, 2005).

(c) Increasing Exercise Load Principle Step by Step

Progressive and effective training can improve the body's sports quality and the level of human function, thereby improving the performance of sports, but this process of improvement is a gradual accumulation of training results. That is, train adapt improve retrain re-adapt to this process. The principle of gradually increasing the training load is the basis of making the training plan. The improvement of physical quality is related to the increasing speed and mode of training load. The correct way to increase the training load is "step by step" and "wave shape" (Grice, 2008). The application of training methods should effectively improve the quality of athletes' special speed. Design the difficulty of training content, adopt reasonable training intensity and training course density in 2003, the training course can guarantee the completion of the training course objectives and tasks, and effectively improve the badminton speed quality.

(d) Feasibility Principle of the Special Speed Training

The training method should be operable, the teaching and training task should accord with the students' acceptance ability, and the difficulty of the training content should be designed according to the actual level of the training object. Adopt reasonable training

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intensity and training course density. In the experiment of badminton special speed training method, the selection of training content, training intensity and training measurement should be operable, and the quality of badminton special speed should be effectively improved through three months' cycle training. In order to further improve badminton athletes' success scores and time perception prediction ability.

(e) Systematic Principle of the Special Speed Training

The principle of systematic operation means that the training content should be comprehensive and systematic, and the training process should follow the scientific training method and be carried out in an orderly manner, which can be carried out step by step and systematically in the training practice (Xiao, 2005). In the process of badminton speed quality training, the training content should be alternately arranged in the training content according to the specific training contents of the reaction speed, the movement speed and the displacement speed of the special speed training, combined with the badminton technology and tactical characteristics. The training intensity and measurement are gradually strengthened, and the effect of special speed training is continuously improved.

2.2.2 Theoretical Model of Time Perception

Cognitive psychology believes that the human’s cognition of events starts from the sensory perception, and the cognitive development process is a progressive process. The progressive development of cognition is a cyclical and progressive development process from cognition to practice and then from practice to cognition. So the perception is the crucial stage for human to obtain knowledge and information. Before the 1960s, psychologists' research on the time phenomenon of the movement development of event is only a research of time interval perception and time estimation. After the 21st century, psychologists found many phenomena on the basis of a large number of experimental researches. The most representative theories are William's time memory strength theory (the latest events are memorized much clearer) and inference

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theory (known time information projection and other related events). With the continuous development of neuroscience, the research on time perception is deeper and deeper; scholars attempt to establish a theoretical model to explain the internal mechanism of time perception, thus many theoretical models and basic theory of perception have been produced in this process. The most typical theoretical models are biological model, cognitive model and comprehensive model. The details of perceptive model is be show in next section (Chen et al., 2011).

(a) Biological Model of Time Perception

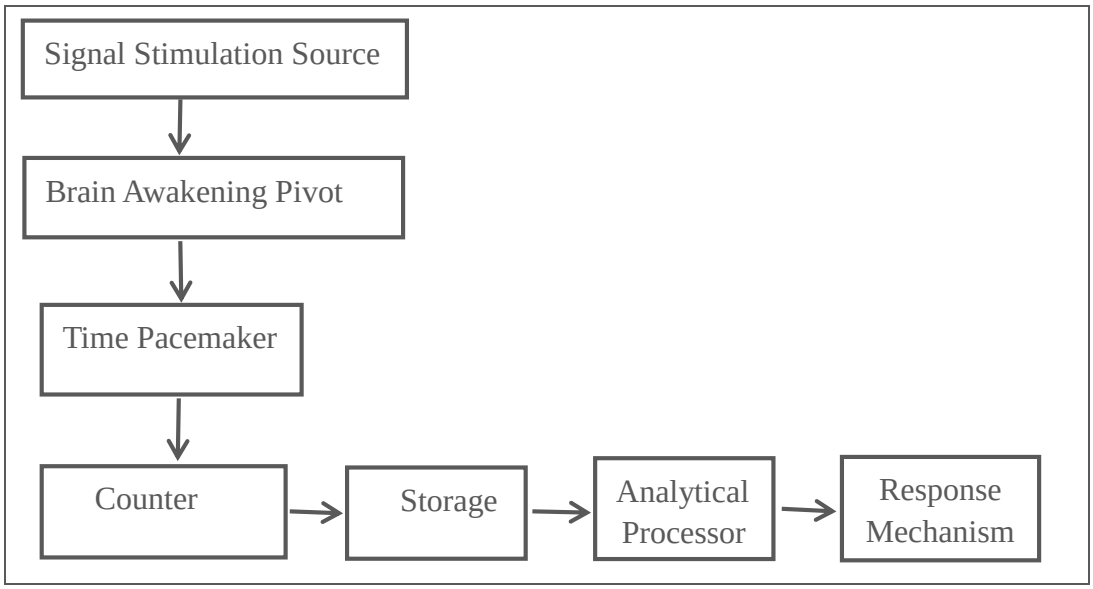
Biological model holds the view that time perception mechanism similar to biological clock or internal clock exists in brain of body (Treisman, 1963). Such theory model considers internal clock in body processes time information by referring to relatively stable periodic variation frequency of external environment. Therefore, according to biological model theory, there are individual differences in time perception. Adherents of such theory regard individual is less subject to factors such as external environment, stimulation type and stimulation quantity, while whether biological model of internal time perception of body is complete is the major factor that affects time perception. As internal clock model is raised by biological model theory, researchers pay more attention to internal differences of body, such as gender, age and other factors. Biological model of time perception is mainly subject to mechanism similar to clock counter inside brain. The earliest “Counter Model” includes the metronome and counter. It lately developed to representative “Internal Clock Model” (Treisman, 1963). Such theory model takes for that there is a “Pacemaker” inside brain; when testee notices stimulation of event or information source, metronome creates fixed pulse, while counter records such pulse, which then has access to storage and is expressed via response mechanism at last after being processed by brain analyzer and finally forms a feedback evaluation.

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Figure 2.1

Internal Clock Model (Treisman, 1963)



(b) Cognitive Models of Time Perception

Cognitive models of time is contrary with biological model, and the cognitive model mainly states influence of external factor on time perception, which includes stimulation conditions and surrounding environmental factors. Stimulation conditions cover stimulation method, stimulation intensity, stimulation frequency, stimulation quantity, etc.; Environmental factors mainly include stimulation object's (testee) familiarity on stimulation scenario and complexity degree. Such theory believes that time perception is indirect result of cognition course and significantly subject to memory and attention. Cognitive model mainly emphasizes individual's course of processing perception and how perception course affects result of processing task. Systematic variation of stimulation environment will create systematic and predictable impression on time judgment; Functional damage of local brain will not eliminate time perception. In addition, cognitive model also emphasizes the importance of method of organism processing different stimulation factors of time information. On such basis, Zakay and Block (1997) proposed "Resource Allotment Model", and such model assumes that there are two kinds of processors inside the brain: time information processor and non-time information processor, which is responsible for sole processing

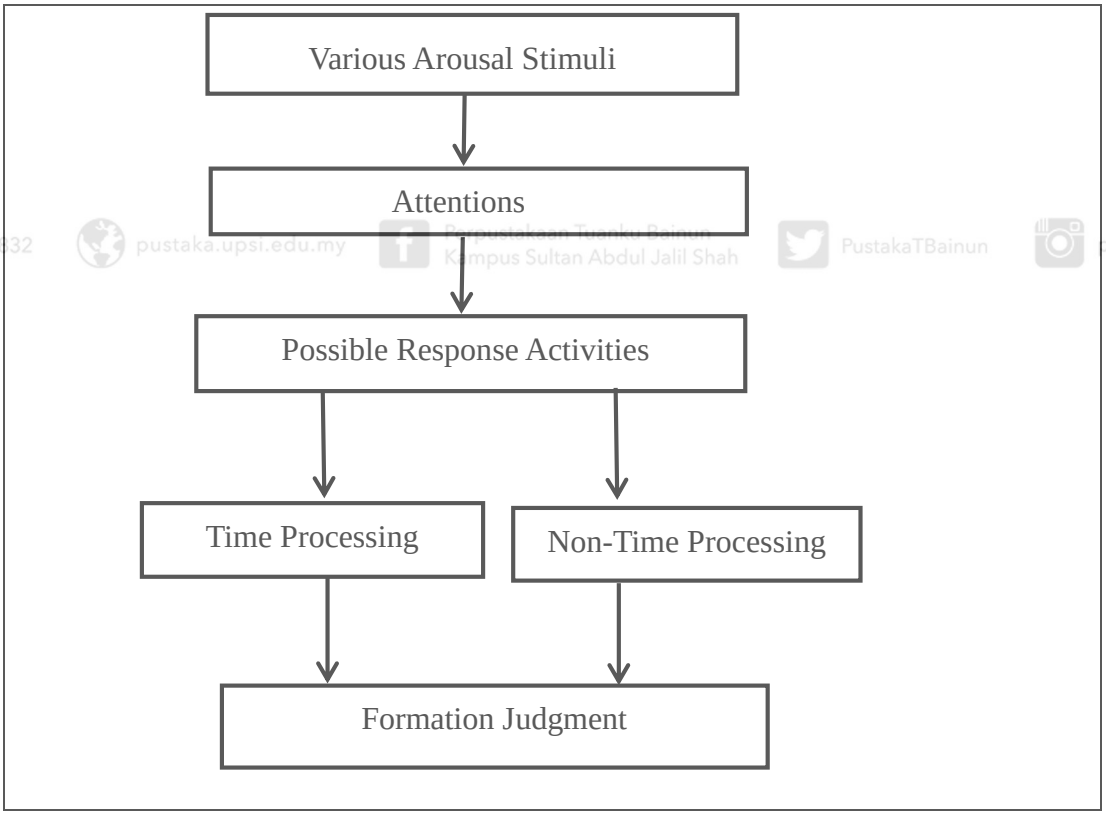
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of time information and non-time information respectively. Testee's result on time interval estimation depends on attention degree on time information and non-time information. Massaro's "Interruption Model" also holds the point that when testee pays attention to much stimulation information, if there is a stronger stimulation subsequently, it will interfere organism processing previous stimulation information, and cause testee to have a shorter time to perceive previous stimulation. As a result, it can be inferred that time interval is related with intensity of stimulation information source and attention degree (Figure 2.2).

Figure 2.2

Resource Allocation Model (Zakay & Block, 1997)



(c) Perceptive Model of Time Distance

Distance perception model is a theory model that integrates and processes information at an interval of 3s continuously (Huang, 1994). When distance perception model

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covers resource allotment model, resource allotment model refers to that the higher attention of current event, the longer the duration of event. Processing time of model (processing time model) is also referred to as attention model (attention model) as stimulation to visual information processing mechanism and processing timer. Information processing time for visual information processing is used to process visual physical feature information of stimulation. Basing on task requirements and different importance, it is available to allot resource allotment of attention to drag processing equipment, and the more attention resources allotted to timer, the longer of time perception (Chen, 2012). Mack (2002) proposed resource allotment model of time extension, information processing and background processing share attention and work memory resource. Over three kinds of attention model. The most difference among the above three models lies in that non-time information and time processing only pay attention to resource jointly, while resource allotment model performs non-time information processing and sharing attention, working internal storage memory and monitoring and allotment of these resources. Basing on resource allotment model, Rosenblatt and Thickstun (1970) proposed energy model, which considers energy source more during consumption and has a long perception duration.

(d) Division Model of the Temporal Cognition

Time cognition's range comprehensive model (Huang & Zhang, 2003) absorbs reasonable part of existing time cognition researches, and conducts a series of researches based on the theory frame raised towards time research. Such model indicates that human has cognition for a duration, and different time and different distances have different expressions, regardless of whether cognition distance of an individual is subject to influence of many factors, such as quantity and structure of event, nature and features of channel, nature, time and time attention, code, division and extraction method, test index, personal time belief, emotion, distance. These factors could explain time perception scientifically. Time cognition division model is applied to various fields of time perception to propose to explain by distance perception and sequence perception model.

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Huang et al. (2011) proposed to make explanation from perception processing mechanism of dual-course model of time perception, and such model indicates that automatic control processing is made under non-attention conditions. Automatic course of time perception is processed based on sense memory, and automatic sense, storage and comparison of time information will be analyzed when no attention is paid. Control course is an attention control course based on awareness control and can be divided to acquisition of sense information processing, perception of information processing suppression, acquisition of time information processing, information processing and perception processing decision-making time. Chen et al. (2012) put forward dual-processing and expression that explain temporal order perception matching and repetition start of adjustment model. Repetition start effect of time sequence perception refers to that target stimulation judgment perception in repetition start time sequence does not begin prior to task, and the processing includes two courses, namely, courses of suppressing activation and representation of response. Drag refers to dual influence of processing on time sequence perception and is adjusted via representation in matching link. In case of occurrence before target stimulation and stimulation representation matches, response suppressing course will continue to suppress perception processing, so that stimulation starts after stimulation judgment, namely repetition reversion causes effect to tack place; As the first sign of target stimulation and beginning to unmatched, response suppressing processing will weaken, start of retaining stimulation representation will activate processing and promotion via stimulation of start processing, and the beginning of stimulation judgment firstly occurs.

(e) Perceptive Model of the Temporal Order

Clock model and cognition model of time perception mainly emphasize that time interval theory and comprehensive model take for that time perception comes from mixed effect of internal factor and external factory (Treisman, 1963). Such theory model lays importance on temporal order perception, the research on which receives attentions from plenty of scholars, and temporal order perception identification ability in many time perception tasks appears to be more important. Comprehensive model includes resource allotment model and attention gate model. Attention gate model

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proposed by Zakay and Block (1997) is relatively mature and widely accepted by people in the meanwhile, and such model covers gate, counter, cognition comparison mechanism, response mechanism, etc. Such model holds the point that when stimulation occurs, time processor and stimulation processor are regulated by attention "Gate"; opening degree of "Gate" is related with allotment of attention resources; when organism pays attention to time stimulation, gate between pacemaker and switch opens, and pulse created by pacemaker constantly enters accumulator; When attention focuses on non-time information, gate closes, and time information accumulated in accumulator decreases. Attention resource will be allotted to different mechanisms through controlling allotment of resource with attention gate, based on cognitive view difference.

There is two-stage model in two time sequence cognition centers, with one being center of the same time, and another being center of order time. The effect is different. Cognition center is also responsible for identifying whether drag stimulation is in succession to determine the sequence of drag center on stimulation. In time identification task, single sense channel reaches a point in brain firstly; The single starting from such point transfers to center, sequence analysis center and central processor of information center at the same time; If arrival time interval of drag signal is less than threshold of center at the same time, the processing is over; If single arrival time interval of two-order center is greater than order threshold, it is available to record two stimulation time sequence; If time interval is less than order and greater than threshold, it will not correctly identity stimulation sequence, and the experience of random response is acquired further (Cheng & Zhang, 2011).

(f) Process Model of Pattern Recognition

Space perception theory is mainly classified to two types, one as constructive perception theory, and the other as direct perception theory (Norman, 2002). Constructive perception theory emphasizes human's initiative, to form (construct) the perception through initiative selection and memory matching, which has the same characteristics as the "Top-down" theory and conforms too many hypotheses of visual

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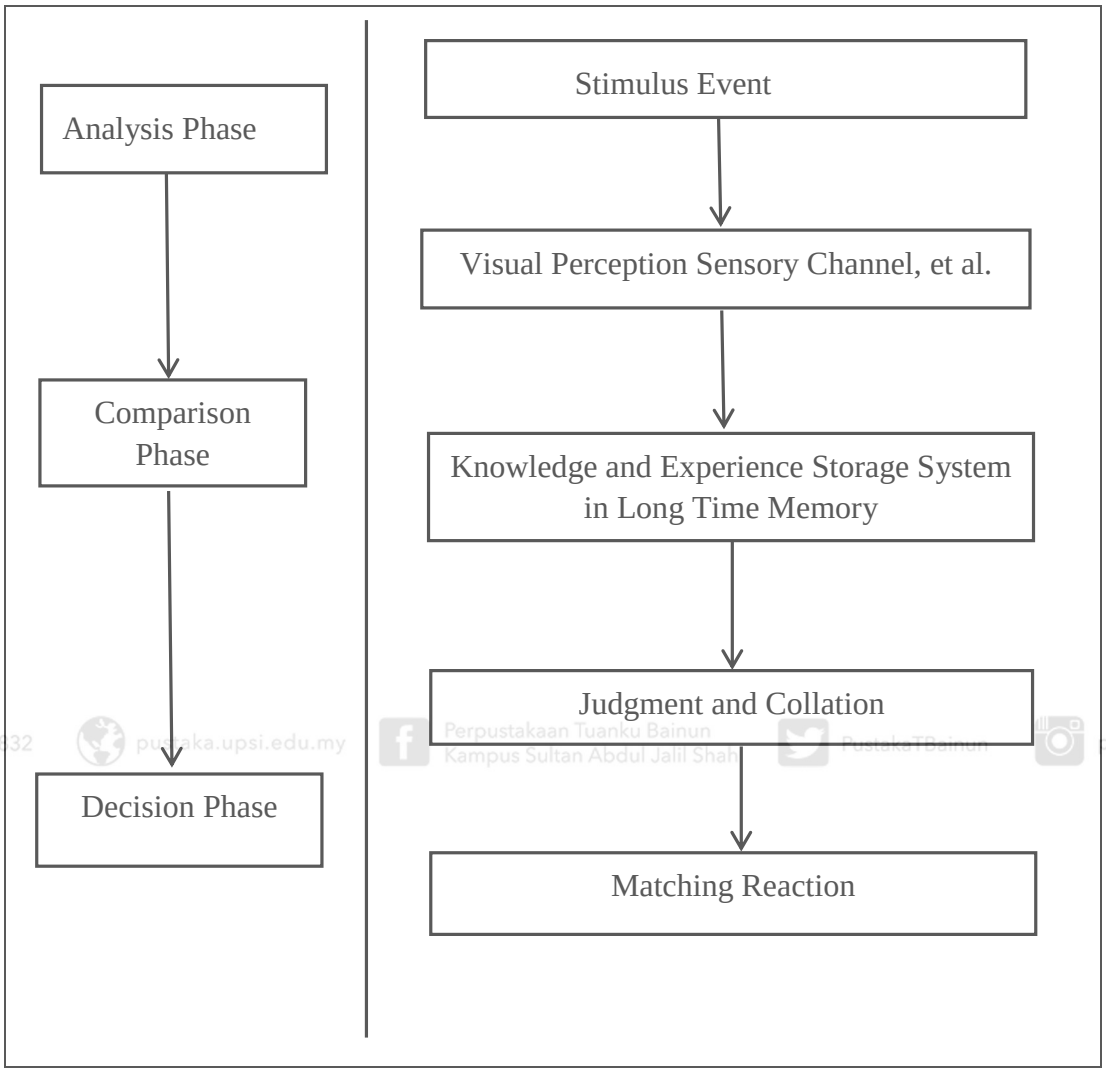
pattern recognition: Direct perception emphasizes that stimulation information is the most important source of perception. Perception process is the process to obtain information directly from the external environment, closely related to the "Top-down" viewpoint. In this Research, it carries out the discussion around the constructive intuition theory, to explain the theory of visual pattern recognition theory in detail (Dodwell, 1970). When people recognize things, the brain will distinguish and memorize the features of things in a certain way, which forms the basis of thinking ability pattern recognition. Pattern recognition is one of the core researches in contemporary cognitive psychology. Meanwhile, it is also concerned by many related professional fields, especially neuroscience and artificial intelligence science. Pattern, as an important concept, refers to a series of elements or the stimulation combined according to some specific relationships. Visual perception is the main content of the research on pattern recognition at present. When the stimulation information is presented, people perceive it, compare and match it with the information stored in the long-term memory system, and then identify the perceived information, which is a process for recognition, integration and classification. Pattern recognition depends largely on the individual knowledge and experience, and the pattern recognition process consists of three main stages: Analysis, comparison and decision-making. It can be seen from Figure 2.3 that human’s intuition system and long-term memory system play an important role in the process of pattern recognition. Individuals receive external stimulation through sense organs and compare the stimulation received with the knowledge and experiences stored in the long-term memory system, and then make judgments and reactions (Figure 2.3).

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Figure 2.3

Pattern Recognition Process Model



2.2.3 Basic Theory of Perception

Through a large amount of literature collection and retrieval, the present situation and research results of visual time perception and perceptual skill learning are analyzed, and the theoretical framework of the research is established. They are Pattern recognition theory，Schema theory，Gestalt theory，the priming effect theory of perception, the theory of perceptual learning process. Adaptive Theory of Cognitive Development, Cognitive Field Theory, Gestalt Theory of format School, The theory of information processing and the theory of observer center. These theories are the

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theoretical basis for supporting the research and development. The analysis and review of each theoretical viewpoint will be shown separately from section 1.2.1 to section 1.2.7.

(a) Pattern Recognition Theory

The perception of a hot spot in research is pattern recognition. In cognitive psychology, a spatial and temporal structure of the overall composition is a group of stimulation or stimulation pattern refers to the Cognitive psychology pattern recognition theory mainly includes three categories: Template theory, prototype theory and feature theory.

Template theory. There are many knowledge experiences in the long-term memory system of human, which are accumulated and formed in the past life. These fixed experiences are called templates. When perceiving the same stimulation again, the template in the long-term memory system will be extracted, compared and matched with new stimulation, thus the new stimulation information will be processed and encoded. The above is the specific process of pattern recognition. The template theory emphasizes that all the templates in the long-term memory system are in a one-to-one corresponding relation with the stimulation. The template theory explains some of the people's recognition behavior to some extent, but it also has some shortcomings. According to the template theory, people must obtain and store the corresponding templates in advance, thus it is possible to recognize the corresponding new stimulation. The template theory has been questioned by most psychologists, who all argue that template theory does not fully explain people's pattern recognition process.

Prototype theory. Prototype theory is built on the basics of the shortcomings of template theory, which believes that the information stored in the long-term memory system is not in one-to-one corresponding relation with the external stimulation; as a recapitulate theory, it is the summary of the basic features of a large class of things, belonging to an abstract concept, which summarizes the key features of things. They are called as Prototypes. The hypothesis prototypes in the prototype theory are not necessarily exactly the same, therefore, for the case similar with the “Prototype"

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features, it can also be compared and matched, that is, in case there is a corresponding prototype, no matter it is a new stimulation pattern or a stored pattern, all can be recognized. So we think that the prototype theory is a modified version of the template theory, which makes it easier and more flexible for individuals to carry out pattern recognition activities, thus to recognize the environment more easily and flexibly. However, there are some shortcomings for prototype matching, which only emphasizes bottom-up processing but ignores the top-down processing.

Feature theory. Feature theory is also called feature matching theory. The theory believes that a pattern or thing is formed by combining many kinds of elements and components according to certain rules and relationships, which the elements or components that make up a pattern are called as features. Therefore, the understanding and recognition of things can be based on their essential features for processing analysis. In the process of pattern recognition, the most important features and key elements of task stimulation are extracted at first, and then compared and matched with the basic features stored in the long-term memory system for recognition. The feature matching theory has two key points. First, mainly extracting the key features of things effectively to reduce the task load of memory. Second, in the process of pattern recognition, it needs to extract key elements, and then carry out the feature integration of these elements, the process itself is a learning and accumulation stage, which is conducive to people's learning. Feature theory also has its own shortcomings, which only emphasizes the bottom-up processing, without top-down processing.

(b) Schema Theory

The concept of schema has been widely researched since the introduction of the concept into the psychology research. Upham et al (2009) used the schema concept to explain the knowledge system stored in human brain memory. With the development of new branch of sciences, especially computer science and information science, the schema already have their own definition of psychology. Although there are many explanations for the definition of schema, we commonly adopt the most general meaning. Researchers regard it as the composing structure of knowledge, which consists of a

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series of general knowledge and experience, forming a complicated Interaction and interrelated knowledge system with a certain structural features. The schema explains the most representative typical features and relationships of certain things and events; these features and relationships are of most representatives, which include the most important and key information. Schema is also a hierarchical relation, which can contain some sub-schema, while the sub-schema can be divided into smaller schema, thus, it can help people recognize and judge events and special situations, which is conducive to the cognitive processing operation. Anderson and Pearson (1984) have summarized four basic features of the schema: (1) Schema meaning changes; (2) Schema can be an inclusion relation; (3) Schema can be organized according to the hierarchical relations, and can also be embedded in the other schema; (4) Schema is abstract. For the meaning of schema, the key is the collection of information. However, the schema structure that has been formed is not fixed, which can be appropriately changed and adjusted. Schema theory explains how people's knowledge is represented and how the representation is applied to learning, thus it is convenient to acquire knowledge. Have ignored the individual's autonomy in the cognition process.

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(c) Gestalt Theory

Early gestalt psychologists: Allport (1955) put forward that the composition of patterns stems from the interactions of stimulation, which is almost nothing to do with past knowledge and experience, but cognitive psychologists always have endless debate about this theory. In recent years, the pattern recognition researches have gradually expanded the earlier theories and achievements, which have been changed from simple stimulation to more complex internal structures and processes.

The canonic perspective belongs to the extension research range of the Gestalt psychology. The canonic perspective refers to the image that can best recognized the stimulation, or the perspective that emerges in memory. It can be the outcome with similar features or similar experience in the same kind of things. The canonic perspective makes us understand the feature of people's thinking efficiency in the process of information processing. By using a group of animal pictures, Allport (1955)

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asked the tested to evaluate the typicality and familiarity of the pictures. The results showed that there is a great correlation between the reaction speed of the tested and the typicality of the pictures; the more typical the picture is, the shorter the reaction time is; under the very atypical stimulation, the tester's reaction time is much longer.

(d) Priming Effects of Perception

Priming effect means that the previously processed stimuli can promote the same stimuli (direct priming) or related stimuli (indirect priming) (Hermans, Houwer, & Eelen, 2001). From the concept, we can see that the priming effect is similar to the transfer in the learning theory, and the priming effect has the characteristics of unconscious and unconsciously produced. It belongs to the category of pre-conscious information processing and the role of top-down processing in perception. This theoretical view dates back to 1970s. Cognitive psychologist (Meyer, & Schvaneveldt, 1971) began to study the priming of perception. They used the experimental paradigm of memorizing words and non-words. The results showed that when the priming stimulus is associated with the detection of stimulus, the reaction time of the subjects is significantly shortened. Priming effects using the "three pairing" paradigm. This paradigm presents two matched groups of words, each with three words, in two groups of words. Adding the right fourth word to a group of words shows a close connection between words. For example, in a group of words are "playing", "credit", and "report". Add the appropriate fourth word "Card, the first three words can be combined with "card" to form a phrase: "playing card". "Credit card" and "report card." another group is the random selection of words that are not closely related, such as "still." "Pages" and "music". The test results showed that not all the subjects are conscious of word processing, and that there should be a pre-conscious component. It can be inferred that the priming effect reflects the role of top-down processing in perception, which further proves the influence of previous processing on subsequent processing and the past classics. The effect of experience on perception is contextual.

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(e) Theory of the Perceptual Learning Process

The perceptual learning process shows that the perceptual achievement improves gradually with the teaching. The teaching process cannot be perceived, and no feedback is needed. The ability to improve perception through teaching can be maintained for a long time, even permanent. Perceptual teaching is associated with specific tasks of teaching. Gibson (1955) conducted a classic experiment on perceptual learning. The task is to identify a card with a coiled pattern. There are 17 cards. Select one of them as the first observation card at 5 seconds, then present the other cards one by one, insert in the middle the participants are asked to recognize the original card four times. There is no feedback in the whole learning process, but after a round of reading, the original card is presented at 5 seconds, and the participants are observed carefully. Then a new round of teaching began. A rotation is conducted until the subjects could identify the original card each time they saw it. From this experimental model, it can be inferred that perceptual learning is plastic. But the teaching theory of perceptual learning process can only be explained by top-down processing theory. This experiment cannot be explained by pattern recognition and feature matching theory. It is true that the mode of perceptual learning theory is exactly the same as the research and design scheme of this experiment, which is why the perceptual learning theory has been introduced into the instructional design theory of this study.

(f) Adaptive Theory of the Cognitive Development

Cognitive development is the famous development history put forward by a psychologist: Piaget in the 20th century, which is recognized as the most authoritative theory in the history of psychology. The so-called cognitive development refers to the activities that the individual adapts to environment from birth, and the perception of things and the thinking model and performance ability to problem situation, of which the process will change and grow with age. The data statistics is more popular in experimental group method research (Piaget, 1964). For individual children (his daughter), through intelligent response as well as careful observation and record of their own affairs, analyze and research the quality. It belongs to this kind of research and is

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widely used by child psychologists. Piaget's (1977) theory of cognitive development stems from the genetic and environmental controversy, puts forward the development of internal and external interaction concept, that is, the psychological development is the result of the interaction between the subject and the object. The main performance of the interaction between the subject and the object are as follows: First, the relationship between the subject and the object is interrelated and mutually restricted in the development of psychology. Second, the interaction between subject and object and the genetic factors are controllable and varying, and it can change the genetic characteristics under the action of the environment. Third, the interaction between the subject and the object is regulated by the individual's subjective initiative, and the process of psychological development is a positive process of self-selection and self-regulation. Piaget believes that the essence of wisdom is adaptation, and adaptation is one of the most advanced forms. He explains the adaptation theory and constructiveness theory, as well as schema, assimilation, adaptation and balance four basic concepts. Schema is cognitive structure. Structure refers to the mental organization instead of the material structure, which is a dynamic functional organization. Schema has the object with the function of information consolidation, classification, conversion and creation, to make the human body effectively adapt to the environment. The cognitive structure is constructed through two ways of assimilation and adaptation. Assimilation refers to the integration of the main environmental information in the process and the integration of existing cognitive structures. The process of assimilation is the main process of conversion, that is, assimilation of external stimulation, which strengthens and enriches the original cognitive structure. Obtain the amount of assimilation pattern changes.

When the subject's pattern cannot meet the requirements of the object, it needs to adapt to change the original pattern or create a new pattern adaptable to the requirements of the environment. Assimilation is the conversion process of the subject to the object. Adaptation reflects the process of subject conversion. A new cognitive structure can be constructed and developed through assimilation and adaptation. Piaget emphasizes the initiative of the subject in the process of cognitive development, that is, the process of cognitive development is a positive process of the subject's self-selection and self-regulation, and balance is the driving force of initiative construction.

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Balance is the main psychological motivation for development and is the development trend of the positive subject. Piaget believes that children who are actively exploring are the environment, and they are actively established through the operation of the objects.

In the cognitive development adaptation theory, the relationship between the subject and the object of cognition, especially the subjective initiative and the state of motivation of the subject in the cognitive process, is positively related to the attention ability that we emphasize in the cognitive process.

(g) Cognitive Field Theory and Symbolic Gestalt Theory

Snygg (1966) cognitive field theory is based on Greta psychology. His theory holds that behavior as an obvious behavior is understandable and purposeful. It is based on the cognition of the relationship between the objective of the environment and the means leading to it. The so-called cognition is not individual perception or partial perception. The cognitive object and the cognitive process are regarded as the whole cognition, which includes the mutual relation and the meaning relation between the objects, and between the cognitive objects and the means, the relationship between the means and the goal which gives meaning to the cognitive object and the means is formed because of the effect of the experience. To call this formed whole. Is the gestalt of a symbol?

In the ordinary college students, sports professional athletes and badminton athletes above the second level of badminton in the space and time cognitive characteristics of the experimental test process. The theoretical idea of the experimental design is to treat badminton as a dynamic whole movement process, and this complete motion pattern is like a gestalt symbol. Only in this way can the athletes have the ability to judge the landing point of badminton sport in advance and accurately. The experimental study is based on the common college students. The characteristics of spatial and temporal perception of badminton are tested and analyzed by sports professional athletes and badminton athletes above the second level, and the characteristics of badminton athletes at different levels are discussed. The other task of

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the experiment is to train the ordinary college students and sports professional athletes through multi-point changing serve and step teaching. Focus on the teaching of ordinary college students and sports professional athletes in the dynamic movement of badminton in the process of space-time perception ability. In this experiment in the pre-test and post-test, the main selection of relevant factors have the ability to pay attention. Visual acuity, perceptual response speed, visual space-time perception, displacement velocity, analysis and problem-solving ability. The success rate and performance of receiving serve are compared and analyzed before and after the experiment, and the related factors of space-time perception of athletes before and after the experiment are compared and analyzed, and the space-time perceptual energy of athletes is discussed. The teaching of strength and athletic ability adapts and changes.

(h) The Completeness of the Lattice-Style School

Helson (1987) conducted a series of classical experimental studies on the problem solving of gorillas. The first cognitive learning theory, which is opposed to Thorndike's connection learning theory, is put forward. He carried out a series of experimental studies from the perspective of the cognitive process of the subject. Therefore, learning is interpreted differently from behaviorists. He thinks that learning constructs gestalt in the mind actively and forms cognitive structure, and learning acquires expectation through comprehension and understanding. It is not under the control of the external environment that the S- R connection is formed passively. The cognitive learning theory, emphasizes the importance of insight in learning, he believes that learning is not the accumulation of action or a blind attempt, but learning the main advantage of their understanding and wisdom on the relationship between scenarios and their insight. Although often appear in the Epiphany after several attempts and error learning is obviously before reaction in making out in the mind, to carry out a similar "hypothesis" thinking. Therefore, the relationship between stimulus and response or environment and behavior, Gestalt psychology homodesmotic structuralisms or behaviorism understanding are different. The former is understood as indirect, to consciousness as a medium, it is a three type, That is: S-O-R; But the latter understanding is direct, does not have the consciousness intermediary function, it is a binomial, namely: S-R.

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Therefore, in the long jump technique teaching. It is very necessary to organize the knowledge structure of the long jump technique and operation mode and to establish the space-time formula of the long jump from the perspective of cognition. From the long jump time and space cognition and the procedure teaching research result (Su, 2010) shows that understanding and mastering the concept of action space-time program is beneficial to the learning and mastering of the movement, and also helps to improve the students' emotional will, learning motivation and attention. Observation and analysis from the point of view of teaching adaptation and motor skill formation principle, space-time cognitive teaching method establishes the skill of action by decomposing the teaching unit. It is beneficial for students to understand and master the action technology, which is consistent with the process of analysis and processing in cognitive theory, whether from the perspective of attention and motivation, observation and analysis ability. It can also explain the adaptability of cognitive ability teaching from the perspective of cognitive information processing theory.

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(i) Information Processing Theory

The basic theory of "information processing theory" is to regard human being as a computer-based information processing system, and the cognitive behavior is determined by the information flow inside the brain (Zheng, 2000). In essence, learning is made up of acquisition and use of information. It is an important way to improve the effect of teaching and teaching by analyzing the forming mechanism of information processing and transmitting, mastering and applying its law.

The information must go through the process from input to output through the three stages of stimulus confirmation, response selection and reaction procedure. Again, the task of the action executor is to decide whether to treat the information provided as "stimulus". If so, the selection relationship between the information discrimination, encoding, and matching results and the corresponding action is then passed to a response selection stage. The task is to organize the motor system to perform the desired action. Before performing the action, the system must be prepared for its movements in the lower centers such as the brain stem and the spinal cord, extract and organize one

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of the most important actions Final control of the movement output of the program, guiding the muscle in the correct order and timing of contraction, generating the strength of the matter, so as to effectively do the action.

Based on the memory process of learning and the theory of information processing, Garner proposed a typical model of learning structure to illustrate the general process. He believes that external stimuli act on human receptors. Through the transformation of information into a variety of patterns of neural impulses to convey the perception register-is a preliminary processing of information, that is, the initial perception of the learners of things to play a role in the structure, information through a short stay. Information is processed through selective perception into the structure of short-term memory, which forms short-term memory. By semantic coding, information that is the main feature of perception in short-term memory is transformed into conceptual or intentional although the information stored in this way forms an understandable concept that can be referenced in the environment. According to the information processing theory, we have developed the long jump procedure and the long jump time and space formula. In order to enable students to learn to deepen the understanding of the long jump skills, fully grasp the skills of action.

(j) Theory of Observer Center

Ideal observer theory has been proved to be a hot topic in the field of visual research. Ideal observer theory has been widely used in different fields, including pattern detection, discrimination and estimation, perceptual grouping, shape. Depth and motion perception and visual attention. Ideal observer theory focuses on pattern vision, perceptual grouping, shape and depth, motion, the main goal of basic vision research is to understand and predict visual performance. The empirical results in visual research have been explained and promoted by a large number of qualitative and quantitative theories and models. Development of visual representation model based on visual observer theory plays an important role in answering one or more of the questions listed above. It is subject to given available information and any specified constraints,

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Perform a given task at the best possible level. If the ideal observer can be derived from a given task, it can serve visual research in several important ways.

Confirm the stimulus attributes related to the task. The ideal observer performs its task in the best way. Describes how to use these attributes to perform tasks. Provides a benchmark for performance of actual or model vision systems. The performance of ideal observers is an accurate "information metric," generally, real and model (heuristic) observers cannot effectively use all task-related information and therefore fail to achieve the performance level of ideal observers.

Geisler (2011) have derived an ideal contour occlusion task for the observer, the observer presents two contours (obtained directly from a natural image) and is separated by a circular occlusion. The observer's task is to determine whether the two elements belong to the same or different physical contours (source: ideal decision). The policy rules are directly derived from the paired statistics of natural image.

Motion is the ubiquitous and basic property of retinal stimulation under natural observation. However, there are relatively few attempts to study motion perception from the perspective of ideal observer theory. Part of the reason is that the complexity of the stimulus and the difficulties associated with measuring the statistical data of related natural scenes (Najemnik, & Geisler, 2008). Maruya, Amano and Nishida (2010) take into account the effect of the prior distribution of motion velocities in natural scenes on two-dimensional motion direction estimation. When retinal image information is poor (for example, low contrast), the ideal Bayesian observer will be more dependent the probability distribution of Lai and the corresponding estimation of the prior estimates. Najemnik and Geisler (2008) measured the speed and accuracy of eye movements used in multiple fixed search task, the contrast of target and background noise texture is changes in the location of a small target. The search is always started from the display center; white spots and lines show that look at the order.

The theory of observer center is the evolution of the theory of component recognition, which suggests that we store images from several different angles of view of three-dimensional objects. Instead of a visual image (Geisler, 2011), the theory

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suggests that when an observer sees an object that does not match any of the shapes he stores, the observer must psychologically rotate to the object's appearance. Until it matches an image of a perspective stored in memory. Mental rotation can take an extra 1-2 seconds to observe. The theory of Viewer-centered approach, the theory of component recognition and the theory of feature analysis are all about the recognition ability of objects. However, most of the research methods are to observe images of several different shapes in static state, which seems to reflect the memory of image features of objects. These theories are all related to memory storage. Analyzing observer center theory from behaviorist theory and information perspective, it is found that these theories are all related to memory learning, so observer center theory is also related to our sports technology learning. Especially visual perception and spatial perception memory.

2.3 Literature Review

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2.3.1 Research Progress of Badminton Special Speed Training Method

Badminton has its own characteristics, on the basis of its characteristics combined with the actual situation of athletes in various countries, constitute the technical style of each country. Style refers to the style of a team, that is, genre play. Such as fast as the core, mainly to attack oriented, the offensive method is to quickly seize the favorable batting position, batting to hate, and accurate, flexible is the technical style of China's badminton team. A team's technical style is not bright, does not stand out, and cannot obtain the ideal result. Badminton is a single game or not more than two people in the competition, its antagonism is very strong, once the game began, both sides are in a state of both fighting skills and intelligence. Integral the competition process is carried out in a quick fight for the initiative, which requires the athlete to "under the guidance of" fast ", ruthless, accurate, flexible change" the opponent quickly. Therefore, in order to form their own style or unique advanced playing method according to the characteristics of badminton, we must find out which aspects is mainly reflected in the badminton athletes' special speed. The special speed of badminton athletes is mainly

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divided into four kinds, namely, reaction speed, batting action speed, displacement speed and speed endurance. The rate of response is directed at the nervous system and refers to the speed at which the human body responds to various stimuli; the velocity of displacement is directed at the whole movement of the lower extremities. The speed of action is directed at "explosive force". It refers to the length of time for completing a single action. These four speeds complement each other in badminton, rely on each other, and only react quickly. To be quick, to hit fast, and to have enough speed and stamina to gain the upper hand in each other (Xiao, 2005).

The speed of badminton is divided into three kinds, namely, reaction speed, moving speed and action speed. Reaction speed refers to the speed of human body to various stimuli; moving speed is the shortest time through a certain distance; action speed is the length of time to complete a single action. These three speeds complement each other and rely on each other in badminton (Xiao, 2005). Only when you react quickly can you speed up, so that you can hit the ball quickly. So how to improve and apply these three speeds in the training competition, correct stand preparation posture due to the athletes in this area (single 34.71 ㎡, doubles 40.8 ㎡) model Movement in the perimeter, and most of the game is in the curve movement, in order to use and play the technology, tactics strive to shift short distance, experience a short time to achieve a quick shot. But the standing posture is reasonable, starts quickly, therefore must maintain the knee joint has the certain bend degree (the angle is about 110 degrees-120 degrees). The body gravity acts mainly on the forehand of the foot, with the center of gravity tilting forward slightly, so that the leg muscles are in a certain tense state of preparation, the reaction time can be shortened, and the speed of the action is faster, which reflects the action speed and the nervous system acting on the active muscles (Shrestha, 2017). Synergistic and antagonistic muscle tone regulation. Standing on the wrong knee before starting, it is necessary to bend the knee first to increase the movement distance. It takes time to increase and the movement speed is slow. This is the phenomenon that we often see late starting and slow motion. A good athlete, when the body is in a certain muscle preparation state, can shorten 7.2%, and the speed of repeated intensive training (multi ball training) depends on the speed of the bar (Tang, 2005). The consolidation of the reflection and the repeated intensification can a new stimulus, a new improvement, and the speed training must be in the nerve system in the

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state of excitement, which will have a good effect. Multi ball training is more acceptable to the athletes than the simple speed training. Multi-ball is not only interesting, more stimulating, but also can be combined with special technology, athletes are more focused and easily excited. Moreover, the coaches can master the method, rhythm, time and times of supplying the ball, so that they can strengthen the speed and excavate ability of the players. In the training of reaction speed, some training methods should be used to improve the flexibility of cerebral cortex, such as quick starting, quick stopping and changing direction quickly, and judging the movement, position and hint of the other side. In the long serve, cover the net in the middle, so that the player cannot see the coach's serve, when the ball across the net, suddenly judge the shot. Coaches can also serve from a high position, the ball is fast and the player must be highly focused and quick to judge and move quickly. You can also do command gait training, watch gestures, move quickly and swing, and do selective (same or opposite) games with signals. Multi-ball training for moving speed. It can be used to kill the Internet to grab a high point, a full-court run, a passive big diagonal, a jump on both sides, and so on. The number of groups and the number of times should be reduced. The running time of one group is about 20 ~ 25 seconds off for 10 minutes and 15 seconds, and then the next group will be trained in another item in about 68 groups. For example, 15m round trip, 30m running back and forth run downhill, etc. The movement speed is mainly reflected in the swing speed of the hand and the speed of the lower extremity pedaling. In the multi-ball training, the backcourt continuous kill, the first half draw, the putter, the backcourt passive flat draw and the low center of gravity, also must use the few times more groups number method, hits the wall, the dumbbell swing, The sand dress footwork and so on can also promote the movement speed enhancement. In this study, through the previous literature, it is found that there are several aspects in the development of badminton special speed training methods:

2.3.1.1 Badminton Special Speed Training Method

According to the special characteristics of badminton and the actual needs of badminton competition to carry out special speed training. The training methods commonly used in training are as follows:

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(a) Enhance Absolute Speed and Explosive Force Training

The purpose of badminton athletes' physical fitness training is to serve to enhance their technical and tactical ability. Therefore, physical training must be carried out according to the special characteristics of badminton and the actual needs of badminton competitions. In general physical training, emphasis on speed training. Quality training to increase the proportion of speed training, such as changing the former main training means from 100m × 200m ×4 to 50m × 20, and to further strengthen the absolute speed and explosion with the method of fewer times and more group force exercise; the past 1000-2500 meters of endurance run to change speed run, to develop the speed (Xiao, 2005).

(b) Multi-ball Training

Speed depends on the degree of consolidation of conditioned reflex. Only by strengthening repeatedly can there be new stimuli, new improvements, and speed training must be in the excited state of the nervous system in order to have a good effect. Multi-ball training is more receptive to improving badminton speed than pure speed training. Multi-ball is not only interesting, more stimulating, but also can be combined with special technology, athletes are more focused and easily excited (Xiao, 2005). Generally speaking, the more the number of multi-ball training in each group, the more the number of people rotated, the less related to the game, which is the majority of the short round of badminton (about 10 s). The time structure of the round is more than 70%. Thus, it can be seen that in badminton special physical training, the combination of multi-ball training should be in the form of fewer balls, more groups and fewer person-times, so that the coaches can master the method, rhythm and time of supplying the ball. The number of times, can enhance the speed of athletes and tap potential.

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(c) Methods for Training Reaction Speed

In the training of reaction speed, some training methods should be used to improve the flexibility of cerebral cortex, such as quick starting, quick stopping and changing direction quickly, and judging the movement, position and hint of the other side. In the long serve, cover the net in the middle, so that the player cannot see the coach's serve, when the ball across the net, suddenly judge the shot. Coaches can also stand from a high down serve, this ball is fast, and the player must be highly concentrated and rapid judgment, fast movement (Xiao, 2005).

(d) Multi-ball Training Method for Moving Speed

You can kill the Internet to grab a high point, a full-court run, passive big diagonal, jump on both sides, and so on, to more groups, fewer times, a group of running time of about 2025 "10 15", and then proceed to the next group. The number of balls can generally be controlled in the range of 10 or 30, and the rotation times can be changed to about 6 or 8 groups with 2 people, such as 15m round trip, 30 m forward and backward running, downhill run, etc. There was no significant difference between the two groups before the experiment. According to this method, after two months of training, the average difference between the experimental group and the control group before and after the experiment was 0.009. Two months later, the difference of field velocity between the experimental group and the control group was 0.2917, there was obvious difference, and the moving velocity was increased obviously (Ma, 2016).

(e) Action Speed is Mainly Reflected in the Swing Speed

In the multi-ball training, backcourt continuous kill, the first half draw, the putter, the backcourt passive flat draw and the low center of gravity, also must use the few times more groups number method, hits wall, the dumbbell swing, The sand dress footwork and so on can also promote movement speed enhancement (Xiao, 2005).

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(f) Speed Endurance Training

Because badminton competition is characterized by alternating aerobic and anaerobic, the development of consumption and recovery is not balanced, and most of the recovery is incomplete because of the transition between short period of high intensity movement and short interval. In particular, the fierce attack and pull in a certain paragraph of the competition require athletes to have a certain ability to resist lactic acid, so as to ensure that the athletes can maintain a long period of rapid movement under the condition of insufficient oxygen supply. Based on this, it is necessary to improve the speed while carrying out speed endurance training. You can use two types of intensive training, with two balls to reduce interval time, increased batting practice time, (including attack, defense, attack) Fixed time, constant intensity, heart rate of more than 30 / 10 seconds after each exercise (Grice, 2008).

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(g) Reasonable Use of Speed in Competitions

In fierce confrontations, it is possible to master initiative only by striving for speed and only by talking about "hard, accurate and alive" (Xiao, 2005). It is difficult to be accurate and changeable if you are controlled by your opponent and in a passive position. In fast attack, we should not only pursue running speed alone, but also be good at making use of the performance of badminton and its movement rules, judge the change of fighter planes at the moment of attack and defense, make a pre-emptive attack, and achieve a quick and fierce attack by surprise attack. Add to that the clever change of position, light and heavy, and a sudden slow motion, sometimes with a false movement that disturbs the tempo of the opponent and makes it impossible to guard against; In order to consume the other side's physical fitness or adjust for itself, the drag-and-hoist attack is used to increase the opponent's displacement and speed relatively slowly, so as to achieve the advantage of self-initiative.

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2.3.2 Research Progress of Time Perception Theory

In this study, the literature review mainly introduces the influence factors of time perception and the research progress of time perception in the field of sports. Next, the research progress of these two aspects will be described in detail.

2.3.2.1 Influence Factor of Time Perception

(i) Time Factor

The research indicates that people is more liable to underestimate long time interval and overestimate short time interval. Bueti and Walsh (2009) adopted time interval duplication method to require testee to test 4 types of time intervals, namely, 300ms, 600ms, 900ms and 1,200ms; the result figured out that testee overestimated time interval of 300ms, and underestimated time interval of 1200ms. In the research on time perception of population with different ages on long and short time conducted that estimation over short time interval is liable to be greater, and that on long time interval is less.

With presentation of the same physical time, there is different in sense of time under blank time interval and real time interval. Blank time interval refers to stimulation type that only covers starting stimulation and closing stimulation, and the middle part is blank. Real time interval refers to stimulation property always exists in time interval from start to end of such time interval (Sun, 1998). For example, in terms of sound stimulation, blank time interval presents prompt tone twice at the start and end respectively, while real time interval is always filled with such prompt tone from start to the end. The research results of indicated that: In judgment of physical time interval with the same length, real time interval is liable to be overestimated. Space-time interval is liable to be underestimated, but after a period of time, the testee made recall and judgment again, then an contrary result is obtained. However, time perception of blank and real time interval in test, with no significant difference.

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(ii) Non-time Factor

(a) Stimulation Status

Great deal of researches find that when no variation is made to stimulation time interval, dynamic stimulation will cause the testee to perceive longer duration. Frasnelli, Wohlgemuth and Hummel (2006) applied duplication method to duplicate presentation time of dynamic and static black graph; black graph presented time interval types of 200ms, 400ms, 600ms, 800ms and 1000ms, and wherein, static black graph is in midpoint of computer screen and dynamic black graph in left bottom corner to start move right along horizontal direction with speed of 2, 4, 8, 16, 24, 32deg/s. Research result concluded that the faster black graph moved, the longer subject perceived, and in other words, dynamic stimulation is more likely to cause the testee to have time dilation effect than static stimulation.

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(b) Influence of Stimulation Dimensions on Time Perception

Stimulation dimensions refer to features of such stimulation, such as size, color, shape, brightness, saturation, of visual stimulation, loudness, pitch and timbre of auditory stimulation. Stimulation dimensions are an important factor affecting time perception. Cholewiak (1999) controlled magnitude of stimulation dimension through altering dot quantity of visual stimulant, size of square, brightness of picture and value, and the result delivered that with unchanged time interval length, the bigger stimulation dimensions, more prone to overestimate time interval by the testee.

Wu (2012) applied duplication method to research influence of different kinds of sounds on time perception, and altered sound property via controlling and altering sound frequency and rhythm, with findings showing that: “High-frequency” sound specialty is more liable to be overestimated by the testee, however, in terms of rhythm, rapid rhythm is more liable to be overestimated.

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Numeric character also has certain influence on time perception. Treisman, Faulkner, Naish & Brogan (1990) took dichotomous method to cause testee to judge length of time interval; time presented by less number is more liable to be underestimated, and that presented by greater number is more liable to be overestimated. chose 3 numbers from 1 to 9 to be presented at three different places, namely left, middle and right on computer screen; number at one location is randomly selected as reference stimulation presented time of 300ms, and the testee's task is to compare length of presentation time of stimulation and reference stimulation. The result showed that different spatial location had significance on time perception; time presented on left is more liable to be underestimated, and that presented on right is more liable to be overestimated. Less number is more liable to be underestimated, and greater number is more liable to be overestimated. Lu et al. applied time duplication method to understand influence of numeric character on time perception in different context of terms. In such test design, numeric and weight unit (Kg) are combined, with presentation time during 0-5s, and the testee controlled duplication time via clicking mouse. The findings are that: When number is combined with "Kg", greater number presentation time would be overestimated, and less number presentation time would be underestimated, but such effect failed to occur in the model of combination of number and "g", which explained that simulation property's influence on time perception is certain related with cognition level of individual. Furthermore, presentation methods of different stimulation types also affect time perception in certain degree. The research on effect of visual and auditory channel indicated that: Testee had a longer duration of perception under auditory form than that in visual form, and the accuracy and stability of time interval perceived under auditory form are better than that in visual form.

(c) Attention

When we are totally devoted in doing something, we feel that time passes quickly, and it is because that we pay more attentions to the thing being done and little attention to time information. In current researches, more researchers employ dual-task test paradigm to explore influence of attention on time perception. Attention gate model raised by Zakay and Block (1997) can well account for how attention affects time

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perception. Difficulty of non-time task will influence time perception and judgment on time task, and when we place more attentions on non-time task, the attention placed on time will be decreased accordingly. Huang et al. adopted dual-task paradigm in the paper of "Memory load effect of time interval processing" to research time perception of university students under memory load of 1-6s, and the result showed that average time duplication length of 4s, 5s, 6s shortened as memory load increased. Huang et al. (2012) adopted dual-task test paradigm of working memory and time judgment to explore interference effect of speech working memory retaining time perception, and the result indicated that the more memory load, the shorter duration in perception. Difficulty of non-time task will also influence time perception: The more difficulty of non-time task, the shorter duration in perception of testee.

(d) Awakening Level

Zhang et al. (2012) took emotive picture as time stimulation material in research, and the result showed that: Compared with neutral stimulation material, testee had longer perception duration under emotive stimulation material, and the reason may be allotment degree of attention resource in time task and non-time task by testee under different emotive levels. However, more researches took the position that such difference is resulted from different awakening levels, and emotive awakening as an external source stimulation could cause pacemaker to increase frequency in release of pulse, so that the accumulated pulse in the same duration is more than that under static status and longer duration is perceived. Tipples (2008) made test on time perception of children at the age of 3, 5 and 8 years under emotive stimulation, and the result showed that duration of time perception of children of three age groups under anger expression stimulation is longer than that under neutral picture. Isaji & Tsuru (2007) adopted the same auditory channel to research relation between awakening degree and time perception. With emotive sound as stimulation material, the research applied time interval duplication method and oral estimation method to investigate influence of enjoyment degree and awakening degree on time perception within 2-6s, and the result showed that within 4s, there is a longer duration of negative sound perceived by testee and, a shorter duration of sound with high awakening degree perceived. Isaji et al. (2007)

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adopted two methods and time generalization method and took emotive picture as materials, which are divided into 4 classifications, namely, positive high awakening, negative high awakening, positive low awakening, and negative low awakening. Awakening degree and positive and negative degree of picture are under control to explore key factor that influences time perception in these two factors. The research results proved that: Perception duration of testee under high awakening emotion is significantly longer than that under low awakening emotion. It indicated that emotion mainly affected time perception via awakening mechanism.

(e) Working Memory Capacity

Working memory capacity (Zhao & Zhou, 2010) refers to amount of information individual keeps while processing information, and it can reflect storage capacity of working memory, and the capacity of processing efficiency and controlling attention comprehensively. Size of WMC influences time perception via influencing attention control of task; in dual-task test paradigm of single task or with low cognition load, individual with high WMC places more attentions to elapse monitoring on time via suppressing interference of irrelevant information, which leads to a more accurate time estimation. Zhao et al. tested WMC of testee in research firstly and divided them into high WMC group and low WNC group, and caused testee to make time estimation in the meanwhile of mathematical operation through dual-task paradigm, with computer task as the main task. Results showed that: High WMC group had a more rapid and accurate mathematical operation than that of low WMC group; computer performance of low WMC group decreased gradually and had a longer time for estimation, which may be resulted from that high WMC group had more psychological resources and allotted attention resource more reasonably, and suppressed irrelevant stimulation, so that task could be completed better, while low WMC group failed to allot more psychological resources to main task, and performed poorly in suppressing attention on secondary task, which resulted in a long time for estimation.

Zhao et al. adopted comparison method and discussed time perception when stimulation picture and picture in working memory matched via controlling and altering

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color and shape of stimulation picture, and two sections of picture stimulation duration are 600ms and 700ms successively, and research results showed that: when stimulation picture and working memory matched, testee perceived longer duration, which further stated that working memory's time perception took certain duration.

2.3.2.2 Research Paradigm of Time Perception

There are expecting type and backtracking type for research paradigm of time perception in previous literature. Expecting type refers to that before start of test, testee is informed of time task expressly and time information to be noticed, and judgment and response are made to it after completion of stimulation time interval presentation; While backtracking type is contrary, before start of test, testee is not told with specific test task; a series of stimulation are presented to the testee, and upon completion of stimulation presentation, testee recalls and judges time stimulation just presented. Psychologists have performed plenty of tests based on these two test paradigms, and research results show that the same test delivers different final result with different research paradigm. Block and Zakay et al. (1997) found in research that: For the same interval judgment, expecting type judgment's time length in perception is significantly longer than that of backtracking type; Backtracking type judgment is significantly greater than expecting type judgment in terms of result variation. In addition, they also discovered some unique time interval judgment regulation variables: Task difficulty will affect expecting type time interval judgment result other than backtracking type judgment: Moreover, length of stimulation interval and complexity degree of stimulation only affect result of backtracking type judgment. Prior to 1950s, classic research methods of time perception mainly included oral report method, time interval creation method, time interval duplication method and time interval comparison method. Oral report refers to testee reports length of perceiving stimulation time interval in the form of oral report, with second or millisecond as reflecting unit in general. Time interval duplication method is widely used, and its principle is that testee perceives the length of time interval in many ways, and then duplicates a section of time interval again by virtue of its perception just now, which is required to be uniform with standard stimulation of perception as far as possible. Time interval creation

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method refers to that testee is told with presentation time of 2.5s to be controlled before test; once testee notices occurrence of stimulation, start timekeeping, and when time of testee perceiving stimulation presentation reaches 2.5s, make instant response. The drawback of time interval creation method is that during the process of time estimation, test is liable to be made with the help of counting and metronome by the testee. Time interval comparison method refers to that two or more time intervals are presented successively. Tested judges' length of time interval with its own perception, and the advantage of comparison method is the availability of comparison of interval in the range of millisecond. After 1980s, with development and progress of scientific research, some new research methods and technologies have been born at the right time. Scientists begin to study time perception with multiple-task paradigm, including time / non-time task, time / time task. The benefits of such research method lie in exploring cognition course of time perception and resource processing course via altering allotment of attention resource in time task. A typical time, time task presents as multiple time stimulation are presented to testee at the same time, then testee makes judgment on one of them after completion of presentation, and such method explores interference effect of Contesting with the same processing resource under multiple time tasks, wherein, attention gate model theory is created based on result of such dual-task test paradigm.

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2.3.2.3 Present Situation of Teaching Research on Time Perception

On the time research of space-time perception, the author mainly selects some typical research results through the search and literature review. For example, Li and Fu (2006) studied the space-time characteristics of diving through analyzing the various stages of diving, including: Diving is the performance in limited time and space. Diving is a physical exercise realized through jumping, tumbling, rotating and other actions in water, with good control of the body posture. This action must dive to a short time before the athlete jumps to the surface of the water. Diving is the time required to master the space. Athletes must complete a set of actions on the platform in required height and master the speed, pace, timing, rhythm and order of each action. Time and space are integrated in diving; Time and space are the existence forms of moving matter.

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Existence space of the matter is extensible, and movement time of matter is continuous. Time and space are indivisible, so that diving is carried out in the integration of time and space perception.

With more and more researches on the time perception, there are more and more researches on the differences of time perception among different levels of athletes. Many sports events are closely related to time perception. In competitive sports, each project has its own characteristics, for example, for running, swimming and other cyclical sports, the time rhythm is relatively stable. The rhythm of volleyball, basketball, football and other projects is more jumping; in many cases, it needs accelerated speed. Therefore, different projects need to develop and show different time rhythms, which requires athletes have a good time perception, keep unique sensitivity to the time rhythm and effective control on their own action rhythm; The cooperation between athletes is necessary in some cooperative group sports, which requires the athletes to have good space perception to the spatial relationship among themselves and their fellow teammates as well as the opponents, so as to make the right judgments and accurate and rapid behavior decision-making. The precondition of these requirements is that athletes must have good space perception ability. During the exercise, it not only involves a variety of relatively static spatial moving relationship (such as football shooting and shooting at the basket), but also involves to the spatial relationship of various actions (such as badminton serve and receive). Therefore, the time perception, space perception and motion perception have important influence on athlete's athletic ability. At present, it has been verified that high-level athletes have better time perception in many sports events.

Mori, Ohtani, and Imanaka (2002) used two types of experiments to study the reaction time of karate athletes and expectations. In the first type of experiment, two stimuli are used to measure the reaction time of the participants. The sports scene of athletes in actual situation is simulated. The other is static solid circle or point. When choosing time prediction task the results show that there are significant differences between karate athletes and novice in choosing reaction time task. The difference between video stimuli is more pronounced than that of point stimuli. In the second experiment, the The correct rate of response to video stimulation is greater than that of

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the novice. The results of the two experiments demonstrated the karate players' ability to predict the target area of the opponent's attack and their advantages in non-specific sensory function.

Williams, Ward, Smeeton, and Allen (2004) By teaching novice tennis players in prediction techniques, the participants' ability to predict serve is measured before and after using in-court measurements of existing video analysis. The study found groups receiving perceptual behavior and perceptual stimulation. In the past, the post-test significantly improved their expected performance. The ability to predict the opponent's serve could be improved by teaching on the field. It highlights the relationship between key body cues and subsequent performance.

Abernethy, Schorer, Jackson, and Hagemann (2012) using handball goalkeepers' task to compare effects of different perceptual teaching methods that require quick prediction of shooting direction. Novice participants are equally assigned to four different teaching groups and two different teaching groups. Control group. The direction of the location of the key expected clues provided by the teaching team, Use oral cues or color cues; match judgment tasks separately to encourage implicit learning. Compare the performance of the group before teaching, after intervention, and in the expected test. The learning, oral and implicit learning conditions provided the greatest continuous improvement in performance, while the group providing color cues performed worse than the control group. Only the implicit learning group performed better than the control group under stress. The Color Tip and implicit Learning Group developed explicit rules related to key shoulder joints, Although reporting based on general cues and rules of all clues does not differ from group to group, it is expected to be improved through a variety of different perceptual teaching methods. The relative effectiveness of different methods depends on the time and conditions for assessing learning.

Hagemanns, Strauss, and Caal-Bruland (2006) combined the temporal and spatial occlusion paradigm with a study of expert attention in motor performance. To determine which key stimuli badminton players use to predict the direction of overhead projection. The main study then evaluated a program to train prospective skills; 200

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video clips are used to direct attention to these key stimuli. Canada has 63 new badminton players 20 national league players and 21 local league players. Use transparent red patch (exogenous orientation) in the ball Draw attention to the trunk 160 milliseconds before the racket contact; arm and racket from 160 milliseconds to 80 milliseconds before contact; from 80 milliseconds to actual contact. Results show that compared with the control group, novice trained in this program have significantly improved post-prediction skills and retention test skills. Although local league players have improved in the past and back, the teaching has no impact on specialist national league players. The use of red transparent patch to highlight the most informative clues in the perceptual teaching plan is an effective way to improve predictive skills.

It is very important that the ability of prediction and make decisions in the during of proficiency performance of athletics skills (Roca, McRobert & Williams，2013). The study looked at the interaction between skilled and less skilled players and defenders. The experiment interacted with live-action movie clips from 11 matches and 11 football occasions. Study the interaction between the different cognitive skills behind prediction and decision making. In two experiments, participants' eye movements are recorded in which the ball is positioned at a distance (offensive or defensive half quests: far and near conditions). And oral reports. Skilled Players report more accurate predictions and decisions than less skilled players, and their superior performance is due to task-specific search behavior and thought processes. Cognitive skills that support excellence expectations and decisions differ in importance. The results are significant for those inter and improving cognitive skills in sports and other fields.

Zhang (2012) took 18 basketball specialized students, 17 volleyball specialized students, 15 specialized students, 18 track and field specialized students in the Physical Education Department as the experimental testees. By measuring the time perception of these testees, and then retesting the time perception of these testees after a month of teaching. Then, comparing and analyzing the time perception data of these testees before and after teaching, the results showed that the time perception accuracy after teaching is better than that before the experiment.

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2.4 Summary

Theoretical background of this study have already analyzed the previous research literature of badminton speed training method, theoretical model of time perception, basic theory of perception and practice progress of badminton special speed training method and present situation of teaching research on time perception. The results were been found that badminton special speed quality training method was not still more used to badminton teaching in Chinese university. Badminton training level is still very backward in Chinese colleges and universities. So, university badminton training and teaching need to develop sports special quality, especially, need to more develop and improve badminton special speed training level. That is, it is important that improve and develop the hitting success rate and the time predictive skills of drop point of badminton players. Next section, the researcher were illustrated research methodology in chapter 2.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, the research process of quantitative research method is discussed. Starting from research method, selecting research subjects, research instrumentation, training intervention, pilot testing, the actual procedures of research implementation and the method of data analysis. The research method is based on the research purpose, and the research method used for the purpose of research is carried out. In this study, the number of subjects selected and how it is divide to the experimental group and the control group, based on the sampling process of each group of elite badminton players is discussed in this chapter. The training methods is adopted by the experimental group and the control group. This chapter also discussed on training implement plan, selected test instruments, instruments validity and reliability. Furthermore this chapter also explained on data collection technique and data analysis methods based on research questions proposed in this study.

3.2 Research Design

Research design is a road-map or strategy for the development of research operations，a good research design can guide the experimental research in an orderly manner, to realize the purpose of the research, to help readers to understand more clearly how the

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data are obtained, and to help them to analyze the research results correctly (Aron, Aron & Groups, 2014). The research purpose is to investigate whether there is a significant difference in the effects of badminton special speed training compare to traditional speed training method on success scores and time perception predictive skill performance of badminton players from pre-test to posttests. On the other hand, the research purpose is to investigate the retentive effects of badminton special speed training on athletes' success scores and time perception predictive skill performance from posttest 1 to posttest 2. In this study, the experimental research design is $2 \times 2 \times 3$ multifactor model. That is to say, these factors are two training methods, two groups (the experimental group and controlling group of same skill level and three test points (pretest, posttest 1 and delay posttest 2).

3.2.1 Research Operational Process Design

The first operating procedure of this study is to select the experimental subjects around the content of the experimental research, and divided into two equal groups (elite group 1 and elite group 2) on experimental subjects. At the same time, to test and analyze on the basic physical education quality of the experimental subjects, if the results of there is no significant difference in the basic physical education quality of the subjects before the experiment intervention, it can become as the condition of experiment control.

Secondly, the new built badminton special speed training method (BSSTM) is confirmed from these resources which based on badminton special speed training outline (Xiao, 2005) and experts' recommend contents. On the other hand, the badminton traditional speed training method (BTSTM) on the intervention of the controlling group (group 1) based on the resource of the traditional speed training method of Chinese badminton outline (Xiao, 2005).

The third step is to select the research measurement instruments. In this study, the experimental measurement instruments includes test instrument of badminton success score, and test instrument of time perception predictive skills performance of elite badminton players. Validity of instrument is confirmed by experts questionnaire

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analysis, reliability of instrument is confirmed by test-retest method in during of pretesting experiment.

The fourth step is the experimental data collection and data collected procedure. First of all, the collected method of the experimental data include test method of the basic quality of physical education,, test methods of success score and time perception predictive skills performance at three test time points. Next, the data collection includes the basic quality of physical education, the data collection of success score and time perception predictive skills performance. Next, data collected procedure how to conduct. The data collected procedure of the basic quality of physical education was adopted test scale in Appendix D, The data collected procedure of success score and time perception predictive skills performance of badminton players at three test points in part B and part C of Appendix A.

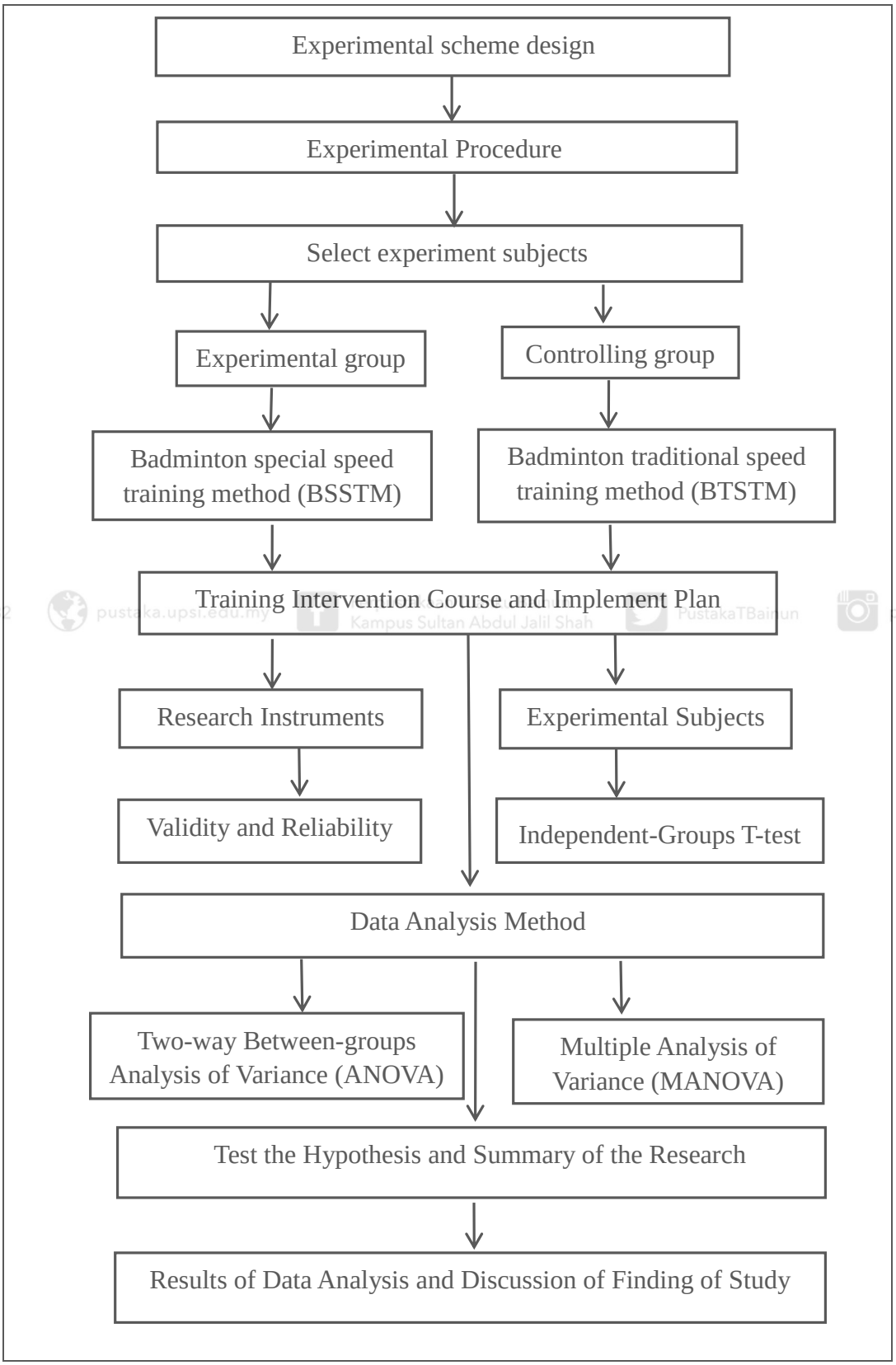
The fifth step is data analysis method and data analysis procedure. First of all, the data analysis method include contents validity analysis method of test instrument, retest reliability analysis method of test instrument, the basic physical education quality of the experimental subjects was employed the independent-groups t-test, the success scores of elite badminton players was employed two-way between-groups analysis of variance (ANOVA), multiple analysis of variance (MANOVA) was employed on the data analysis of time perception predictive skills performance of elite badminton players. Next, the data analysis how to come from which procedure. The analysis data of contents validity on success score and time perception predictive skills performance came from the test data of expert questionnaire, contents validity of success score test method and test method of time perception predictive skills performance was adopted the Consistency of Cronbach'a coefficient analysis method. On the other hand, the reliability analysis of data collection method of success score and time perception predictive skills performance is adopted the test-retest reliability analysis method. The analysis data of test-retest reliability on success score and time perception predictive skills performance came from the test data of pretesting experiment. Above this research operating procedures to expend on contents, the road-map of the research operating procedures is shown in the following Figure 3.1.

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Figure 3.1

Research Operating Procedures Design



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3.2.2 Experimental Procedure

This study was divided into two aspects research from the content of dependent variable. The experiment study 1 is the effect of badminton special speed training on successful score of badminton players, the experiment study 2 is the effect of Badminton special speed training on the temporal perception predictive ability of badminton players. In order to the implement of the experimental procedure, the experimental research design and research variables is shown in Figure 3.2. After the experimental content and research variables have been confirmed. The researcher selected the experimental subjects from the physical education boys in Chinese university. This experiment was selected 30 elite badminton boys, the experimental subjects was stratified random sampling procedure from Xi'an institute of physical education. The sampling experimental subjects was divided two equal groups (the experimental group 1 are15 elite boys, controlling group 2 are 15 elite boys). The experiment group adopted the new built badminton special speed training method (BSSTM). The controlling group used badminton traditional speed training method (BTSTM) (Xiao, 2005). At the same time, the researcher have tested the basic physical quality of experiment subjects before the experiment implement training intervention beginning, the basic physical quality of the experimental subjects cannot have significant difference which was used as the control condition of the experiment. The second step of experimental procedure was expanded on how to select the new built method of badminton special speed training and traditional speed training method from review resource (Xiao, 2005). Diagram explaining of the implementation process of badminton special speed training method, training intervention course plan, implement progress and training requirement. The third step of the experiment was described how to select the test methods for the two experimental dependent variables by expert questionnaires: (i) the check index and method of the special speed training on the effect of success score of elite badminton athletes. (ii) The check index and method of badminton special speed training on the effect of the time perception predictive skills performance of elite badminton athletes. The fourth step of experimental procedure was stated the training course implement plan. The fifth step was employed data collection method and data analysis method of dependent variables.

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3.2.3 Experimental Technical Framework and Research Variables

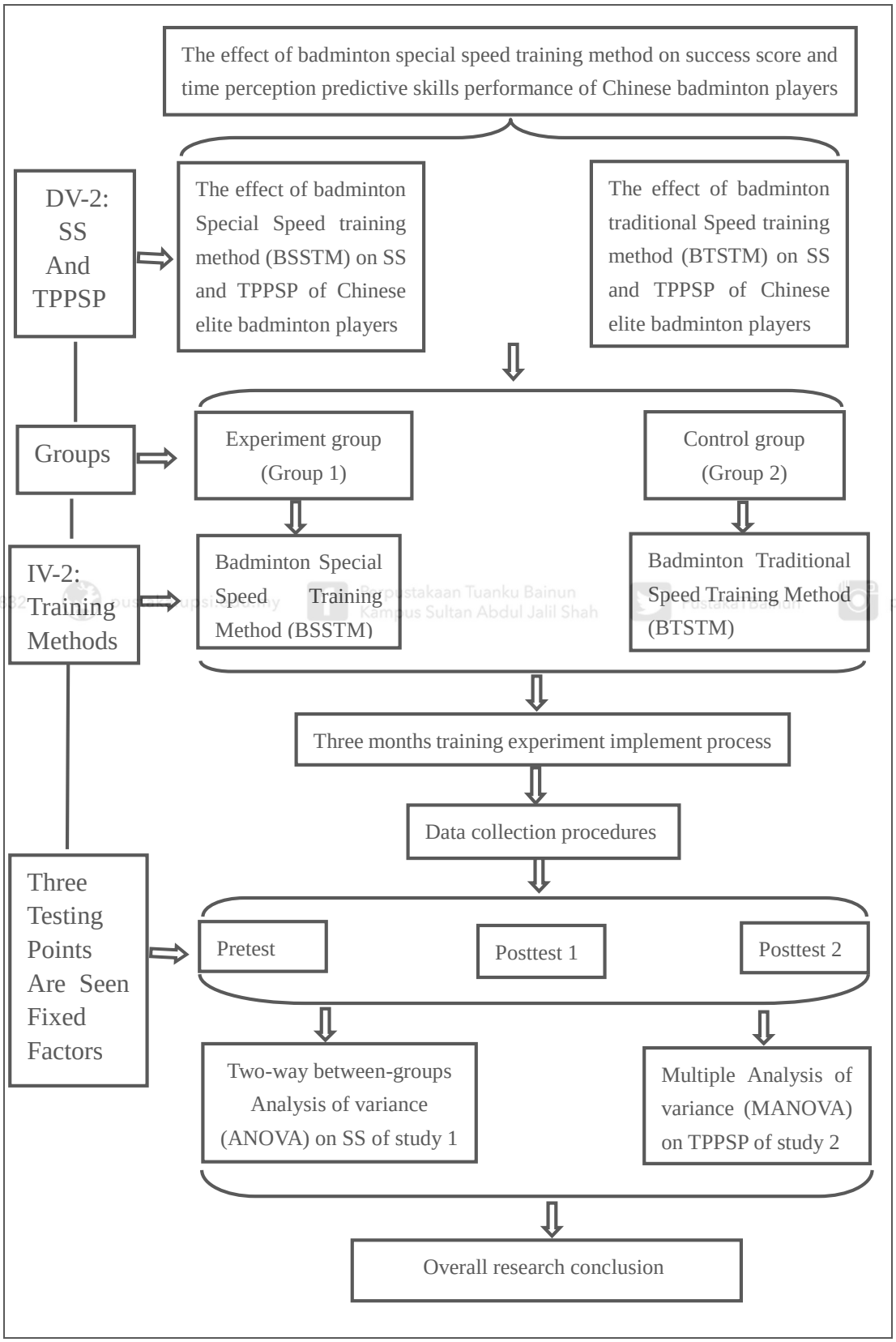
As reflected in Figure 3.2. This experiment adopts multi-factor mixed experimental design model, multi-factors are 2 training intervention method, 2 groups and 3 three test time point. Firstly, among them in factors design model, the training method is inter-group variable, test points and players sport levels is intra-group variable. Dependent variables (DV) are the success scores (SS) and time perception prediction skills performance (TPPSP), independent variable are badminton special speed training methods (BSSTM) and badminton traditional speed training method (BTSTM). Two groups (group 1 and group2) and three test points is to see as a fixed factor. On the other hand, in order to investigate whether there is significant difference in the training effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on success score and time perception predictive skills performance of Chinese elite badminton athletes at three test points. Therefore, after random sampling, the subjects were divided into two groups: the experimental group (group 1) and controlling group (group 2). Next, dependent variables was carried out before experiment intervention beginning. The length of the experiment intervention was designed for three months. The intervention method was two kinds of training methods (BSSTM and BTSTM). In the course of the two training methods, the elite badminton athletes in the experimental group and the control group were stimulated with high intensity and medium intensity. After three months of intervention training, the posttest 1 was carried out in the 13th week, and the posttest 2 was carried out in the 15th week. In the process of collection data, the testing tools and methods of the three test time points are the full same as the test contents for success scores, and time perception predictive skills performance. When the collection data of the three test points was finished, the study 1 was employed two-way between-groups analysis of variance (ANOVA) on success scores of elite badminton players. Result of data analysis answered research 1 and research 2 and tested research hypotheses 1 and 2. At the same time, the study 2 was employed multiple analysis of variance (MANOVA) on time perception predictive skills performance of elite badminton players. Result of data analysis answered research 2 and research 3 and tested research hypotheses 3 and 4. Overall research conclusion. Next, Figure 3.2 shown the experimental design and research variables.

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Figure 3.2

Experimental Design and Research Variables



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3.3 Population Sample Size and Location

In this study, population sampling is college students, this kind of sampling method is target sampling. Target population refer to group of persons (students, teacher or other individuals) who have particular qualities (Fraenkel & Wallen, 2000). Statistics from the Shaanxi Provincial Education Development Bulletin in 2017 show that there are 93 colleges and universities in the province, including 55 undergraduate colleges and 38 higher vocational colleges, with 1,069,374 students registered in public universities and higher vocational colleges in 2018. There are 14 of the 55 undergraduate universities which include students majoring in physical education. Therefore, the sampling population in this study is all physical education major student in public schools in Shaanxi Province, China. The total number of student was physical education major students as in 2018 when data were collected from ministry of education was 14,200. Next section stated the sampling procedure.

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3.3.1 Sampling Procedure

First step of this experimental procedure is to start to select experimental subject. This section mainly state the researcher how to select experimental subjects. First of all, the researcher will start to selection training experimental subjects after confirmed the experimental content. This experiment selects Chinese elite level badminton athletes as the experimental object, same level is the badminton elite athlete.

In order to facilitate the development of the research experiment, this study will select Xi'an Institute of physical Education from 14 ordinary colleges and universities in Shaanxi Province. This experimental research subjects will randomly selected from Xi'an Institute of physical Education. There are 8148 physical education undergraduate students in Xi'an Institute of physical Education in 2018, which 5000 are boys of physical education major, 1080 of whom are first semester boys of major of physical education in 2018. 1080 students of class 2018 of physical education major were selected as the total random sample in the experiment. Among 360 elite badminton boys, the experiment adopted a systematic sampling method. The sampling steps are: First

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step sampling 360 elite badminton players from 1080 of whom are first semester boys of major of physical education in 2018. The second step is to determine the interval K and segment the number. Because k = 360 / 30 = 12, the interval is located at 12; the first individual number is determined by simple random sampling method in the third step from the first interval with numbers 1 to 30, and the first random number determined in this experiment is 2; The fourth step is starting from number 2, every 12 numbers to take one, to get 2，14，26，38... . 350 (equal difference sequence with tolerance of 12), that is to say, $a_n = a_0 + (n-1) \times 12$. This results in an experimental sample of a sample size of 30, and the experimental subjects of a sample of 30 elites badminton elites. The mobilization was divided into the experimental group of 15 elite's badminton players, and the controlling group of 15 elite's badminton players. Experimental subjects was stratified random sampling procedure, and the process of displaying the sample data is shown in Table 3.1.

Table 3.1

Experimental Subjects Was Stratified Random Sampling Procedure

Sampled Location and Department	**Population Sample**
93 universities in 2018 in Shaanxi Provincial，China	1,069,374 students registered
14 universities contains students physical education	26000 P.E. major students
Xi'an Institute of Physical Education was used as an experimental sample	There are 8148 P.E. major students in 2018
The physical education new students in 2018 (first semester)	1080 Physical Education major students
Sampled 360 elite badminton players in 2018	Sampled 360 boys of elite badminton players
Stratified random sampling 30 elites boys from 360 elites badminton players	
The interval K and segment the number, K= 360/30 = 12, $a_n = a_0 + (n-1) \times 12$. If selected the first badminton player is 4 of the number, and then the second badminton player is $a_2 = a_0 + (n-1) \times 12 = 4 + (2 - 1) \times 12 = 16$, that is second badminton player is 16 of the number, and so on	
30 elite badminton players were divided into group 1 and the controlling group 2	

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3.3.2 Test of the Basic Physical Education Quality of the Experimental Subjects

After the sampling was completed, the selected subjects were tested by the basic physical education quality of the experimental subjects. The purpose of the basic physical education quality test is to control the experimental conditions. The basic physical education quality of the same level of the experimental subjects were required to carry out this study experiment. Therefore, there is no significant difference in the test result of the basic physical education qualities of elite badminton players before the experimental implement beginning, this test result is regarded as this condition of the control of experimental subjects. That is to say, this is for the sake of protection on the experimental subjects of the same level who produced the same training effect through the same training stimulation. Such this to ensure the validity and reliability of the study. In particular, researcher should emphasize the choice in the research of sports technology projects. The experimental subjects at the same level are required to have the basic physical education quality, the same sports to ensure the equal level of athletes of the experimental group and the control group. Before experimental intervention beginning, the experimental subjects have the same physical quality. In order to ensure the smooth progress of the experiment study, the content of the test include the basic population information and the basic physical education quality of the experimental subjects. The details contents of the test on the basic physical education quality include age (year), height (cm), weight (km), standing long jump (m), 60 meter run (seconds) and the backward put the shot (m). Data analysis method of t-test was employed on test indexes of the experimental selection, the results need to conform the controlling condition of the experiment, so, there should not a significant difference in the results of t-test test. Details of the tests are shown in Appendix D.

3.4 Training Intervention Method

As for this study, there are two the training intervention methods (or training program), one of them is badminton special speed training method, and the other is badminton traditional speed training method. The experimental group (group 1) was undertaken badminton special speed training method (BSSTM) training intervention; The control

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group (elite group 2) was undertaken badminton traditional speed training method (BTSTM) training intervention. Training duration is 90 minutes per day; Total days training per week is three days; Total length of training is 12 weeks. Training load progression (high, medium and low) is three weeks; Adopted three-levels training intensity scale (Low intensity, medium intensity, high intensity). Adopted three-levels training intensity. Repetitive Sequences in one week from high (95%~86% of HR max), medium (85%~76% of HR max) to low (75%~50% of HR max). Training Load: 2 minutes to 30 seconds, 4-5 times of per group exercise, all exercise 4-5 groups in per training course, rest time 1-2 minutes at in the middle of per exercise. The training intervention structure of badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) are illustrated in Table 3.2.

Table 3.2

Illustrate on Structure Contents of the Training Intervention Method of Badminton Special Speed Training Method (BSSTM) and Badminton Traditional Speed Training Method (BTSTM)

Particular Groups	**Method of Training Intervention**
The Experimental group (Elite group 1)	BSSTM
The Controlling group (Elite group 2)	BTSTM
Training duration of per training class	90 minutes
Total days of training in per week	Three days
Total length of training	12 weeks (3 months)
Training load progression (from high, medium to low).	Three weeks (first course is high load in per week, second course is medium load and third course is low load)
Adopted three-levels training intensity: From low to High-intensity interval training (HIT)； Training Load and intermittent time.	Repetitive Sequences in one week from high (95%~86% of HR max), medium (85%~76% of HR max) to low (75%~50% of HR max). Training Load: 2 minutes to 30 seconds, 4-5 times, 4-5 groups, rest time 1-2 minutes.

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3.4.1 BSSTM Training Intervention

In this study, content of BSSTM training intervention was stated 5 parts, the details are from section (A) to section (E).

(A) BSSTM Come from Badminton Training and Practice Theory
(B) Division of Exercise Load of BSSTM Training Intervention
(C) Block Schedule of BSSTM Training Intervention Course
(D) The Conceptual Framework of BSSTM Training Intervention
(E) The Coaching Practices method of BSSTM Training Intervention

(A) BSSTM Training Intervention Came from Badminton Training and Practice Theory

Second step of this experimental procedure is to select training method. In this study, the experimental group adopt the new built badminton special speed training method (BSSTM), badminton special speed training method was be built in this study, it should be followed the principles of six aspects: (a) The selection of badminton special speed training methods must be based on the characteristics of badminton skills and tactics style, and the training methods selected in the experiment process should be identical with the characteristics of sports skills and tactics. (b) The training method should be practical and operable. The selection of training methods must be based on the actual conditions of the experimental objects and training conditions. (c) The content of training and exercise load should be consistent with the actual level of the experimental object, and make the training method itself reasonable. (d) The use of training methods should effectively improve the badminton athletes' special speed quality. Make the selected badminton training method effective. (e) The construction of training methods should focus on the main content of badminton special speed quality, so that the selected badminton special speed content has the characteristics of diversity. (f) The implementation of training methods should follow the research results of modern training science, and the process of training implementation should be carried out in a scientific and orderly manner. In this study, through collecting Chinese badminton

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special speed training outline (Xiao, 2005) and previous research literature (Grice, 2008), the author further sorted out the specific content of badminton specialized speed training. In the same time, according to dimension contents of badminton specialized speed. The training methods of badminton specialized speed include the training method of special reaction speed, special action speed and special displacement speed (Xiao, 2005). Three parts content will be shown in the following:

Part I -Training Method of Badminton Special Reaction Speed:

(I) Fast move all kinds of footwork training to adopt Listen to or look at gesture signals

Flexible and robust footwork and keen time prediction can provide the player with the opportunity and more time and more favorable space to play a greater variety of shots (Jayal, A., Mcrobert, A., Oatley, G., & O' Donoghue, 2018). Good footwork also can provide guarantee for the player's quick reaction and the correct anticipatory follow-on batting movement completes, in the same time, the player can obtain the opportunity more to defense and attack. For example: the chance to hit the shuttle early while it is still above net height、the ability to recover quickly and narrow gaps、the chance to deprive your opponents of time and get an early shot when the opponent has not had time to return to position. In addition, good footwork are a player's ability to quickly return mid-court and the maintained your balance, it can form an offensive and defensive posture. You will not only have the ability to move around the court in all directions with confidence, you will also feel capable of increasing your speed.

All kinds of footwork exercises to fast move by Listen to or look at gesture signals in the full-court、forecourt、mid-court and rear-court. Fast footwork training method through listen to signal or look at gesture can improve the athlete's reaction speed.

(i) Fast movement Footwork forwards through listen to signal or look at gesture: (a) running forwards. (b) Skipping forwards. (c) Sliding step forwards.

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(ii) Fast movement footwork backward through listen to signal or look at gesture: running backwards. (b) Skipping backwards. (c) Sliding step backwards.

(iii) Fast movement footwork sideways through listen to signal or look at gesture: (a) Movement to the racket side. (b) Movement to the non-racket side.

(iv) Do Starting footwork training through listen to signal or look at gesture: All kinds of starting footwork exercises of a step with visual or auditory signals. Starting footwork can improve the fast reaction speed of badminton players.

(v) Training of the fast lunge and recovery through listen to signal or look at gesture: A deep lunge into the forecourt and recovery, lunge into the right forecourt and recovery、lunge into the left forecourt and recovery.

(vi) Fast move footwork training to four corners by listen to signal.

(II) Listen to preset commands and do a variety of fast hitting and swing racket training：Badminton player completed a variety of hitting and swing racket after heard the commands. Training of fast hitting and swing racket action by the forehand and backhand on overhead continuously, the underarm hitting action continuously. Touching the target with your hand after hearing the signal.

Part 2 -Training Method of Badminton Special Action Speed

(I) Fast Serve to target position: Use a variety of serve techniques，According to the serve badminton frequency of 1.3 to 2 seconds, training multi-group of fast serve badminton to the target position training, the forehand and backhand low serve, the forehand and backhand high serve, the flick serve, the drive serve.

(i) Various fast batting shuttlecock action exercises: (a) the forehand overhead fast drop shot. (b) Move quickly in forecourt of badminton in 30 seconds and finish killing (the shuttlecock is above the top of the net). (c) Net shots (shuttlecock just below top of net). (d) Fast move in tow corners of badminton rear-court and kill continuously in 30 seconds. (e) Fast batting practice: use multiple balls, narrow the distance between the

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grounds, do a variety of action of rapid batting practice.

(ii) Fast hit shuttlecock on the wall for 2 minutes.

(iii) Fast frequency swing racket practice: do a variety of quick swing exercises according to signal. Swing the racket quickly with forehand on overhead, forehand underarm fast swing the racket action training.

(iv) Footwork fast frequency exercise: Variable speed frequency starting footwork practice, change speed left and right body cross jump exercise, change speed forward pad step and backward rotation body exercise.

Part 3 -Training Method of Badminton Special Displacement Speed

(i) Various running practice in badminton court: (a) Straight line forward and backward running practice: From the bottom line of the court start full speed forward to run to the front of the net, one big lunge footwork and hand contact with the net and then fast run backward to the bottom line and completed jumping hitting action, then run forward again, repeat practice in turn. (b) Footwork sideways: Movement to the racket side and movement to the non-racket side, and complete to the return of kill. Repeated practice in turn. (c) Listening to the signal, start to touch the target exercise. Place the shuttlecock in the four corners of the court, each with 4 shuttlecocks as the target.

(ii) Fast move to two corners of rear-court and kill shot continuously in 30 seconds.

(iii) Fast the return shot of serve at 6 target positions on the court.

(iv) Fast move forwards and backwards, the forehand overhead clears and underarm net of the return of shots training.

(v) Rally for 2 minutes: Fast movement forwards and backwards, the forehand overhead slow drop shot, forehand and backhand underarm net of the return of stroke training.

(vi) Rally for 2 minutes: Fast movement forwards and backwards, the forehand overhead fast drop shot and smash, return of smash, forehand and backhand underarm clear.

In this study, according to the training principles and badminton movement characteristic. Experimental groups intervention method from the development of

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Badminton special speed training method mainly include all above part 1、2 and 3 contents. The badminton special speed training method came from theory and practice of badminton (Xiao, 2005), badminton steps to success (Grice & Grice, WA, 1996) and some badminton experts recommended method. In this study, there are 13 kinds of badminton special speed training methods came from above three parts for the experimental training intervention method. Badminton special speed training method (BSSTM) came from the development of badminton training and practice theory are shown in Table 3.3.

Table 3.3

Badminton Special Speed Training Method (BSSTM) Came from the Development of Badminton Training and Practice Theory

Items code	Experimental Intervention Method	Sources
BSSTM1	Badminton fast serve to target position (forehand special speed backhand low serve, high serve).	Xiao, (2005)
BSSTM2	Training auditory signals : (a) Run backward method. (b) Skip backward. (c) Slide footwork.	Grice & Grice, WA (2008)
BSSTM3	Footwork training move to one side of racket and to the side of the non-racket.	Experts Recommended
BSSTM4	Training of the fast lunge and recovery: A deep lunge into the forecourt and recovery, lunge into the right forecourt and recovery, lunge into the left forecourt and recovery.	
BSSTM5	Move to 6 positions and touch the shuttlecock.	
BSSTM6	Forehand clear and backhand overhand slow drop.	
BSSTM7	The forehand and backhand net hook Shot	
BSSTM8	Forehand overhead fast drop shot to target position and Smash to target position.	
BSSTM9	Net kills (shuttle above top of net).	
BSSTM10	Movement forewords and backwards, forehand, overhead clear and underarm net shots.	
BSSTM11	Fast movement to the midcourt and the drives.	
BSSTM12	Rally for 2 minutes: Movement forwards and backwards, forehand overhead slow drop shots, forehand and backhand underarm net of the return of stroke training.	
BSSTM13	Rally for 2 minutes: Movement forwards and backwards, the forehand overhead fast drop shot and smash, return of smash, forehand and Backhand underarm the return of clear ball.	

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(B) Division of Exercise Load of BSSTM Training Intervention

The dimension of the division of exercise load is presented in nine ways. It is training format, bouts, Training duration, Duration each exercise, energy system supply, rest, score of RPE, percentage of HR max and training volume. The exercise intensity in the table was measured by a five-level scale: Low exercise intensity is 0-1 (50 to 60％ of HR max), Medium exercise intensity is 1-2 (61 to 75％ of HR max), Large exercise intensity is 2-3 (76 to 85％ of HR max), Sub-maximal intensity is 3-4 (86 to 95％ of HR max), maximal intensity is 4-5 (96 to 98％ of HR max); RPE (Rating of Perceived Exertion) is adopted a seven-rating segmentation scale (scale of 7 rating). Borg scoring: The force of self-understanding consists of exceptionally light force (6-8 scouring), very light force (9-10), light force (11-12), a little hard force (13-14), hard force (15-16), very hard force (17-18), exceptionally hard force (19-20). Generally, the intensity of aerobic exercise should be controlled in the range of 12-13 points. Division of exercise load between badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) for elite players reflected in Table 3.4.

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Table 3.4

Division of Exercise Load between BSSTM and BTSTM for Elite Players

BSSTM and BTSTM Format	**Bout**	**Training Duration**	**Duration Each Exercise**	**Energy System**	**Rest**	**Score of RPE**	**％ HR max**	**Volu-me**
Single Play Exercise 15 vs 15	4-8	90 minutes/ per times training course	Each exercise: 30 Sec. to 2 min.	Short intensive aerobic and anaerobic	1: 1 to 1.5	17 to 20 (scale of 7 rating)	Sub-maximal Intensity : 86 to 95% of HR max	8-16 min.
15 vs 15 Double Play Rally Exercise	4-5	90 minutes/ per times training course	3 min. to 6 min.	Medium intensive aerobic/ anaerobic	1: 1	13 to 18 (scale of 7 rating)	High Intensity : 76 to 85% of HR max	12-30 min.
15 vs 15 Double Players Rally	4-6	90 minutes/ per times training course	4 min. to 6 min.	Medium intensive aerobic/ anaerobic	1: 1	12 to 16 (scale of 7 rating)	Intensity Medium: 61 to 75％ of HR max	16-36 min.

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(C) Block Schedule of BSSTM Training Intervention Course

This section will state the third step of the experimental procedure, which is training framework class implement plan for badminton special speed training method (BSSTM). In this study, the experimental groups (elite group 1) will be adopted new built BSSTM training intervention from the development of BSSTM. The experimental training requirement in progress of classes implement schedule: the training classes will be implemented by the same coach under the same equipment condition. The Experimental training class all will be completed in 3 months, 4 weeks per month, 3 times classes in per weeks, 3 month is a total of 36 times training classes. Each times training class is 90 minutes, which include in between rest time and prepare warming body time. In the process of BSSTM training intervention, there are 13 kinds of different training method and contents will be used in the experimental groups (elite group 1). As for the development intervention of BSSTM training, the details of block schedule of BSSTM training intervention for the experimental group (elite group 1) is stated in section A of Appendix C.

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(D) The Conceptual Framework of BSSTM Training Intervention

As for the conceptual framework of skills coaching for BSSTM reflected in table 3.6 for BSSTM in terms of unit, BSS training method, tactical problems, skill performance focus, coaching objective dimensions, coaching process assessments system of badminton special speed training method. In the process of BSSTM training intervention, the training intervention contents of the development from BSSTM mainly highlights the tactical problems, skill performance focus and coaching dimension characteristics. BSSTM training intervention of the from development contents of BSSTM, it is closer to the requirement of scoring strategy and skill performance capability of control badminton landing target position in the technical practice, and the training method is directed directly at the technical content and tactical style, the details of the conceptual framework for BSSTM training is be shown in section A of Appendix C. Therefore, the two training methods embody different characteristics in content.

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(E) The Coaching Practices Method of BSSTM Training Intervention

In this study, the training intervention of badminton special speed training method reflect through the basic practice conditions and coach guidance points. BSSTM training intervention always revolves around the characteristics of the fast-starting reaction speed, displacement speed and batting action speed. BSSTM training intervention further improve the ability of the controlling shuttle landing point and predictive landing time of badminton players. Therefore, the coach should run through the speed training in the technical teaching in the badminton special speed training process. Let technical teaching and development of special speed quality integration, fully reflect the importance of special speed quality. The basic points of coaches' training methods in the course of badminton specialized speed training. Reaction speed and displacement speed are the basis, action speed is the key. It can be said that any perfect shot is based on rapid response speed and degree of movement in place. The back-stroke quality is affected by the reaction start speed, the pace movement speed and the hand movement speed, so the fast reaction speed and the movement speed is the guarantee of the step-in place.

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However, if the movement speed of the hand is slow, the quality of the return stroke will decline, so in the badminton training, we should not only emphasize the development of reaction speed, but also the development of the movement speed. In the course of the training and development of these three speed qualities, attention should be paid to the training and improvement of batting technique. These aspects: 1 to relax, that is, before hitting the grip and preparation to relax. It includes arms, wrists, and fingers to relax, otherwise it will affect the use of fast power.

(i) Quick action - the speed of hitting can be maximized only when the muscles of the whole body are relaxed.

(ii) High hitting point-the player should try to choose the best space and time to hit the ball when the relative space position is high, which will improve the batting quality and threaten the other team members. In general, the player is required to choose the right shoulder side (take the right hand grip as an example), the hanging ball is on the right

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shoulder or a little forward, and the shot or slap is slightly above the right shoulder.

(iii) The hitting point should be accurate-the position of the hitting space and the hitting point of the ball should be accurate.

(iv) Hit hard-when hitting the ball. Fast shot, strong batting, threat to the opponent's defensive return shot, resulting in the other side making mistakes.

(v) Learn to be flexible-in training to develop the player's flexible and changeable ability to handle the ball, especially, the line and position of return stroke should be changeable, the technical action of hand should be flexible and changeable.

(vi) The positions should be accurate, reaction start and return to stopping position should be quick, displacement action and batting action should be consistent. In short, in the process of training, it is necessary to develop and improve the reaction speed, displacement speed and movement speed of badminton players. The following is followed by a description of the training methods of badminton specialized speed and the specific implementation of the process. At the same time, the training method of badminton special speed training method (BSSTM) selected in this experiment.

Practice 1—Train Fast Serve to Target Position (show in Figure 3.3)

In badminton, serving is a basic competitive technique and a crucial part of the game tactics. The technical quality of the serve has a direct impact on the outcome of the match. Good badminton serve technique is an effective means to attack in games. There are four types of serve: the low serve, the high serve, the flick serves, the drive serves. It is possible to play all four with a forehand or backhand action. And each of these four serve modes has its own flight mode and different speeds. Nowadays, in singles, men often use backhand serve and women use forehand; backhand serve is often used in doubles. Forehand serve preparation: Body left shoulder side to the net, left foot in front, right foot behind, center of gravity on the right foot, right hand patter to the right back side to raise, elbow relaxed micro-bend, left thumb, index finger and middle finger to

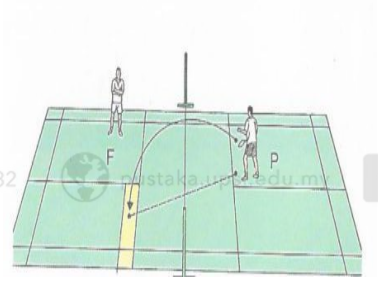
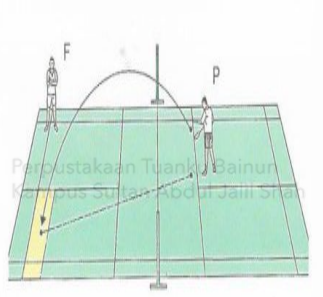
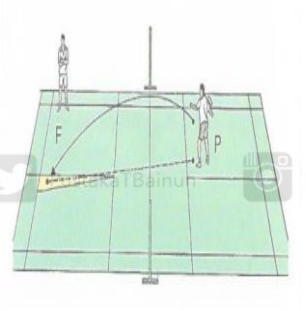
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grasp the ball, in between chest and abdomen. When serving, the body weight shifts from right foot to left foot. Backhand serve preparation: Your right foot is in front your left toe is on the ground and your center of gravity is on your front foot. Use your left thumb, index finger and middle finger to hold the badminton of the ball and place the ball below your waist. With your right arm raised slightly in the elbow, grip the racquet with a backhand, placing the racquet naturally behind the player holding the backhand, with your eyes facing forward, in the preserve position (show in Figure 3.3)

Figure 3.3

Train Fast Serve to Target Position (Figure 3.3 Came From Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Basic Skills and Techniques: pp. 52)

		
Serve the low badminton to target position. **Conditions:** Play two sets. The laws of service apply. In the first set the player should hit forehand serve to target position. In the second set he should hit backhand serves to the target position. The player stands in the front of the midcourt. **Coaching points:** The hitting action is a push and the shuttle should skim the net. The player must adopt the ready position on completion. The feeder observes while the player serves to the target.	Serve the high badminton to target position. **Conditions:** Play one set. The laws of service apply. The serve and flick serve should alternate and the shuttle must reach the rear of the midcourt. **Coaching points:** The hitting action, a tap, is used at the last possible moment. The player stands in the front of the midcourt. The feeder observes and the player hits drive serves to the target areas.	The drive serve to target position. **Conditions:** Play one set. The laws of service apply. The player stands in the front of the midcourt. The feeder observes and the player hits drive serves to the target areas. **Coaching points:** The hitting action is a push, the arm swing fast. The shuttle trajectory should be shallow, with the hand cooked back throughout. The player hits drive serves to the target areas.

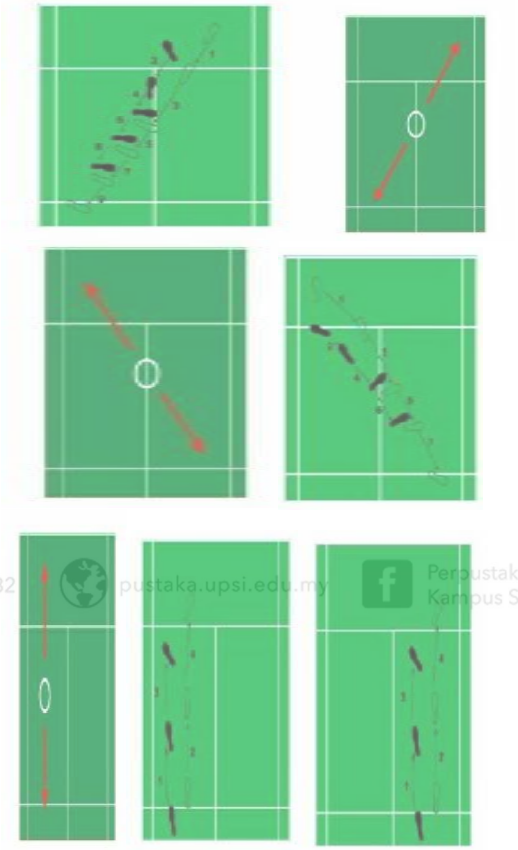
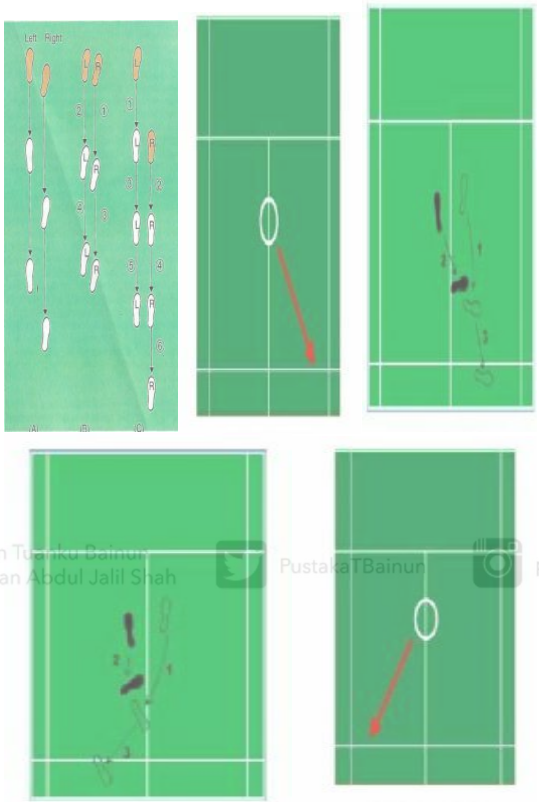
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Practice 2 — Train Forward Footwork and Backward Footwork (Figure 3.4)

Figure 3.4

Train Forward Footwork and Backward Footwork (Figure 3.4 Came From Movement around the Court. John Edwards, 1997: pp.26)

	
Training Forward footwork and backward footwork with visual or auditory signals **Conditions:** In the half court, let the players clear the audiovisual signals to the pace of practice, coach for demonstration for players, and then players for imitation exercises. **Coaching points:** Adopted: (a) Run forward and backward. (b) Skip forward and Skip backward. (c) Slide footwork forward and Slide backward. Move footwork to forecourt and stroke in the forehand and move footwork to rear court and stroke in the overhead.	Backward footwork with visual or auditory signals **Conditions:** In the half court, let the players clear the audiovisual signals to the pace of practice, coach for demonstration for players, and then players for imitation exercises. **Coaching points:** Train backward footwork with visual or auditory signals： ①Run backward. ② Skip backward. ③Slide footwork move footwork to rear court and stroke in the overhead, drop shot, kill and smash shots in rear court.

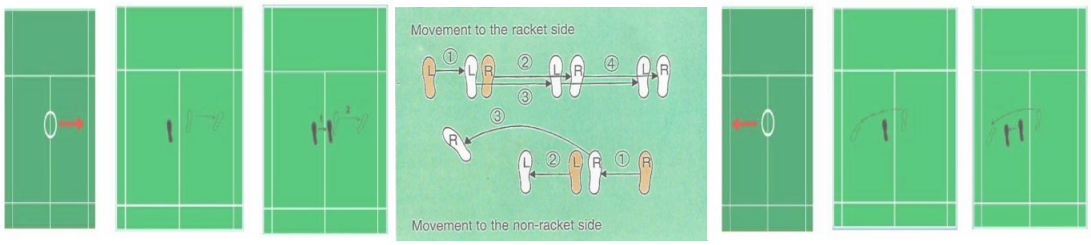
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Practice 3 —Footwork Move to One Side of Racket an Non-Racket (Figure 3.5)

Figure 3.5

Footwork Move to One Side of Racket and Non-Racket (Figure 3.5 Came from Movement around the Court. John Edwards, 1997: pp.26)



Footwork move to one side of racket and to the non-racket

Conditions: In the half court, coach for demonstration for players, and then players for imitation exercises. **Coaching points:** To adopt a sliding footwork to one side of racket and to the non-racket or backward one cross footwork continue again made one times a sliding footwork to one side of racket and to the non-racket. This step is mainly used to the return killing and the return smashing or drive shot the ball near the midcourt and rear court of the side line.

Practice 4 — Deed Lunge into the Right Forecourt and Left Forecourt (Figure 3.6)

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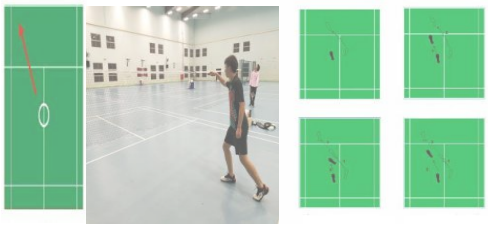
Figure 3.6

Deed Lunge into the Right Forecourt and the Left Forecourt (Figure 3.5 Came from Movement around the Court. John Edwards, 1997: pp.26)



Fast a deep lung into the right forecourt

Conditions: Player adopt one step lunge or two step lunges move to the net, and then complete kinds of stroking ball action. **Coaching points:** One step lunge into forecourt in the side of racket, two step lunges into forecourt in the side of racket, pad step plus pedal step lunge into forecourt, cross step plus pedal step lunge into forecourt. This step is mainly used to the net kill, net push, net hook, net drop, net, crosscourt drop shot at net、tumble drop shot at net and hairpin shot at net.



Lung into the left forecourt

Conditions: Player adopt one step lunge or two step lunges move to the net, and then complete kinds of stroking ball action. **Coaching points:** One step lunge into forecourt in the side of non-racket, two step lunges into forecourt, pad step and plus pedal step lunge into forecourt, cross step and then plus pedal step lunge into forecourt. This step is mainly used to the to the net kill, net push, net hook, net drop, net, crosscourt drop shot at net、tumble drop shot at net and hairpin shot at net.

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Practice 5 — Move to 6 Positions of Badminton Shuttlecock (Figure 3.7)

Figure 3.7

Move to 6 Positions of Badminton Shuttlecock (Figure 3.7 Came from Photos taken at the stadium of University Pendidikan Sultan Idris. Showing the athlete is Su Yi Ping)



Conditions: Put badminton in 6 corners of badminton court, 4 in each corner. Move Footwork forward, backward, left and right. Fast a deep lung into the right forecourt and Lung into the left forecourt.

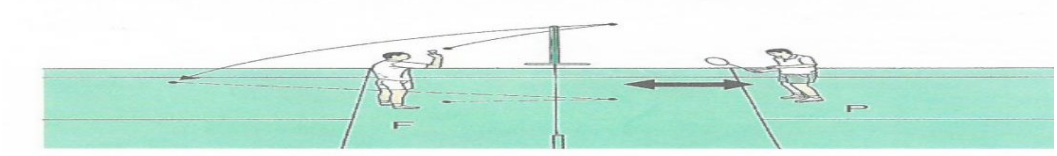
Coaching points: (a) The Lunge and Recovery: the player starts moving from the center of the badminton court, first moving forward to the right corner, then back to the starting center, then second moving forward to the non-racket in the left front forecourt. Turn back to the center position after each touch to shuttlecock. (b) Defense action and then third move to the left and right line of the midcourt, the return of kill or smash and drive shot, go back to the center. (c) Backward footwork and recovery: Move to the right rearcourt and the left rearcourt.

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Practice 6— Net Kills (Shuttle Above Top of Net) and Overhead Forehand Fast Kill in The Two Corners of Rearcourt in 30 Seconds (Figure 3.8)

Figure 3.8

Net Kills (Shuttle Above Top of Net) and Overhead Forehand Fast Kill in the Two Corners of Rearcourt in 30 Seconds (Figure 3.8 Came from Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Skills and Techniques: pp. 56)



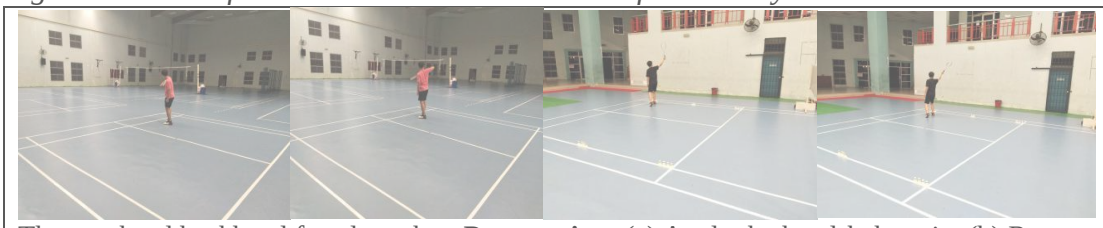
Conditions: The player stands on the edge of the midcourt. The feeder stands in the opposite forecourt. The feeder lobs hand feeds upwards to the net. The player steps into the forecourt, adopts a pan handle grip and kills the shuttle with a dab downwards. Play two sets. In the first set the feeder feeds to the player's forehand side. In the second set the feeder feeds to the player's backhand side. **Coaching:** The hitting action is a tap. The player should step quickly into the forecourt with the racket foot, to take the shuttle early and in front. It is imprint to transfer the body weight quickly upwards after hitting the shuttle.

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Practice 7 — Overhead Backhand Fast Drop Shot and Underhand Drop Shot (Figure 3.9)

Figure 3.9 Came from Photos Taken at Stadium of University Pendidikan Sultan Idris



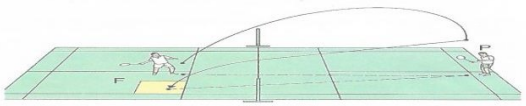
The overhead backhand fast drop shot. **Preparation:** (a) Apply the handshake grip. (b) Recover into waiting, or receiving, stance. (c) Hold your arm up. (d) Use your backswing to place your wrist in cocked position. e) Distribute your weight evenly on the balls of your feet. **Execution:** (a) Pivot and turn to the oncoming shuttle. (b) Swing forward to contact shuttle high. (c) Reach your racket out to meet the shuttle, which is blocked, not hit. (d) Move your racket head so that it travels in the shuttle's direction. **Follow-through**: (a) Continue in line with the shuttle's flight. (b) Allow your swing to follow the angle of the shuttle. (c) Push off with your feet back toward midcourt. (d) Return to center court.

Underhand drop shot: Preparation: **(**a) Apply backhand, or thumb-up, grip. (b) Recover into waiting or receiving stance. (c) Hold racket head downward. (d) Point racket head downward. (e) Distribute weight evenly on both feet. **Execution:** (a) Reach with your dominant foot. (b) Pivot and turn back to net. (c) Use backswing to place wrist in cocked position. (d) Lead forward swing with your elbow. (e) Allow racket head to lead hand up to contact. (f) Contact as high as possible. (g) Angle racket face downward. (h) Supinate forearm. **Follow-through:** (a) Continue swing down with shuttle's flight. (b) Swing toward net. (c) Push off your rear foot back to midcourt. (d) Return to center court.

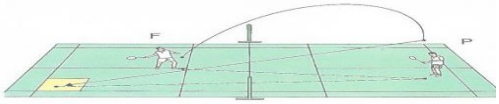
Practice 8 — Forehand Overhead Fast Drop Shot to Target Position and Smash to Target Position (Figure 3.10)

Figure 3.10

Figure 3.10 Came from Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Basic Skills and Techniques: pp. 52



Fast Drop Shot to target position: The player stands in the front of the midcourt. The feeder observes and the player hits drive serves to the target areas. **Conditions:** Play one set. The laws of service apply. **Coaching points:** The hitting action is a push, the arm swing fast. The shuttle trajectory should be shallow, with the hand cocked back throughout. Player stands in the rear of the midcourt and feeder forecourt of the midcourt. The feeder hits high feeds to player, who returns smashes to opposite midcourt.



Smash to target position: The player stands in the front of the midcourt. The feeder observes and the player hits drive serves to the target areas. **Conditions:** Play two sets. In the first set play at 75% power. In the second set play at 100% power. The shuttle should land within the shaded area. **Coaching points:** The hitting action is a whip. The player should recover fully into a balanced position after each attempt. The shuttle should fall steeply.

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Practice 9 — Crosscourt Drop Shot at Net、Tumble Drop Shot at Net and Hairpin Shot at Net (Figure 3.11)

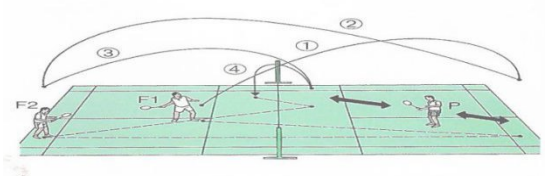
Figure 3.11

Figure 3.11 Came from Photos Taken at Stadium of University Pendidikan Sultan Idris)

		
Crosscourt drop shot at net: The player stand on edge of the forecourt. The feeder squats down in the forecourt close to net and hand feeds shuttles into the player's forecourt. The player lunges and squats down to return the shuttle into opposite forecourt. **Condition:** Play one set. Both the feed and return should be close to the net. The player should recover fully between shots. **Coaching points:** The hitting action is a hook and push. The player should lunge correctly, recover quickly and maintain balance.	**Tumble drop shot at net:** The player stands on edge of the forecourt. The feeder squats down in the forecourt close to net and hand feeds shuttles into the player's forecourt. The player lunges and squats down to return the shuttle into opposite forecourt. **Condition:** Play one set. Both the feed and return should be close to the net. The player should recover fully between shots. **Coaching points:** The hitting action is a tap and push.	**Hairpin shot at net:** The player stands on edge of the forecourt. The feeder squats down in the forecourt close to net and hand feeds shuttles into the player's forecourt. The player lunges and squats down to return the shuttle into opposite forecourt. **Condition:** Play one set. Both the feed and return should be close to the net. The player should recover fully between shots. **Coaching points:** The hitting action is a push. The player should lunge correctly, recover quickly and maintain balance.

Practice10 —Movement Forewords and Backwards, the Forehand Overhead Clear and Underarm Net Shots (Figure 3.12)

Figure 3.12 Came From Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Basic Skills and Techniques: pp. 56

	midcourt. F2 hits a drop shot to the forehand (3). The player moves forwards. Lunges into the forecourt, players a net shot (4) to the opposite forecourt, and recovers to the front of the midcourt. **Conditions:** Above is one sequence. Play 10 sequences. First five sequences: the feeder 2 hits to the player's forehand. Second five sequences: the feeder 2 hits to the player's backhand. **Coaching points:** The hitting action are whip and push. The player to recover fully between each sequence. Maintain balance throughout.
The player stands in the midcourt, the first feeder (F1) stands in the front of the midcourt. The second feeder (F2) stands in the rearcourt. F1 hits high serves (1) to rearcourt. The player moves back to the rearcourt, hits a forehand overhead clear (2) to the opposite rearcourt and return to the drop shot.	

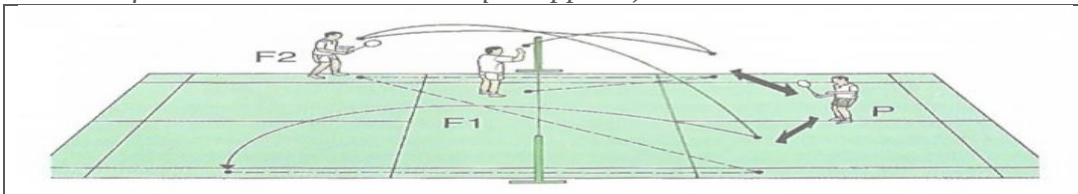
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Practice 11 — Fast Movement Push or the Forehand and Backhand Drive from Midcourt (Figure 3.13)

Figure 3.13

Fast Movement Push or the Forehand and Backhand Drive from Midcourt (Figure 3.13 *Came from Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Basic Skills and Techniques: pp. 58*)



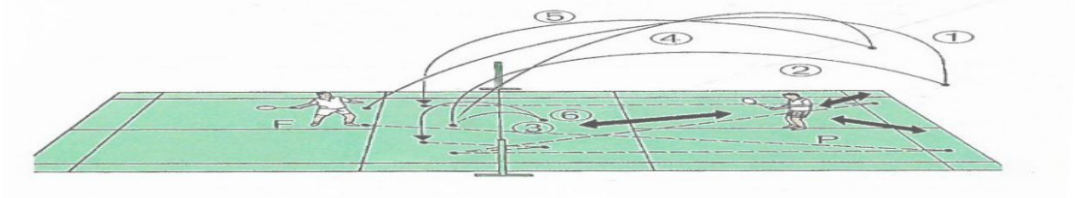
The player stands in the midcourt. The first feeder(F1) stands in forecourt, and the second feeder (F2) stands in the midcourt. The first feeder (F1) hand feeds shuttles to the tramlines. The player moves sideways, lunges to hit a straight forehand drive to the second feeder (F2), Then recovers to the midcourt. The second feeder (F2) hits a cross-court drive to the player's backhand side. The player moves sideways, lunges to hit a straight backhand drive, and recovers to the midcourt.
Conditions: Play three sets. In the first set the exchanges should be forehand to backhand. In the second set they should be backhand to forehand. In the third set the second feeder (F2) hits to either side of the player.
Coaching points: The hitting action is a tap. The forehand drives are taken off the racket foot. The backhand drives are taken off either foot.

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Practice 12 — Rally for 2 minutes: Movement Forwards and Backwards, Forehand Overhead Slow Drop Shots, Forehand and Backhand Underarm Net of the Return of Stroke Training (Figure 3.14)

Figure 3.14

Movement Forwards and Backwards, Forehand Overhead Slow Drop Shots, Forehand and Backhand Underarm Net of the Return of Stroke Training (Figure 3.14 Came From Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Basic Skills and Techniques: pp.57)



The player stands in the midcourt. The feeder stands in the front of the opposite midcourt. T feeder hits a high serve (1) to the rearcourt. The player moves back to the rearcourt, hits a forehand overhead slow drop shot (2) to the opposite forecourt, and return to midcourt. The feeder hits either a net shot (3) to the forecourt or a clear (4) to the rearcourt. The player moves accordingly and plays a drop shot (5) or a net shot (6) to the forecourt and recovers. The feeder repeats the net shot or clear to continue the rally. **Conditions:** Rally for 1 minute. The feeder should hit loose net shots and high clears. **Coaching points:** The hitting action is a push. The players should maintain their balance throughout. They play a continuous rally, and aim to make no mistakes.

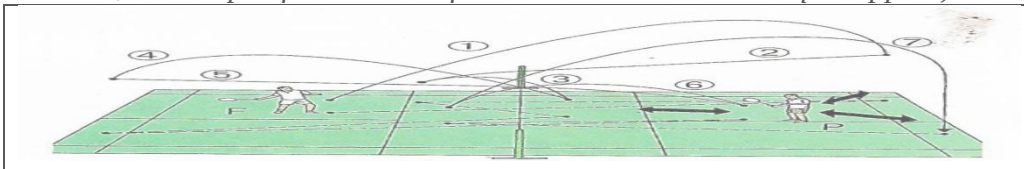
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Practice 13 —Rally for 2 Minutes: Movement Forwards and Backwards, the Forehand Overhead Fast Drop Shot and Smash, Return of Smash, Forehand and Backhand Underarm the Return of Clear Ball (Figure 3.15)

Figure 3.15

Rally for 2 Minutes: Movement Forwards and Backwards, the Forehand Overhead Fast Drop Shot and Smash, Return of Smash, Forehand and Backhand Underarm the Return of Clear Ball (Figure 3.15 Came from Crowood Sports Guides Badminton. John Edwards, 1997. Specific Practices for Basic Skills and Techniques: pp.57)



The player stands in the midcourt. The feeder stands in the opposite midcourt and hits high serves (1) to the rearcourt. The player moves back to the rearcourt, hits a forehand overarm fast drop shot (2) and returns to the midcourt. The feeder blocks (3) to the forecourt. The player moves from the midcourt, lunges into the forecourt, plays am underarm clear （4） to the opposite rearcourt and then returns to the midcourt. The feeder plays a fast drop shot (5) to the midcourt. The player blocks to the forecourt (6) and remains in the midcourt. The feeder clears (7) high to the rearcourt. The player moves back to the rearcourt and hits a forehand overarm fast drop shot to repeat the sequence. **Conditions:** Rally for 2 minutes. Turn fast drop shots into smashes as proficiency improves. **Coaching points:** The hitting actions are tap, push and whip. The feeder blocks to either side of the player's forecourt. They play a continuous rally and aim to make no mistakes.

3.4.2 BTSTM Training Intervention

In this experimental, control group adopted training intervention of badminton traditional speed training method. Badminton traditional speed training method (BTSTM) come from outline of badminton speed training method (Xiao, 2005). Contents of training intervention of badminton traditional speed training method was stated 4 parts, which of them are as following:

(A) BTSTM Training Intervention Come from Outline of BTSTM

(B) Division of Exercise Load of BTSTM Training for Group 2

(C) Block Schedule of BTSTM Training Intervention Course

(D) The Conceptual Framework for BTSTM Training Intervention

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(A) BTSTM Training Intervention Come from Outline of the Theory and Practice of Badminton

Badminton traditional speed training method (BTSTM) came from《the theory and practice of badminton》 (Xiao, 2005) and Chinese badminton traditional speed training outline. The control group intervention training method based on the development of badminton traditional speed training method (BTSTM). There are 13 kinds of BTSTM will be adopted in the process of control groups (elite group 2) intervention training method, which they are shown in Table 3.5.

Table 3.5

Intervention Method from Development of BTSTM

Control Groups Intervention Method from Development of Badminton Traditional Speed training Method (BTSTM)

Items code	Experimental Intervention Method	Sources
BTSTM1	Transform signal variable speed run	Xiao, (2005)
BTSTM2	Listen to signal and touch the target	Chinese badminton training outline
BSSTM3	60m running	
BTSTM4	Jump rope fast for 1 minute	
BTSTM5	Standing high and running for 15 seconds	
BTSTM6	Fast recumbent push for 20 seconds	
BTSTM7	Jump and hit the target ball	
BTSTM8	Two corners of forecourt move and jump to kill ball	
BTSTM9	Move to the backcourt and kill ball	
BTSTM10	Weight-bearing strength training	
BTSTM11	Throw shuttlecock in the distance	
BTSTM12	Move to 6 positions and place shuttlecock	
BTSTM13	Fast stroke badminton training on the wall	

Note: BTSTM = Badminton Traditional Speed Training Method

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(B) Division of Training Load in the Process of Training Intervention

In this study, the same intervention intensity (medium and low) was used in the process of training intervention of badminton special speed method (BSSTM) and badminton traditional speed training method (BTSTM)，format of training method adopted the single play exercise Rally 15 vs 15 and Double play exercise Rally 15 vs 15. Training Duration was 90 minutes per times training course, Duration each exercise was 3 min to 6 min and 4 min to 6 min. Details of training load reflected in table 3.21. Division of training load included training format, bouts, duration, energy system, rest, RPE, percentage of HR and training volume. The exercise intensity in the table was measured by a five-level scale (Large scale 2-3, Medium scale 1-2, Small scale 0-1, Sub-limit 3-4, Limit 4-5). RPE (Rating of perceived exertion) also adopted a seven-rating segmentation scale.

Table 3.6

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Division of Training Load

Division of Training Load between BSSTM and BTSTM

BSSTM And BTSTM Format	**Bout**	**Training Duration**	**Duration Each Exercise**	**Energy System (Supply)**	**Rest**	**Score of RPE**	**％ HR max**	**Volume**
Single play exercise 15 vs 15	4-8	90 minutes per times training course	3 min to 6 min	Medium intensive Aerobic/ Anaerobic	1: 1	13 to 18 (scale of 7 rating)	Intensity medium: 76 to 85％ of HR max	12-30 min
Double play exercise Rally 15 vs 15	4-5	90 minutes per times training course	4 min to 6 min	Medium intensive Aerobic/ Anaerobic	1: 1	12 to 16 (scale of 7 rating)	Intensity Medium: 61 to 75％ of HR max	16-36 min

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(C) Block Schedule of BTSTM Training Intervention

This section will state the third step of the experimental procedure, which is training framework class implement plan for badminton traditional speed training method (BTSTM). In this study, the control group (elite group 2) will be adopted BTSTM training intervention from the development of badminton traditional speed training method (BTSTM) training outline in Chinese university (Xiao, 2005). The experimental training requirement in progress of classes implement schedule: the training classes will be implemented by the same coach under the same equipment condition. Experimental training class all will be completed in 3 months, it have 4 weeks in per month, 3 times classes in per weeks, training intervention total length is 3 month, training duration is 90 minutes in each times training class, which include in between rest time and prepare warming body time. In the process of badminton traditional speed training method (BTSTM) training intervention, there are 13 kinds of different training method and contents will be used in the control group (elite group 2). As for the development intervention of badminton traditional speed training method (BTSTM) training, block schedule of badminton traditional speed training method (BTSTM) training intervention for elite group 2 was shown in section B of Appendix B.

(D) The Conceptual Framework of BTSTM Training Intervention

In the process of badminton traditional speed training method (BTSTM) training intervention, the training intervention contents is be developed from Chinese badminton traditional speed training method outline. As for the conceptual framework of skills coaching for badminton traditional speed training method (BTSTM) training reflected in section B of Appendix C. The conceptual framework of skills coaching for badminton tradition speed training method include the tactical problems, skill performance focus and coaching dimension characteristics. On the other hand, badminton special speed training method (BSSTM) training and badminton traditional speed training method (BTSTM) training have the different characteristics in the tactical problems, skill performance focus and coaching dimension. Badminton special

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speed training method (BSSTM) training intervention mainly develop basic speed quality, And the special speed training is the intervention training which combines the badminton technique and the tactics characteristic, therefore, the badminton speed training method is more advantageous to improve the badminton athlete's technical and tactical level as well as the speed quality. Badminton is mainly won by speed, so developing speed quality is an important for badminton players. Although, this study is advocated that badminton special speed training should be the main part. But, traditional speed training intervention is equally important in developing athletes' basic speed quality.

3.5 Research Instruments

This study instrument adopted from badminton special speed training method (BSSTM) training intervention (Xiao, 2005; Grice & Grice 1996). However, the research instrument was self-designed by the researcher based on the previous theory resource, and they have been confirmed on the validity and the reliability through 5 badminton experts. Therefore, the current study adopted badminton special speed training method (BSSTM) training intervention , test instrument of success score (Part A of research instrument), test instrument of time perception predictive skills performance (Part B of research instrument) for elite and novice badminton players. The research instruments resource came from badminton specialized speed training method in Badminton theory and practice (Xiao, 2005), Badminton steps to success (Grice & Grice, 1996), the recommended content of some senior badminton experts and the basic physical education quality test outline of Chinese badminton players. At same time, this research instrument test scale instrument will be used in the test procedure on success score and time perception predictive skills performance of players. On the other hand, research instrument badminton serve machine and stopwatch parts of the research instrument have been used in this study instrument. Next section, each research instrument is described from part A to part E.

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3.5.1 Part A: Method Instrument of Success Score in Data Collection

The success score of badminton refers to the number of times of success accomplished by the athletes according to the requirements of the set goals of badminton sports techniques and movement skills performance (Grice & Tony., 2008). In this study, data collection method instrument of success score of badminton players come from previous theory Sources (Xiao, 2005 & Grice, 1996), the researchers have extracted 5 items of the test method of badminton success score of badminton, the data collection method of badminton success score have been validated by 5 badminton expert. In this study, the purpose is to control the experimental conditions by using the badminton server machine, experiment can collect reliability data of the success score of badminton players, and because of badminton server machine can control the flight path, distance, height, frequency and speed of the ball. On other hand, this experimental test establishes a unified scale of batting to target position, which overcomes in previous studies the absurd research method of using doubles play model to test badminton players' performance or score. Batting ball to target position will enable all participants in the same test conditions to collect themself success score of badminton players The specific test methods of the experiment selected five test methods and contents which can best reflect the technical level of badminton players. The experimental subjects serve to the target position within 30 seconds, recorded the successes number of serving to target position, success score according to the standard checking score of service success, and record the participants' success scores; The other four test methods are in 30 seconds, using badminton server machine to serve, and then let the experimental subjects hit the ball back to the target position, record the successful number of the hitting badminton to target position, and then check badminton players batting badminton to target position to get success score. Details of collection data method instrument of success score of badminton player show in Table 3.7.

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Table 3.7

Method Instrument of Success Score in Data Collection

Code	Collected Data Method of Success Scores	Sources
MIOSS1	High serve to target position in the rearcourt in 30 second. **Check success score:** Success 10 to 9 times = 5 points; Success 8 to 7 times = 4 points; Success 6 to 5 times = 3 points; Success 4 to 3 times = 2 points; Success 2 to 1 times = 1 point.	(Xiao, 2005 & Grice, 2008)
MIOSS2	Using 2.0 frequency of the serve machine, serve to midcourt. Record the successful times of drop shots to target position in 30 seconds: **Success score check:** Success 10 to 9 times = 5 points; Success 8 to 7 times = 4 points; Success 6 to 5 times = 3 points; Success 4 to 3 times = 2 points; Success 2 to 1 times = 1 point.	
MIOSS3	Using the 2.0 frequency of serve machine to serve to the two corners of rearcourt in 30 seconds. Record successful times of kill ball to target. **Success score check:** Success 10 to 9 times = 5 points; Success 8 to 7 times = 4 points; Success 6 to 5 times = 3 points; Success 4 to 3 times = 2 points; Success 2 to 1 times = 1 point.	
MIOSS4	Using the 2.0 frequency of serve machine, serve to 6 position court, check the successful times of the return shot in 30 seconds: **Success score check:** Success 10 to 9 times = 5 points; Success 8 to 7 times = 4 points; Success 6 to 5 times = 3 points; Success 4 to 3 times = 2 points; Success 2 to 1 times = 1 point.	
MIOSS5	Using 2.0 frequency of the serve machine, serve to the midcourt. Smash to target position in 30 Seconds. **Success score check:** Success 10 to 9 times = 5 points; Success 8 to 7 times = 4 points; Success 6 to 5 times = 3 points; Success 4 to 3 times = 2 points; Success 2 to 1 times = 1 point.	

Note: MIOSS = Method Instrument of Success Score

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3.5.2 Part C: Method Instrument of Time Perception Predictive Skills Performance in Data Collection

The prediction ability of athletes' time perception refers to ability of predicting time of different sports tasks and information, and the ability of sports time perception is also one of the abilities of motor skills. In ball games, the level of movement time perception directly affects the athletes' accurate judgment of the return stroke line and the flight space of the ball, thus further affecting the movement performance. The analysis of variance of repeated measurement was carried out on the predictive response time of different level badminton practitioners to different sports tasks and information content. The results showed that the reaction time of experts was significantly shorter than that of novice players. The fixation time of experts is obviously less than that of novice (Wang, 2009). In this Article, the time perception research paradigm adopts the time point within 5 seconds (Fraisse, 1984); in the research on the characteristics of time perception and teaching effect of badminton, the badminton's single-flight is deemed as a continuous dynamic event. n this experiment, different batting methods are used to change the flying speed and distance of badminton, so as to change the task difficulty of motion and the speed and slow change of observation information. The predictive ability of time perception of badminton at different flight speeds was observed. The observation movement information source of the time perception ability test of badminton athletes in the study comes from the training methods of different sports techniques in the special speed training method. Observing the source of motion information comes from the training methods of different sports techniques in specifications. To predict the landing time of badminton, the badminton server was used to serve the badminton, so that the participants could observe the badminton in the same sport uniformly, and test the performance of participants' ability to predict the landing time of the badminton in the same sport. At the same time, using a badminton server to serve in a fixed mode, let a fixed player return serve, let all participants predict the landing time of different return shots, This allows you to check the participants' prediction of the hit time of the ball at different speeds or different batting techniques, so the different speeds and batting techniques is tantamount to changing The reliability of the study can be improved by changing the experimental stimulation information source.

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In this study, each of the subjects predicted the landing time of badminton from the start of badminton service batting, and recorded the actual predicted landing time of badminton players. The actual predicted landing time included the Clue period time of badminton landing time of badminton players in this experiment. Therefore, the data collection of predictive time requires count process. According to the characteristics of badminton and the theory of prediction clues of sports time (Wang et al., 2005). The time when badminton flies from the serve to the highest point is the clue period time predicted by the landing point when predicting the setting point of the serve to the rearcourt. Therefore, the time when badminton flies from the serve to the highest point is the clue period predicted by the landing point. In this experiment, the formula for landing predictive time of the service to rearcourt of badminton players is that the predicted landing time of badminton players from serve beginning minus (subtract) 1/2 of the total flight time of badminton (that is to say, $T_{\text{actual prediction.}} = T_{\text{prediction of test}} - 1/2\ T_{\text{total flying}}$). In addition, the predicted smash and hanging ball data threshold is equal to the total badminton flight time minus the predictive time of badminton players (that is to say, $T_{\text{actual prediction.}} = T_{\text{prediction of test}} - T_{\text{before batting flying}}$). The prediction time of each participant was measured repeatedly, and then the predicted data were selected for analysis (as shown in Table 3.8).

Table 3.8. Method Instrument of TPPSP in Data Collection

Items code	**Collected Data Method of TPPSP**	**Sources**
TPPSP1	F1: Used 1.2-2.0 frequency of serve machine to serve to target of rearcourt. Badminton landing time of F1 serve. Record the perceptual prediction time of players on F1 serve Badminton landing time (Seconds). Calculate the threshold of prediction time	(Xiao, 2005 & Grice, 2008)
TPPSP2	F1: Used 1.2-2.0 frequency of serve machine to serve to target of rearcourt. Coach the forehand smash F1 serve. Let players to predict coach smash badminton landing time. Record the perceptual prediction time of players on badminton landing time (Seconds). Calculate the threshold of prediction time	
TPPSP3	F1: Uesed1.2-2.0 frequency of serve machine to serve to the target midcourt. Coach drop shot F1 serve to net. Let players to predict coach drop shot badminton landing time. Calculate threshold of predictive time	

Note: TPPSP = Time Perception Predictive Skills Performance

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3.5.3 Part D: Method Instrument of Badminton Serve Machine

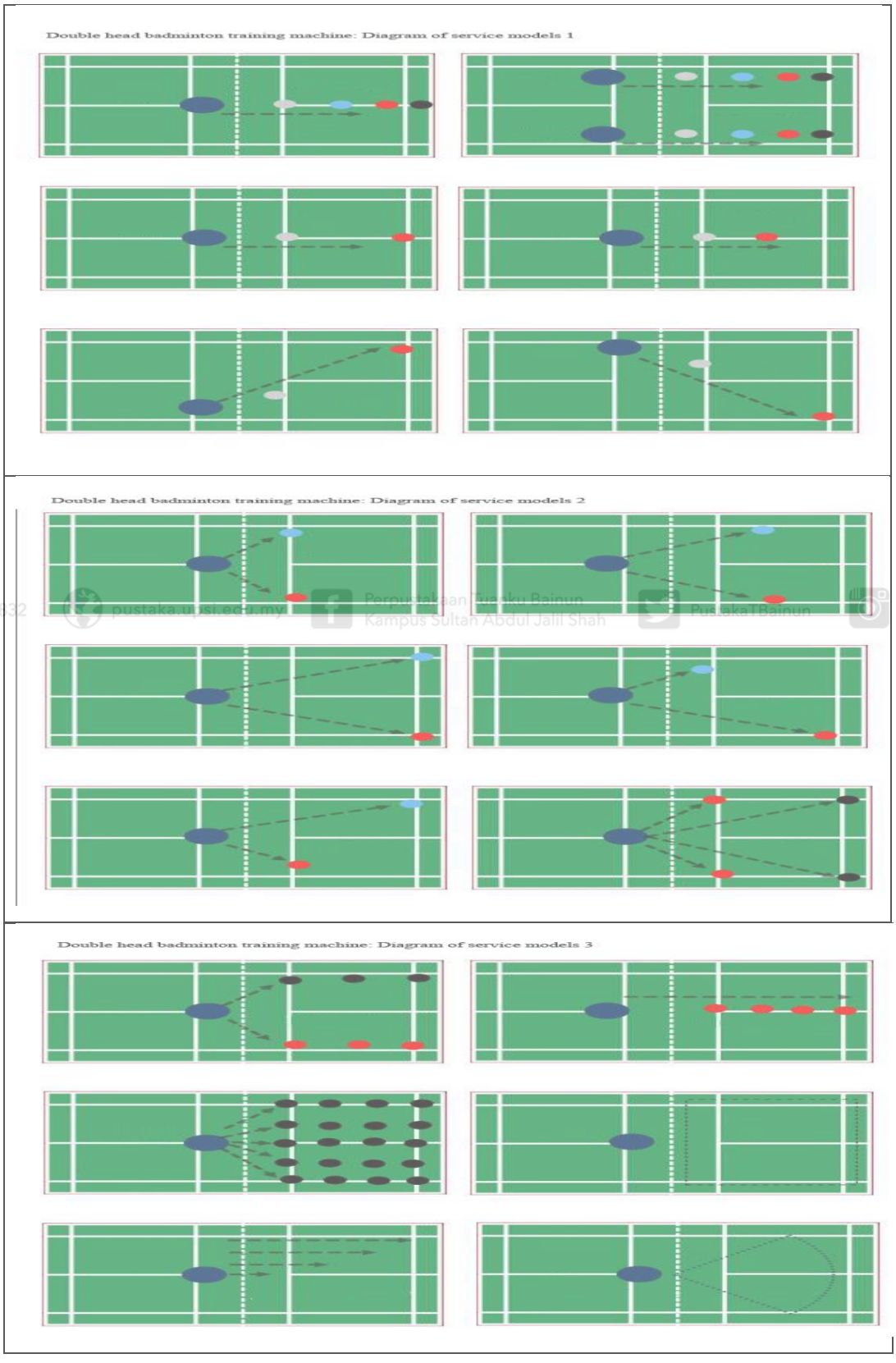
Method instrument of badminton serve machine for this study control experimental condition, it is used in the test procedure on success score and time perception predictive skills performance. The researchers used badminton training machine, Model S8025, which consists of a cage, a noses, a base, and a tablet computer. The cage can hold 140-200 badminton balls and serve at an elevation angle of 35. Degree-16, frequency of service 1-8 seconds, height of service 7.5 meters, speed of service 20-140 km/h. Automatically adjust any angle within the range of the court, no remote control, all function tablet computer control. Can automatically store 96 different modes. The schema is saved successfully and can be enabled with one click. Multi-mode storage can make the corresponding teaching and training plan for different level students and different skill level. The operation mode is controlled by computer, which can simulate the interface of the course, directly set, delete, add, modify the mode, the ball of different flight lines and landing points, speed, frequency, horizontal angle, vertical height can be adjusted at will. The serve is stable and the line is clear and accurate. Can achieve the backcourt highland ball, high ball, flat shot, midfield shot, the front court shot, the back court kill ball, net ball and so on free kick road, can also use the computer to set up the multi-circuit and many fall according to the need A point of service. There are 3 kinds of service models though double head badminton training machine: Diagram of service models 1, 2, 3. The picture shows that the big blue dot is the server, the arrow is the serve direction, and the small red dot and other small dots are the position of the ball. Controlling landing position line model of the badminton serve machine is shown in Figure3.16.

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Figure 3.16

Controlling Landing Position Line Model of the Badminton Serve Machine Came from Diagram of Service Models Double Head Badminton Training Machine in Online Download Picture in 2019



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3.5.4 Part E: Stopwatch Instrument for Test Method of Time Perception Predictive Skill Performance of Badminton Players

In this study, stopwatch instrument for test method of time perception predictive skills performance of elites and novices, test time predictive need 60 stopwatches, with each experiment subject hold a stopwatch. Test method and contents of time perception predictive skills performance shown in research instrument part C. Time perception skills performance will be reflected by predicted in advance badminton flying landing time. Predicted badminton fly landing time adopt collection method of observation data, collection data is the predicted badminton fly landing time by stopwatch recording. The predictive badminton fly landing time will be adopt observation method include 3 aspects, it is (a) to serve the high serve to the target of rearcourt and predict the landing time of the high serve; (b) to serve to the target position of the reacourt, the forehand smash to badminton rear-court, predict the landing time of the forehand smash to rearcourt; (c) to serve to the target of the mid-court, the return drop shot and predict landing time.

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3.6 Pilot Study

Pilot study is a small-scale preparation study before the complete full-scale study. It can also mean specific pretesting of research instrument, including the pilot study of the survey questionnaires or conducted prior small-scale experimental activities before full scale experimental study (Teijlingen & Hundley, 2001). The purpose of the pilot study is to validate the experimental feasibility of badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) of training intervention, and the validity and reliability of research instrument of success score test method and time perception predictive skills performance test method. However, pilot study is essential before the actual data collection in order to identify weaknesses in the constructing of the survey questionnaire on BSSTM training intervention, success score test method and time perception predictive skills performance. Firstly, a pilot test will be organized distributing three kinds of survey questionnaires to 5 badminton expert professor or coaching with their opinions on the items provided in survey questionnaire

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(see in Table 3.10). Such can improve the content of the questionnaire and confirm the content validity of BSSTM training intervention, success score test method and time perception predictive skills performance through expert survey questionnaire. On the other hand, badminton specialized speed training method (BSSTM) training intervention, test method instrument of success score and test method instrument of time perception predictive skills performance. The content of these research instruments is consistent, the dimensions are clear, therefore, the content validity of these three research instruments can be analyzed by experts. Secondly, this pilot conducted prior to the implementation of the real research to determine the feasibility of carrying out the activities as BSSTM training intervention plan in the lesson plans. At same time, in the pilot study, the researchers confirmed the reliability of the success score test and the test method of time perception predicting the skill performance of badminton players by using the method of test-retest reliability. These three questionnaires contributed in pilot test were excluded from the actual data collection of the current research.

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Table 3.9

Expert Respondent Participated and Response Rate in the Contents of BSSTM, Test Method of SS and Test Method of Time Perception Predictive Skills Performance

Description	**Instruments**	**Sample Expert**	**Usable Rate%**
Distributed	Part A: BSSTM	**5**	**100**
	Part B: Test Method of SS	**5**	**100**
	Part C: Test Method of TPPSP	**5**	**100**
Received	Part A: BSSTM	**5**	**100**
	Part B: Test Method of SS	**5**	**100**
	Part C: Test Method of TPPSP	**5**	**100**

Note: TPPSP = Tim Perception Predictive Skills Performance

This pilot test purpose is to evaluate the experimental lesson plan by finding out the possible weaknesses in the lesson of BSSTM training intervention, getting feedback on the coaching activities and planning for actions to overcome the weaknesses before

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the implementation of the actual experiment research. In the pilot test, the students are taught using Lesson Plan 1. Based on the feedback, reflection and observation from the pilot test, the training lessons plans are modified accordingly in order to overcome the spotted weaknesses. The modification actions taken are as follows. Firstly, in the stage of explaining the main points of action technique, the teacher should emphasize the speed of starting up, the speed of action and the speed of displacement, so that the athletes can give full play to the maximum speed of individual when they complete all kinds of technical actions. In order to achieve the purpose of special speed training experiment; Second, in the imitation exercise stage, students should ensure the completion of the learning tasks of each course according to the density and intensity of the training course; Thirdly, in the stage of consolidation and improvement, students should strengthen the consolidation practice and gradually improve the quality of reaction speed, movement speed and displacement speed. Teachers should ensure that the special speed training and developing speed ability run through the whole process of the training class. At the same time, ensure that the athletes' success score and time perception ability can be improved on the basis of fully developing the athletes' special speed ability.

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The second purpose of this pilot test is to validate the reliability and validity of the research instruments. The effects of badminton special speed training method (BSSTM) training intervention of test method of success score on badminton players and test method of time perception predictive skills performance of badminton players will be adopted the content validity of experts and retest reliability, the results of validity and reliability score is acquired from the pilot study test for variables of test method of badminton success scores and test method of time perception predictive skills performance from getting pilot study test. Next, validity and reliability of research instrument will be validated procedure shown in the following section.

3.6.1 Validity and Reliability

In this study, the content validity of the research instrument will be confirmed by the panel of experts in pre-testing phase of pilot study. The reliability of research instrument

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A and B will be confirming through retest reliability in pre-testing of pilot study. The content Validity and reliability of theses research instruments will be provided later in this section.

3.6.1.1 Validity of Instrument

Validity is the degree to which researchers measure what they want to measure. Validity can also be interpreted as the degree to which a research instrument can truly reflect the concept it expects to study (Wang, 2011). There are many kinds of validity and different classification methods. At present, the classification method proposed by Cohen, Manion, Morrison (2007) and Hongbiao (2009) is widely used. They believed that the methods of calculating validity include content validity (also known as expert validity), structural validity (also known as construct validity), and calibration validity (also known as demonstration validity).

In this study, the method of content validity was used to calculate the validity of the research instrument. Content validity refers to the appropriateness of the content in the observation instrument. Content validity is a judgment based on the theoretical basis and practical experience on whether the instrument reflects the variables to be measured, including enough items with proper content distribution ratio, and so on.

Content validity also known as expert validity. Content validity is to examine the nature of the instrument from the content. The commonly used method to determine the content validity is to judge the conformity between the test items and the range of the content involved by experts, which is a qualitative analysis method. The implementation of content validity requires that the number of survey experts should be 3-10, with 5 being more suitable. The survey experts should be related to the area covered by the research instrument.

In view of that explanation, evaluated on the item validity of research instrument of A，B and C in the pre-testing of pilot study. The evaluation opinions of the validity of research instrument in items include strongly agree, agree, undecided, disagree and

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strongly disagree. Expert validation of research instrument (part A, part B and part C) are shown in Appendix A. The contents of instrument part A is badminton special speed training method (BSSTM) training intervention, 13 items of instrument part A of badminton special speed training method (BSSTM) training intervention; The contents of instrument part B is test method of success score, 5 items of instrument part B of success score; The contents of instrument of instrument part C is test method of time perception predictive skills performance, 4 items of instrument part C of time perception predictive skills performance. In content validity, the expert questionnaire of research instrument need display that it reasonably and lengthily represents the area or questions that it meaning to signify (Cohen, Manion, & Morrison, 2007). Before going to this pilot data, the expert questionnaire (instrument part A, part B and part C) will be distributed to 5 badminton experts for content validity to made evaluation opinion, items of these questionnaire changes will be taking according to the results of experts evaluated opinion. After the revision of the questionnaire contents of instrument part A, instrument part B and instrument part C, the experts will conduct a questionnaire survey in pilot data. The content validity was calculated by 5 experts test method in of pre- testing stage of this pilot study, the content validity of research instruments tests the results on part A, part B and part C of instrument which show in Table 3.10.

Table 3.10

Evaluation Results of Research Instrument Validity

DV: BSSTM, SS and TPPSP

Sub-Variables	Content Validity	No. of Items
BSSTM	α = .963	13
SS	α = .956	5
TPPSP	α = .956	3

Note: α refer to Cronbach's Alph Coefficient. When the coefficient is between 0 and 1, the closer to 1, the better the consistency of content and the higher the level of information. BSSTM=badminton special speed training method; SS=success score; TPPSP=time perception predictive skills performance.

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3.6.1.2 Reliability of the Instrument

Reliability of the instrument refers to the degree of the consistency and stability of measurement results. The reliability of a questionnaire scale or test instrument means that the same results can be obtained by repeated application of the same measurements under the same measuring environment (Moser & Kalton, 2017). Reliability has three main characteristics: stability, internal consistency and equivalence. According to these three characteristics of reliability, the corresponding measurement method is: (a) Stability-retest reliability; (b) Consistency of Cronbach'a coefficient or content-half-fold reliability； (c) Equivalence-reliability between assessors. In this study, the method of retest reliability is used. The implementation process and analysis results of retest reliability are described in detail below.

Stability-retest reliability is the degree of consistency of the results obtained by measuring the same object twice or more with the same instrument. The higher the degree of consistency, the better the stability of the instrument. The calculation method of instrument stability is test-retest reliability. The specific operation method is to select 10-20 cases of research object, and use the research instrument to carry out the first test on the research object, and then use the same instrument to retest the research object after a period of time interval. Then the correlation coefficient of the two test results is calculated, which reflects the reliability of the research instrument retest. The correlation coefficient is between 0 and 1, the closer to 1, the higher the retest reliability. The higher the test-retest level, the research instrument is the more stable. The better the quality. Problems to be considered when using retest reliability: the interval between two measurements, the consistency of the measuring environment, and the properties of the variables measured by instrument.

Internal consistency refers to the internal consistency among the various items of the research instruments, that is, the homogeneity among the items in the questionnaire. The measurement method has a half-fold reliability or Cronbach's Alpha coefficient. The Cronbach'a coefficient is usually used in the reliability calculation method. The evaluation method is to evaluate a group of people with this tool, calculate the Cronbach's Alpha coefficient with SPSS software, select the analysis path and select

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the variables to be analyzed for reliability analysis. When the coefficient is between 0 and 1, the closer to 1, the better the consistency of content and the higher the level of information.

It is generally considered that the reliability coefficient should be higher than 0.6, A reliability of 0.9 means very well. The reliability of the test data is analyzed by using SPSS software through the retest method of three research instruments. In this study, the retest reliability of badminton special speed training method was tested by instrument part A of expert survey questionnaires (see in Appendix A) and Cronbach's Alpha was used to analyze the retest reliability of badminton specialized speed training method training intervention (see in Appendix A). Reliability statistics on training method of badminton specialized speed is Cronbach's Alpha. The reliability test of badminton success score scale (see in Part B of Appendix A) and time perception predictive skill performance test scale (see in Part C of Appendix A) obtained data through pre-testing on 15 experimental subjects in pilot study. First, 15 subjects were selected as pre-testing subjects, and the subjects were measured twice. Two measurement interval of 10 days, in pilot study, the Cronbach's Alpha coefficient of the two measuring scales. Specific reliability analysis results show the following.

Table 3.11

Evaluation Results of Research Instrument Reliability

DV: BSSTM, SS and TPPSP

Sub-Variables	Retest Reliability	No. of Items
BSSTM	r =.953	13
SS	r = .986	5
TPPSP	r = .974	3

Note: r refers to correlation coefficient. BSSTM=badminton special speed training method; SS=success score; TPPSP=time perception predictive skills performance.

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3.7 Procedure of Test Data Collection

After we have chosen the corresponding research design, an important step of the subsequent research procedure is how to collect the data accurately and effectively, so as to objectively and comprehensively reflect the real situation of the research problem. In a general way, data collection methods include observation, interview, questionnaire, testing, semantic analysis, content analysis and so on. But, in this study, the data collection mainly used expert observation and test method. The process of collecting data for this study is discussed in detail below.

Firstly, data collection on the basic physical education quality measure of the research subjects before first week in procedure of this experimental training intervention. Before the experiment was carried out, and then the researchers tested the basic physical fitness on experimental elite group 1 (n = 15), the control elite group 2 (n= 15). Test items include age (years old), height (cm), weight (kg), standing long jump (m), 60 meters run (Sec) and backward put the shot (m). After the experimental group and the control group were divided, the experimental group1 and control group2 tested with the above six items of basic information of population and basic sports quality. The tests will be conducted at the same time and place, and when the tests are completed, the researchers will collect and collate test data of the basic physical fitness.

Secondly, the data collection of the effect of badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) will be measured by scale of measuring instruments B and C on experimental group 1 and control group 2. In this experimental research, the measurement scale used in this experiment includes badminton success score scale and badminton athletes' time perception predictive ability scale. The two measurement scales have passed the reliability and validity tests. The results of the test accord with the experimental condition of using the scale. In the course of data collection in this study, according to the purpose of the research, the problems to be solved and the research design scheme, the test that needs to be completed is divided into three test points (pre-test, post-test 1 and delayed post-test 2). At these three test points, the test method is exactly the same as the test scale, that is, badminton success score scale B and badminton players time

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perception predictive ability scale C. The schedule of the test is scheduled according to the plan of the research program. At the end of each test point, the valid data are collated to provide effective data for the next step data analysis. The specific test schedule and methodology procedure are shown in the following Table 3.12 and Figure 3.17.

Table 3.12

Method of Data Collection

DV: SS and TPPSP

Test Point	Test Time	Data Collecting	Items
Pretest	First week	SS and TPPS	5 and 3
Posttest 1	13th week	SS and TPPS	5 and 3
Posttest 2	15th week	SS and TPPS	5 and 3

Note: BSSTM=badminton special speed training method; SS=success score; TPPSP=time perception predictive skills performance.

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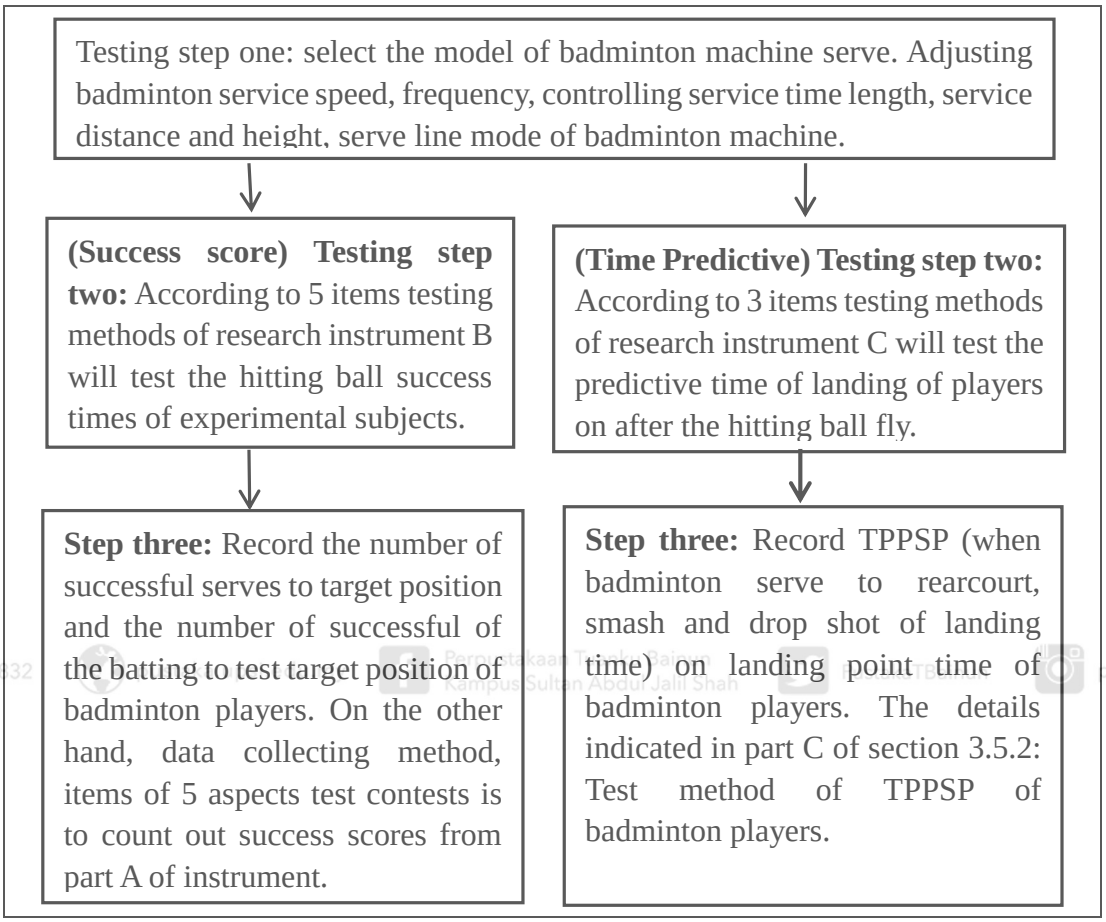
Figure 3.17 is indicated the testing step at three test points (pretest、posttest 1 and delay posttest 2). The specific test procedure has three testing steps. Step one is select the model of badminton machine serves. Adjusting badminton service speed, frequency, controlling service time length, service distance and height, serve line mode of badminton machine. Testing step two is according to the part B of 5 items testing methods of research instrument B test the hitting ball success times of experimental subjects, and part C of 3 items testing methods of research instrument test the predictive landing time of experimental subjects. Step three is recording and count test data (Figure 3.17).

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Figure 3.17

Figure 3.17 Shown 3 Items Testing Methods of Research Instrument Test the Predictive landing Time of the Experimental Subjects. Step Three Is Recording and Count Test Data. Testing Step at Pretest, Posttest 1 and Posttest 2



3.8 Data Analysis

In this study, when the data collection is completed, the selection of data analysis methods is based on the relationship between the need to solve the research question and design of research variable factors. The researcher should choose data analysis method of the most appropriate for the specific research questions will be reply and research hypothesis will be test and verify. So, the Independent-groups t-test will be employed data analysis of the collection data of basic physical education quality of the experimental subjects; Two-way between- groups ANOVA with post-hoc comparisons will be employ on data analysis of success score of elite badminton players; Multivariate analysis of variance (MANOVA)

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with post-hoc comparisons will be employ on data analysis of time perception predictive skills performance of drop points of elite badminton players. The details of the specific steps and processes of analyzing the experimental data are described in the following section:

3.8.1 Independent-Groups T-test Was Used in Data Analysis of Basic Physical Education Quality of the Experimental Subjects

Independent sample t-test, also called two independent samples t-test, is based on the independent samples from two populations to infer whether there are significant differences in the mean values of the two populations, and is suitable for testing whether the two samples come from populations with the same mean value (Xia , 2014). Independent two-sample t-test is used to compare the mean of two independent samples. The so-called independent sample means that there is no correlation between the two samples, that is, the sampling of one sample has no effect on the other sample, and the two independent samples adopted the same measurement scale and method. The number of samples may or may not be equal. The conditions of T test for independent samples are as follows: (a) two samples must be independent; (b) the samples from the population should be obeyed from the normal distribution. In the T test of independent two samples, we first assume that the original hypothesis Ho: assumes the mean value of the two samples is equal; Alternative hypothesis H1: Assume that the mean values of the two samples are not equal.

In this study, data analysis method of independent group's t-test will be adopted for data analysis of the collection data of basic physical education quality of the experimental subjects (Table 3.13). In the analysis process of experiment data. The test variables included age, height (cm), weight (kg), standing long jump (cm), and 60 meter run (seconds) and backward put the shot (m). The experimental group 1 and control group 2 of novice badminton players, the experimental group 1 and the control group 2 of expert badminton players were divided into two groups: experimental group 1 and control group 2. The basic physical index variables of the experimental group and the control group were taken as the conditions for the control of the experiment. If there was no significant

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difference in the basic physical fitness between the experimental group and the control group before the experimental implement. That is to say, using Levene F test method, SPSS automatically tests zero assuming (H_0) that the variance of the two groups is equal. If the P value corresponding to the F value is higher than the significant level, the variance of the experimental group and controlling groups is considered equal. Therefore, in order to control the experimental conditions, the sampling requirement of the same sports level subjects is the equal experimental group in before BSSTM training intervention and BTSTM training intervention experiment, the experimental subjects should not be significant difference in aspects of the basic physical education quality.

Table 3.13

Data Analysis Method

Data Analysis Method of Basic P.E. Quality of the Experimental Subjects.

Variables	Data Analysis Method
Age, Height (cm), Weight (kg)	Independent Groups T-test
Standing long jump (cm), Running in 60 meter (seconds), Backward put the shot (m)	

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3.8.2 Two-Way Between-Groups ANOVA Was Used in Data Analysis of Success Score

A study on success score of Badminton players. Independent variable factors include the two kinds of training methods (badminton specialized speed training method and badminton traditional speed training method) and three test points (pretest、posttest 1 and delay posttest 2). Dependent variable factor refers to success score. In this research design, according to two kinds of independents variables (one variable is training intervention of BSSTM and BTSTM, the other variable is three test points) and one dependents variable (success score). So, data analysis model of the research design is 2×2×3×1 factor model. In the research design of 2×2×3×1 factor model, data analysis method on test data of

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dependent variable should be employed two-way between-groups ANOVA with post-hoc comparison (as show in Table 3.14).

Table 3.14

Data Analysis Model of the Research Design is 2××2×3 ×1 Multiple Factors Model

IV (2×3 Model)	**DV**
(BSSTM and BTSTM) ×2 Groups ×(Three Test Points)	Success Scores
Design Model of Data Analysis	
2 IV ×2 Groups ×3 Test points ×1 DV	
Data Analysis Method	
Two-way between-groups ANOVA with post-hoc comparison	

Note: IV = Independent Variables (BSSTM and BTSTM); BSSTM = Badminton Special Speed Training Method; BTSTM = Badminton Traditional Speed Training Method. Fixed Factors include three test points = (Pre-test, Posttest 1 and Posttest 2) and 2 Groups (Group 1 and Group 2). DV = Dependent Variable (Success Scores).

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The two-way analysis of variance (ANOVA) operates in the same manner as the one-way ANOVA except that one-way ANOVA are examining an additional independent variable. Each independent variable may possess two or more levels. In a two-factor between-groups design, each participant has been randomly assigned to only one of the different levels of each independent variable. Each of the different cells represents the unique combinations of the levels of the two factors. In addition, to conduct the two-way between-groups ANOVA, the data must follow the normal distribution, Secondly, the data samples need to satisfy the homogeneity of variance, and each observation is independent of each other. Secondly, the data samples need to satisfy the homogeneity of variance, and each observation is independent of each other.

3.8.3 Multivariate Analysis of Variance (MANOVA) Was Used in Data Analysis of TPPSP of Drop Points of Badminton Players

A study on the performance of time perception Prediction skills of Badminton players. Independent variable factors include the two kinds of training methods (badminton

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specialized speed training method and badminton traditional speed training method) and three test points (pretest、posttest 1 and delay posttest 2). Dependent variable factors include time perception predictive skills performance (three kinds of dependent variable factors) of elite badminton players, three dependent variables (the time perception predictive skills performance) refer to time predictive threshold value of drop point of badminton serve to rearcourt of badminton players, the time predictive threshold value of drop point of badminton smash of elite badminton players and the time predictive threshold value of drop point of drop shot of elite badminton players. In this research design, according to two kinds of independents variables (one variable is training intervention of BSSTM and BTSTM, the other variable is three test points) and three kinds of dependents variables (the time predictive threshold of drop point of serve to rearcourt, the time predictive threshold of drop point of smash and the time predictive threshold of drop point of drop shot). So, data analysis model of the research design is 2×2×3×3 multiple factors model. In the research design of 2×2×3×3 multiple factors model, data analysis method on test data of three kinds of dependent variables should be employed multivariate analysis of variance (MANOVA) (as show in Table 3.15).

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Table 3.15

Data Analysis Model of the Research Design is 2×2×3×3 Multiple Factors Model

IV of two kinds of variable factors					**DV of 3 kinds**		
Training Method		Two Groups and Test Points			Threshold Value of TPPSP		
BSSTM	BTSTM	Groups Pre-test	Groups Posttest 1	Groups Posttest 2	Serve to Rearcourt	Smash	Drop Shot
Design Model of Data Analysis							
2 IV ×2×3×3 DV							
Data Analysis Method							
Multivariate analysis of variance MANOVA with post-hoc comparisons							

Note: 2 IV = 2 Independent Variables (BSSTM and BTSM); 3 DV = Dependent Variable (Threshold Value of Time Perception Predictive of Badminton Serve to Rearcourt, Smash and Drop Shot); BSSTM = Badminton Special Speed Training Method; BTSTM = Badminton Traditional Speed Training Method. Two Groups = Group 1 and Group 2.

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The extension of univariate analysis of variance (ANOVA) to the involvement of multiple dependent variables is termed multivariate analysis of variance (MNOVA). Same characteristic of one-way between-groups ANOVA and two-way between-groups ANOVA is only having one dependent factor variable. But multiple analysis of variance (MNOVA) have data of dependent variable of two or more than two. Multiple analysis of variance (MAOVA) can test and verify the effect of more levels of itself of more independent variable factors on more dependent variables in the same time, And the interaction between the factors. The hypotheses tested with MNOVA are similar to those tested with ANOVA accepted that sets of means replace the individual means specified in ANOVA. In addition, to conducted a MANOVA. In addition, in MANOVA, it is necessary to pay attention to the fact that the samples of each factor must be independent random samples, and the data must follow the normal distribution, and the variance of each population should be equal.

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3.9 Summary of Research Objectives, Research Questions, Hypotheses, and Data Analysis (as show in Table 3.16)

Table 3.16

As described in chapters 1 and 2, data analysis technique in chapter III will be adopted on discussion of research objectives, research questions, and hypothesis. These utilized in the current study, are displayed in sequential direction Table 3.16 below.

No.	Research Objectives	Research Questions	Hypotheses	Data Analysis
1	To investigate whether there are significant differences in the training effect of badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) on success score of Chinese elite badminton players (success scores of group 1 from pretest to posttest 1 and success scores between group 1 and group 2 at posttest 1).	**RQ1:** Is there any significance difference in the effect of badminton special speed training method (BSSTM) compared to badminton traditional training method (BTTM) on success score of Chinese elite badminton players (success scores of group 1 from pretest to posttest 1 and success scores between group 1 and group 2 at posttest 1)?	**H1:** There is the significance difference in the effect of badminton special speed training method (BSSTM) compared to badminton traditional training method (BTTM) on success score of elite badminton players (success scores of within-group 1 from pretest to posttest 1 and success scores between group 1 and group 2 at posttest 1).	Two-way between- groups ANOVA with post-hoc comparisons

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2	To investigate whether there are the retention of training effect of badminton special speed training method (BSSTM) on badminton score success of Chinese elite badminton players from post-test 1 to delay post-test 2.	**RQ2:** Is there any the retention of training effect of badminton special speed training method (BSSTM) on badminton score success of Chinese elite badminton players from post-test 1 to delay post-test 2?	**H2:** There is no significance difference in the retention effect of badminton special speed training method (BSSTM) compared to badminton traditional training method (BTTM) on badminton score success of Chinese elite badminton players from post-test 1 to post-test 2.	Two-way between- groups ANOVA with post-hoc comparisons
3	To investigate whether there are significant differences in the effect of badminton special speed training method and badminton traditional speed training method on time perception predictive skill performance of Chinese elite badminton players from pretest and posttest 1.	**RQ3:** Are there any significance difference in the effect of the badminton special speed training method compared to badminton traditional training method (BTSTM) on time perception predictive skill performance of Chinese elite badminton players from pretest to posttest 1?	**H3:** There are the significance difference in the effect of the badminton special speed training method (BSSTM) compared to badminton traditional training method (BTSTM) on time perception predictive skill performance of Chinese elite badminton players from pretest to posttest 1.	Multivariate analysis of variance (MANOVA) with post-hoc comparisons

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4	To investigate whether there are the retention of training intervention effect of badminton special speed training method (BSSTM) on time perception predictive skill performance of drop point of Chinese elite badminton players from post-test 1 to delay post-test 2.	**RQ4:** Are there any significance difference in the retention effect of the badminton special speed training method (BSSTM) compared to badminton traditional training method (BTSTM) on time perception predictive skill performance of elite Chinese badminton players from post-test 1 to delay post-test 2?	**H4:** There are the retention of training intervention effect of the badminton special speed training method (BSSTM) on time perception predictive skill performance of Chinese elite badminton players from post-test 1 to delay post-test 2.	Multivariate analysis of variance (MANOVA) with post-hoc comparisons

Note: Time perception predictive skills performance (TPPSP) of drop point of serve to rearcourt, smash and drop shot.

Delay posttest 2 refer to the results of tests after the stopping training intervention a week.

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3.10 Summary

This chapter has presented a discussion of research methodologies, which include the research design procedure of badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM), the sampling procedure of the experimental subjects, the training implement plan, the validity and reliability of research instrument tested procedure, test data collection procedure, data analysis method of the experimental design model. The experimental research is suitable for the application of quantitative research method, pretest, posttest 1 and delay posttest 2 experimental processing mode. According to the research task and time plan, the training model and training progress of the research experiment are determined. The research factors have been identified in the experimental study, the experimental test measurement scale was conformed through survey questionnaire on success score and time perception predictive skills performance of badminton players, the reliability and validity of the test results accord with the requirements of the test scale on the test scale of success score and time perception predictive skills performance. The methods of data collection, data analysis and the test methods of research are introduced in this chapter. The data analysis process and analysis results and the experimental findings will be described in chapter four and chapter five.

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CHAPTER 4

DATA ANALYSIS

4.1 Introduction

This chapter mainly discussed the results of data analysis of three sections. The first section was used the independent-groups t-test, in the process of the independent-group's t-test, collected data of variable are the demography information and the basic sports physical quality of the experimental subjects. Aim of data analysis is to investigate whether there are significant differences in the demography information and the basic sports physical quality of the experimental subjects. Research controlled condition require there is not a significant difference in the demography information and the basic sports physical quality of the experimental subjects. The experimental sampling is guaranteed to be the same level.

Second section was used two-way between-groups analysis of variable (ANOVA) on the analysis of success scores (SS) of 30 elite badminton players. Research purpose is to investigate whether there is a significant difference in the effect of badminton special speed training method (BSSTM) on success score of Chinese elite badminton players from pre-test to posttests. Second purpose is investigated whether there is the retentive effect of badminton special speed training method (BSSTM) on success score of Chinese elite badminton players from post-test 1 to post-test 2. At the same time, these result of data analysis in study 1 can reply research question 1 (RQ 1) and research question 2 (RQ 2), and these results of data analysis in study 1 also test

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and verity research hypothesis 1 ($H_{1)}$ and research hypothesis 2 (H_2).

Third section was used multivariate analysis of variance (MANOVA) on the analysis of time perception predictive skills performance (TPPSP) of 30 elite badminton players. Research purpose is to investigate whether there are the significant differences in the effect of badminton special speed training method (BSSTM) on time perception predictive skills performance of Chinese elite badminton players at pre-test and posttests; Second purpose is investigate whether there are the retention effect of badminton special speed training method (BSSTM) on time perception predictive skills performance of Chinese elite badminton players from post-test 1 to post-test 2. These results of data analysis can reply research 1 (RQ 1) and research 2 (RQ 2) in study 2, and test and verity hypothesis 1 ($H_{1)}$ and hypothesis 2 (H_2) of study 2.

4.2 Independent-groups T-test on Demography Information and the Basic Sports Physical Quality of the Experimental Subjects

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This section was adopted the data analysis method of independent group t-test. Data of analysis came from the collected data of demography information and the basic sports physical quality on the experimental group (group 1) and control group (group 2). In the case of t-test of the independent-groups on demography information of the experimental subjects, purpose of t-test is test whether there is a significant difference in demography information of the experimental subjects, criteria are CI (.95). Groups of t-test are groups 1 (experiment group) and group 2 (control group), dependent variables are age、height、weight、standing long jumping、60-meter run、backward the put shot. The t-test analysis of between-groups mainly shown the results of statistics and independent samples test. Group statistics included groups, sample number, mean, Std. deviation, Std. error mean. Independent samples test mainly shown Levene's test for equality of variance (F and Sig.), t-test for equality of means (Sig. 2-tailed), and 95% confidence interval of the difference. The results of the independent-groups t-test, if given that Leven’s test has a probability greater than .05, researcher can assume that the population variances are relatively equal. Therefore, data of variables in this study can use the t-value, df. and two- tail significance for the equal variance estimates to determine whether demography information and the

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basic sports physical quality of between-groups differences exist. The two-tail significance for without additive indicates that p > .05, therefore, is not significant. This study therefore accepts the null hypothesis and reject the alternative hypothesis. The group 1 and group 2 must come from the same population because no significant difference exist- t (df) = value, that is p > .05. The following divided section was stated the results of group statistics and independent sample test on test collection data of 6 variables data (show in section 4.2.1 and 4.2.2).

4.2.1 Independent-groups T-test on Demography Information of the Experimental Subjects

First, the result of the independent- groups t-test of ages of the experimental groups (show in Table 4.1). T-test result of age variable of group 1 and group 2 shown that F value was 0.58, the concomitant probability was 0.45, which was higher than the significant level of 0.05 (p > 0.05). Therefore, the assumption of equal variance (equal variances assumed) could not be rejected, and group 1 and group 2 had no significant difference in the age variable. Then looking at the result of t-test when variance is equal, the associated probability of t- statistic is 0.59, which is higher than the significant level of 0.05. The zero hypothesis (H_0) of t-test cannot be rejected. That is to say, there is no difference in the age mean of group 1 and group 2 (Sig. 2-tailed: p = .59 > 0.05).

Second, the result of the independent-groups t-test on height of the experimental groups (show in Table 4.1). T-test result of height variable of group 1 and group 2 shown that F value was 0.005, the concomitant probability was 0.94, higher than the significant level of 0.05, so the assumption of equal variance could not be rejected. It could be concluded that the height variance of group 1 and group 2 had no significant difference. Then looking at the result of T test when variance is equal, the associated probability of T statistic is 0.96, which is higher than the significant level of 0.05. The zero hypothesis (H_0) of T test cannot be rejected. That is to say, there is no difference in the average height of group 1 and group 2 (Sig. 2-tailed: p = .96 > 0.05).

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Third, the result of the independent-groups t-test for weigh of the experimental groups (show in Table 4.1). T test result of weight variable of group 1 and group 2 shown that F value was 0.103, the concomitant probability was 0.75, weight than the significant level of 0.05, so the assumption of equal variance could not be rejected. It could be concluded that the weight variance of group 1 and group 2 had no significant difference. Then looking at the result of T test when variance is equal, the associated probability of T statistic is 0.70, which is higher than the significant level of 0.05. The zero hypothesis (H_0) of t-test cannot be rejected. That is to say, there is no difference in the average weight of group 1 and group 2 (Sig. 2-tailed: p = .70 > 0.05). All in all, the results of t-test showed that there was no significant difference in demography information (ages, heights and weights) between group 1 and group 2 (p > 0.05) (shown in Table 4.1). So, the result of independent sample t-test meets the experimental conditions, it will be as one of the controlled conditions of this experiment.

Table 4.1

T-test on Demography Information

Results of T-test on the demography information of Groups

Variables	N	Mean ± SD Group 1	Mean ± SD Group 2	Sig. (2-tailed) T-test
Age	15	20.13 ± 0.99	20.33 ± 1.04	.59
Height	15	177.86 ± 4.62	177.80 ± 4.49	.96
Weight	15	68.53 ± 4.13	69.13 ± 4.34	.70

4.2.2 Independent-groups T-test on the Basic Physical Education Quality of the Experimental Subjects

Fourth, the results of data analysis on the standing long jumping between group 1 and group 2 by the t-test of independent group. T-test result of the standing long jumping variable of group 1 and group 2 shown that F value was 0.004, the concomitant probability was 0.94, the standing long jumping than the significant level of 0.05, so the assumption of equal variance could not be rejected. It could be concluded that the standing long

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jumping variance of group 1 and group 2 had no significant difference. Then looking at the result of t- test when variance is equal, the associated probability of t statistic is 0.64, which is higher than the significant level of 0.05. The zero hypothesis (H_0) of t-test cannot be rejected. That is to say, there is no difference in the standing long jumping between group 1 and group 2. The result of t-test for the Standing Long jumping (Sig. 2-tailed: p = .64 > 0.05) (show in Table 4.2).

Fifth, the result of the independent-groups t-test for 60-meter run. T test result of 60-meter run variable of group 1 and group 2 shown that F value was 0.29, the concomitant probability was 0.59, sixty meter run than the significant level of 0.05, so the assumption of equal variance could not be rejected. It could be concluded that the weight variance of group 1 and group 2 had no significant difference. Then looking at the result of t-test when variance is equal, the associated probability of t- statistic is 0.23, which is higher than the significant level of 0.05. The zero hypothesis (H_0) of t-test cannot be rejected. That is to say, there is no difference in the 60-meter run between group 1 and group 2 (Sig. 2-tailed: p = .23 > 0.05) (show in Table 4.2).

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Sixth, the result of T-test on the backward the put shot of the experimental subjects. T-test result of the backward put shot variable of group 1 and group 2 shown that F value was 0.24, the concomitant probability was 0.62, the backward put shot than the significant level of 0.05, so the assumption of equal variance could not be rejected. It could be concluded that the backward put shot variance of group 1 and group 2 had no significant difference. Then looking at the result of T test when variance is equal, the associated probability of T statistic is 0.63, which is higher than the significant level of 0.05. The zero hypothesis (H_0) of T test cannot be rejected. That is to say, there is no difference in the backward the put shot between group 1 and group 2 (Sig. 2-tailed: p = .63 > 0.05) (show in Table 4.2). All in all, the results of statistical analysis and independent sample t-test showed that there was no significant difference in basic sports physical quality between the experimental group (group 1) and the control group (group 2) (p > 0.05) (as shown in Table 4.2).

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Table 4.2

T-test on the Basic Physical Education Quality

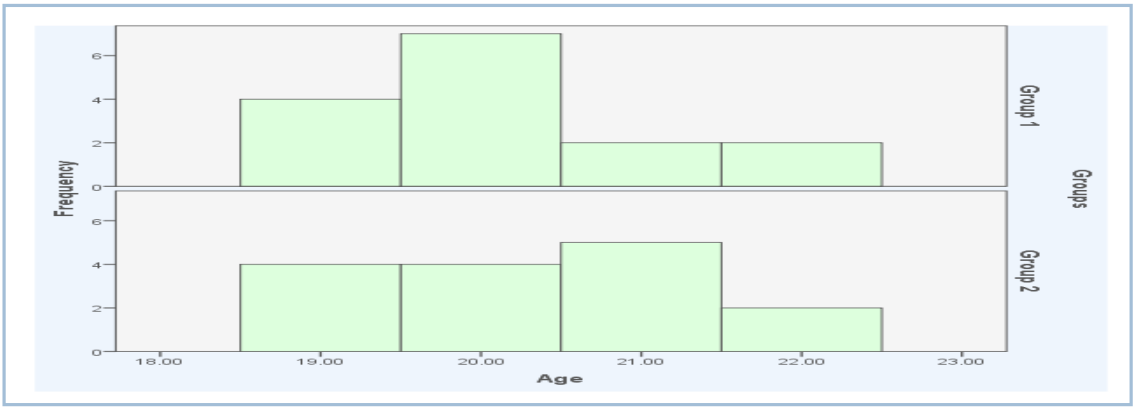
Results of T-test on the basic Physical Education Quality of Groups

Variables	N	Mean ± SD Group 1	(Mean ± SD) Group 2	Sig. (2-tailed) t-test
Standing Long Jump	15	2.66 ± 0.09	2.67 ± 0.09	.64
60 Meter Run	15	12.36 ± 0.35	12.52 ± 0.32	.23
Backward the Put Shot	15	11.60 ± 0.86	11.21 ± 0.87	.63

4.2.3 Histogram Frequency of Distribution between Demography Information and the Basic Sports Physical Quality of Experimental Subjects

Histogram describes the frequency of continuous data falling into an interval by the length of the bar. The length and width of the histogram band have specific meanings. In this section, the histogram will be drawn to describe the data size and frequency of the quantitative variables of the test on experiment subjects, so that the analyst can grasp the basic statistical characteristics of the data and grasp the overall distribution of the test data. It plays an important role in the further analysis of data and data modeling. The histogram of the collection data of the test variables in this study is described demography information and the basic sports physical quality of experimental subjects in the following contents.

Figure 4.1. Histogram Frequency of Distribution of Age of Groups



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Figure 4.2

Histogram Frequency of Distribution of Height of Groups

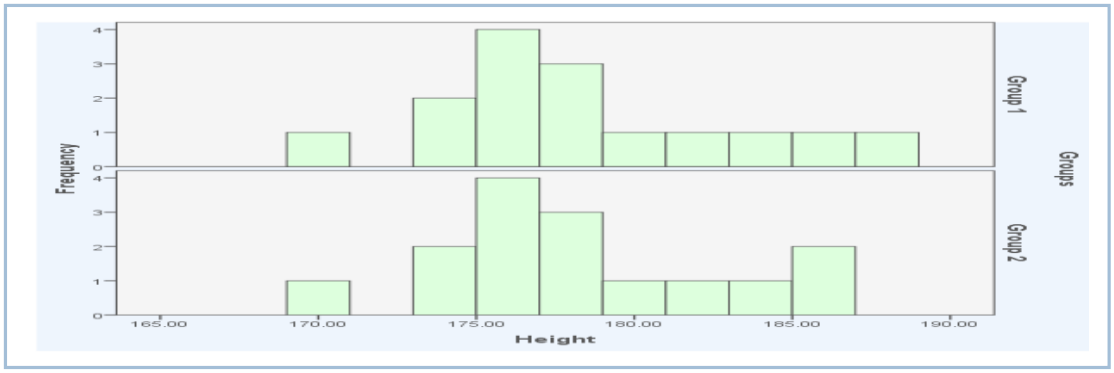


Figure 4.3

Histogram Frequency of Distribution of Weight of Groups

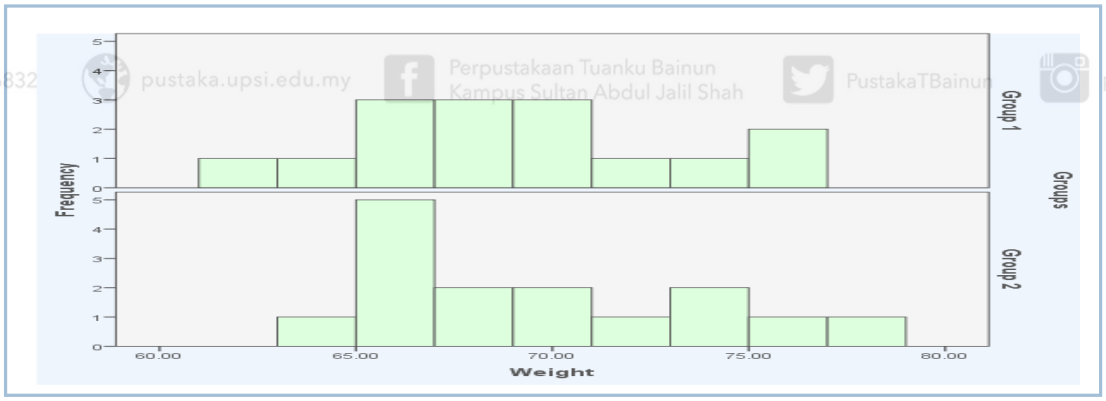
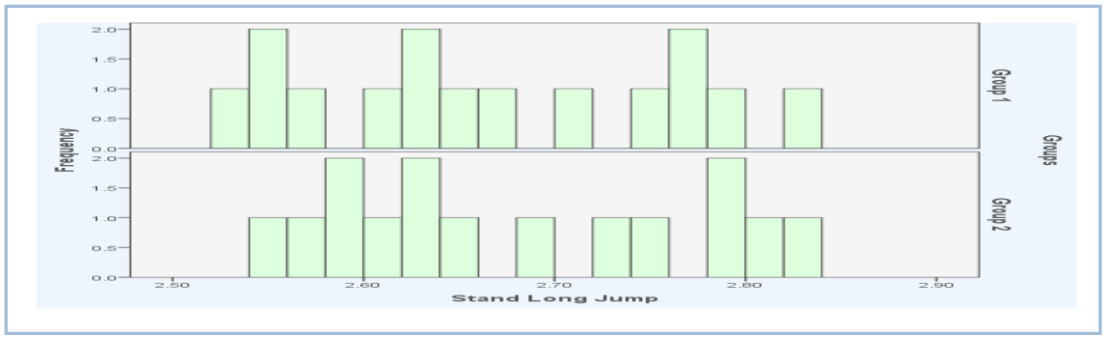


Figure 4.4

Histogram Frequency of Distribution of the Standing Long of Groups



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Figure 4.5

Histogram Frequency of Distribution of 60 Meter Run of Groups

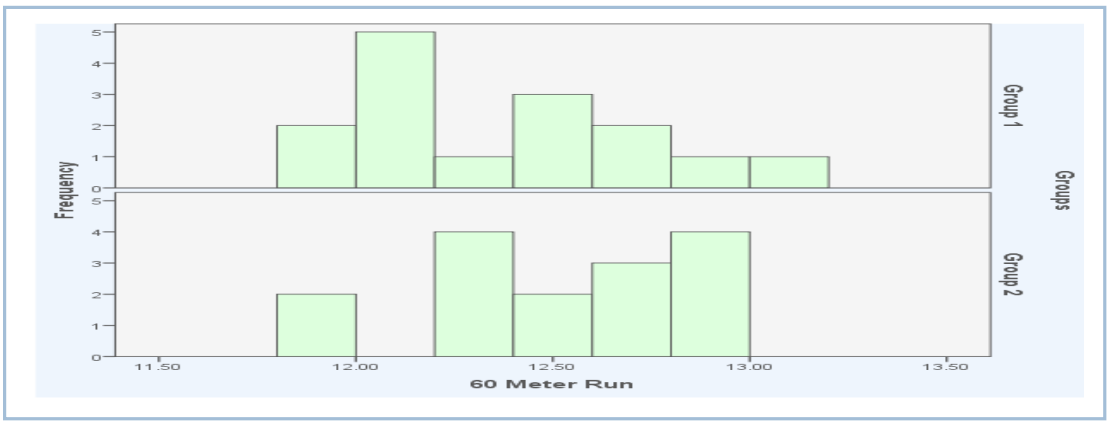
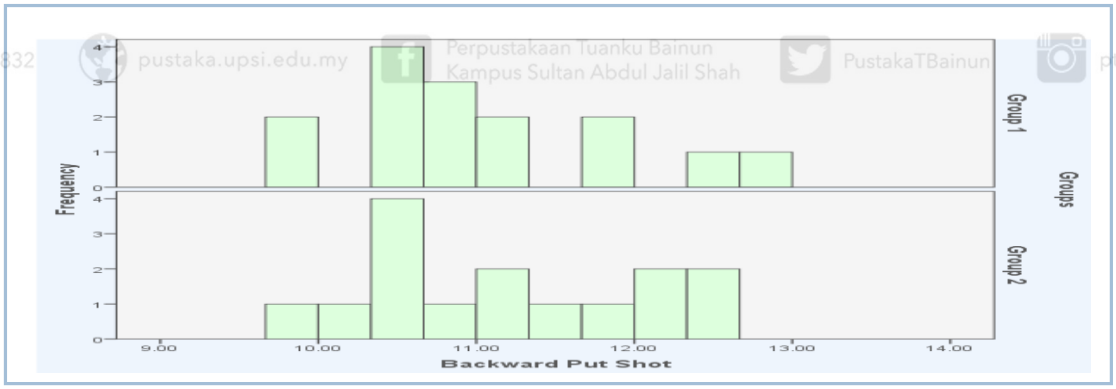


Figure 4.6

Histogram (normal) Frequency of Distribution of the Backward Put Shot of Groups



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4.3 Two Way Between-Groups ANOVA Was Used on Data Analysis

The first aim of the current study 1 is to investigate whether there are significant differences in the effect of badminton special speed training method (BSSTM) compare badminton traditional speed training method (BTSTM) on success score elite's badminton players. This second aim is to investigate whether there are significant differences in the effect of badminton special speed training method (BSSTM) compare badminton traditional speed training method (BTSTM) on time perception predictive skills performance of elite's badminton players. Data collection come from three test

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points (pre-test, posttest 1 and posttest 2), data was collected procedure through the testing method on success score and time perception predictive skills performance. Furthermore, the results of data analysis could reply research questions and verified research hypothesis.

Study 1 of in this study, the analysis method of two-way between-groups ANOVA with post-hoc comparison was employed on success scores of elite badminton players. Data analysis program of success scores need to show out the results of five blocks. First block is the result of descriptive statistics; Second block is the results of normality distribution test and homogeneity of variance test; Third block is the result of tests of between-subjects effects. Fourth block is the result of tests of post hoc tests (multiple comparisons); Fifth block is mean plots of estimated marginal mean of success scores. The results of the data analysis are described separately in the following by these blocks.

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4.3.1 Descriptive Statistics on Success Scores

In this study, the results of descriptive statistics of success score of group 1 and group 2 at three test points (as shown in Table 4.3). The results of descriptive statistics of success score mainly show the mean and standard deviation at each intervention levels and three test points. From the results of descriptive statistics of within-group and between-groups, the details were shown in Table 4.3.

First of all, the results of mean value comparisons within-group 1 at three tests points (as shown in Table 4.3). The mean value of success score of pre-tests (mean = 12.73) is lower than that of post-test 1 (mean = 14.66) and posttest 2 (mean = 14.86), and the mean of post-test 1 is similar to that of post-test 2. Next, the results of mean value of success scores within group 2 at three test points (as shown in Table 4.3). The results of descriptive statistics was shown the mean value (12.66) at pre-test is similar to post-test 1 and post-test 2 (12.86 and 12.93).

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Table 4.3

Descriptive Statistics

Descriptive Statistics on Success Scores of Groups at Three Test Points

IV	DV	Mean ± SD	N
Without Intervention	SS of Group 1 at Pre-test	12.73 ± 2.86	15
BSSTM Intervention	SS of Group 1 at Posttest 1	14.66 ± 2.05	15
Without Intervention	SS of Group 1 at Posttest 2	14.86 ± 2.16	15
Without Intervention	SS of Group 2 at Pre-test	12.66 ± 2.43	15
BTSTM Intervention	SS of Group 2 at Posttest 1	12.86 ± 2.13	15
Without Intervention	SS of Group 2 at Posttest 2	12.93 ± 1.90	15

4.3.2 Test of Normality Distribution and Homogeneity of Variance

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The study conducts before the analysis by two-way between-groups ANOVA on success score. The researcher must ensure that the necessary assumption is met. The assumption for two-way ANOVA are the same as those for the one-way ANOVA: (1) Population normality: The populations from which the samples have been drawn should be normal, check this for each group using normality statistics such as one-sample Kolmogorov-Smirnov. (2) Homogeneity of variance: The success scores in each group should have homogeneous variances.

To conduct population normality test by one-sample Kolmogorov-Smirnov test method. Before the two-way between-groups ANOVA with post-hoc comparison test on success scores of group 1 and group 2. Firstly, it is necessary to set the normal distribution test for the data to determine whether the data satisfies the precondition of the two-way variance analysis. The normal distribution test of the one-sample Kolmogorov-Smirnov test was employed on success scores of badminton players. In set of this study, one-sample Kolmogorov-Smirnov test the variable of success scores (SS) at three test points. These variables include success scores of groups 1 at pretest, success scores of group 1 at posttest 1, success scores of group 1 at posttest 2, success

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scores of group 2 at pretest, success scores of group 2 at posttest 1, and success scores of group 1 at posttest 2. The test results of One-Sample Kolmogorov-Smirnov (K-S) on success scores indicated that the value of mean, standard deviation, the Z value of test statistic and Sig. (2-tailed).

The results of the normal distribution test on success scores (SS) of badminton players shown in Table 4.4. Data came from success score between group 1 and group 2 at three test points, the normal distribution test is employed one-sample Kolmogorov-Smirnov. The result of the one-sample Kolmogorov-Smirnov test of success scores of group 1 at pretest shown that $z = 0.19$, $p = 0.13^{c} > 0.05$. The result of the one-sample Kolmogorov-Smirnov (K-S) test of success scores of group 1 at posttest 1 shown that $z = 0.16$, $p = 0.20^{c,d} > 0.05$. The result of the one-sample Kolmogorov-Smirnov (K-S) test of success scores of group 1 at posttest 2 shown that $z = 0.189$, $p = 0.15^{c} > 0.05$; The result of the one-sample Kolmogorov-Smirnov (K-S) test on success scores of group 2 at pretest shown that $z = 0.11$, $p = 0.20^{c,d} > 0.05$. The result of the one-sample Kolmogorov-Smirnov (K-S) test on success scores of group 2 at posttest 1 shown that $z = 0.12$, $p = 0.20^{c,d} > 0.05$. The result of the one-sample Kolmogorov-Smirnov (K-S) test on success scores of group 2 at posttest 2 shown that $z = 0.17$, $p = 0.20^{c,d} > 0.05$.

All in all, the results of the one-sample Kolmogorov-Smirnov (K-S) (NORMAL) test on success scores (SS) between group1 and group 2 at three test points, the results indicated that the all p value greater than 0.05 (as shown in Table 4.4). So, two-way between-groups ANOVA with post-hoc comparison test on success scores can be conducted.

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Table 4.4

Test of Normality Distribution

Test of One-Sample Kolmogorov-Smirnov on Success Scores of Groups at Three Test Points

Group (N = 15)	Normal Parameters[a,b] Mean ± Std. Deviation	Test Statistic Z	Sig. (2-tailed)
Group 1 Pre-test	12.73 ±2.68	.19	.13[c]
Group 1 Posttest 1	14.66 ±2.05	.16	.20[c,d]
Group 1 Posttest 2	14.86 ±2.16	.18	.15[c]
Group 2 Pre-test	12.66 ±2.43	.11	.20[c,d]
Group 2 Posttest 1	12.86 ±2.13	.12	.20[c,d]
Group 2 Posttest 2	12.93 ±1.90	.17	.20[c,d]

a. Test distribution is Normal. b. Calculated from data.

b. Lilliefors Significance Correction.

c. This is a lower bound of the true significance.

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To conduct homogeneity of variance test by Levene's test of equality of error variances[a] test method. The results of homogeneity of variance test on success scores of the experimental groups shown in Table 4.5, the results employed the Levene's test of equality of error variances[a] test on success score of the between group 1 and group 2 at three test points. The result of Levene's test of equality of error variances[a] test told that the homogeneity of variance assumption has not been violated. The output illustrated that the main effects for success scores of between group 1 and group 2 at three test points are not significant ($p = .84 > 0.05$). Therefore, it can be inferred that the homogeneity variance of data analysis of success scores (success scores of group 1 and group 2 at three test point) is true. The next step of variance analysis can be conducted. The details result of Levene's test of equality of error variance on data analysis of success scores shown in the following Table 4.5.

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Table 4.5

Test of Homogeneity of Variances

Levene's Test of Equality of Error Variances[a] on SS of Two Groups at Three Test Points.

F	df1	df2	Sig.
.40	5	84	.84

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Test Points

4.3.3 Between-Subjects Effects

The results of tests of between-subjects effects mainly indicated that source of variation, sum of squares, df, mean square, F and significant, Etc., the corrected model is mainly used to test the variance analysis model, and all the factors in the model are the *original* hypothesis. In Table 4.6, the F value of the correction model is 3.10, p = .01, which reaches a very significant level, from which it can be inferred that at least one of the factors in the analysis has an effect on the improvement of the success score of at the different test points. At the same time, the output also shows that there is a significant main effect (that is test points: p = .01< .05). That is, the influence of training intervention of test points on success scores improved dependent on whether the different training intervention method have been performed at different test points. So, with a significant main effect, post-hoc analysis is required. The "multiple comparison tables" in post-hoc analysis mainly show which factors are affected on dependent variables (success score) and the degree of significance of the influence (as shown Table 4.6).

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Table 4.6

Tests of Between-Subjects Effects

Tests of Between-Subjects Effects on Success Scores of Badminton Players

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	78.32[a]	5	15.66	3.10	.01
Intercept	16294.67	1	16294.67	3228.19	.00
Test Points	78.32	5	15.66	3.10	.01
Error	424.00	84	5.04		
Total	16797.00	90			
Corrected Total	502.32	89			

a. R squared = .15 (Adjusted R squared = .10)

Comparison of marginal means of success score (SS) show that marginal means of (success score) SS of group 1 at pre-test is similar to that of three test points of group 2. Marginal Means of success score (SS) of two posttest points of group 1 is higher than marginal means of each test points of group 2 (as shown in Table 4.7).

Table 4.7

Estimated Marginal Means

Estimated Marginal Means on Success Scores of Groups at Three Test Points

Test Points	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Group 1 Pre-test	12.73	58	11.58	13.88
Group 1 Posttest 1	14.66	58	13.51	15.82
Group 1 Posttest 2	14.86	58	13.71	16.02
Group 2 Pre-test	12.66	58	11.51	13.82
Group 2 Posttest 1	12.86	58	11.71	14.02
Group 2 Posttest 2	12.93	58	11.78	14.08

a. Based on modified population marginal mean

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4.3.4 Multiple Comparisons on Success Score

In post hoc tests. The results of the multiple comparison on success scores between group 1 and group 2 was been shown in Table 4.8. Between group 1 and group 2 at three test points (pre-test, posttest 1 and posttest 2) by data analysis method of least significant difference (LSD). Based on observed means, the error term is mean square (Error) = 5.04. In *. The mean difference is significant at the .05 level. The results of the multiple comparison of successful scores are indicated from the post hoc tests of Table 4.8.

First of all, whether there are the significant of mean difference of comparison of within-group 1 at three test points by the least significant difference test (LSD). The results of least significant difference (LSD) test on success score of within-group 1 indicated there is a significant difference in the mean success scores of group 1 at pre-test compared to group 1 at posttests (posttest 1 and delay posttest 2), the probability p values are 0.02 and 0.01 respectively, that is, $p = .02 < 0.05$ and $p = .01 < 0.05$. That is to say, there is significance difference in the effect of badminton special speed training method (BSSTM) on success score of elite Chinese badminton players from pretest to posttests. Therefore, it can be inferred that the special speed training of badminton (BSSTM) has a significant effect on the development and improvement of the successful scores of badminton players. This conclusion fully proves that the special speed training method established in this study has the practical significance of training. At the same time, the results of least significant difference (LSD) test on success score of within-group 1 indicated there is no significant difference in the mean comparisons of success scores at posttests (posttest 1 and posttest 2). The probability p values are 0.808, that is, $p = .80 > 0.05$. Therefore, there is significance in the retention effect of badminton special speed training method (BSSTM) on badminton score success of elite badminton players from post-test 1 to delay post-test 2. That is to say, after three months of special speed training for badminton, the success score of badminton players has been significantly improved, and its training effect can be maintained after stopping training. This conclusion can be inferred that the special training method of badminton adopted in this experiment is true to the development and improvement of badminton players' successful scores. Meanwhile, second,

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whether there are the significant of mean difference of comparison of within-group 2 at three test points by the least significant difference test (LSD). The results of least significant difference (LSD) test on success score of within-group 2 indicated there is no significant difference in the mean success scores of group 2 at pre-test compared to group 2 at posttests (posttest 1 and delay posttest 2), the probability p values are 0.80 and 0.74 respectively, that is, $p = .80 > 0.05$ and $p = .74 > 0.05$. At the same time, the results of least significant difference (LSD) test on success score of within-group 2 indicated there is no significant difference in the mean comparisons of success scores at posttests (posttest 1 and posttest 2). The probability p values are 0.93, that is, $p = .93 > 0.05$. That is to say, there is no significance difference in the effect of badminton traditional speed training method (BTSTM) on success score of elite Chinese badminton players from pretest to posttests. Therefore, it can be inferred that the badminton traditional speed training method (BTSTM) did not has a significant effect on the development and improvement of the successful scores of badminton players. This conclusion fully proves that the badminton traditional speed training method of has no obvious effect on improving the successful scores of badminton players.

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Third, whether there are the significant of mean value comparison of three test points from group 1 compare to group 2 by the least significant difference test (LSD). The results of least significant difference (LSD) test on success score between group 1 at pre-test and group 2 at three test points indicated there are no significant difference, the probability p values are 0.93, 0.87 and 0.80 respectively, that is, $p = .93 > 0.05$, $p = .87 > 0.05$ and $p = .80 > 0.05$. In addition, the results of least significant difference (LSD) test on success score from group 2 at pre-test compare to group 2 at posttests indicated there are no significant difference, the probability p values are 0.80, 0.74 and 0.93 respectively, that is, $p = .80 > 0.05$, $p = .74 > 0.05$ and $p = .93 > 0.05$. That is to say, there are no significance difference in the effect of badminton traditional speed training method (BTSTM) on the improvement of success scores of badminton players, therefore, it can be inferred that the badminton traditional speed training method (BTSTM) has no significant effect on the development and improvement of the successful scores of badminton players.

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Fourth, the results of least significant difference (LSD) test on success score of group 1 at two posttests test points and group 2 at three test points indicated there are significant difference. The probability p values of group 1 at posttest 1 compared to group 2 at three test points are 0.01, 0.03 and 0.03, that is, $p = .01 < 0.05$, $p = .03 < 0.05$ and $p = .03 < 0.05$. At the same time, the probability p values of group 1 at posttest 2 compared to group 2 at three test points are 0.01, 0.01 and 0.02, that is, $p = .01 < 0.05$, $p = .03 < 0.05$ and $p = .03 < 0.05$. The results of least significant difference (LSD) test on success score of group 1 at posttests and group 2 at three test points indicated there are significance difference in the effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on success score of elite Chinese badminton players. Therefore, it can be inferred that the badminton traditional speed training method (BTSTM) did not has a significant effect on the development and improvement of the successful scores of badminton players. In addition, it can be inferred that the badminton special speed training method (BTSTM) has a significant effect on the development and improvement of the successful scores of badminton players (as shown in Table 4.8).

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Table 4.8

Multiple Comparisons

Multiple Comparisons on Success Scores of Group 1 and Group 2 at Three Test Points by the Least Significant Difference *(LSD) Test*

(I) Test Points	(J) Test Points	Mean Difference	Std. Error	Sig.
Group 1 Pre-test	Group 1 Posttest 1	-1.93*	.82	.02
(Within Group 1)	Group 1 Posttest 2	-2.13*	.82	.01
Group 1 Pre-test	Group 2 Pre-test	.06	.82	.93
(Between-	Group 2 Posttest 1	-.13	.82	.87
Groups)	Group 2 Posttest 2	-.20	.82	.80
Group 1 Pre-test	Group 1 Posttest 2	-.20	.82	.80
(Within Group 1)	Group 2 Pre-test	2.00*	.82	.01
(Between-	Group 2 Posttest 1	1.80*	.82	.03
Groups)	Group 2 Posttest 2	1.73*	.82	.03
Group 1 Posttest 2	Group 2 Pre-test	2.20*	.82	.00
(Between-	Group 2 Posttest 1	2.00*	.82	.01
Groups)	Group 2 Posttest 2	1.93*	.82	.02
Group 2 Pre-test	Group 2 Posttest 1	-.20	.82	.80
(Within Group 1)	Group 2 Posttest 2	-.26	.82	.74
Group 2 Posttest 1	Group 2 Posttest 2	-.06	.82	.93

Based on observed means. The error term is mean square (Error) = 5.04.

*. The mean difference is significant at the .05 level.

4.3.5 Profile Plots of the Estimated Marginal Mean of Success Scores

Profile plots of the estimated marginal mean is mainly used to show the effect of different test points and training intervention method on badminton players' success scores. In addition, the profile of estimated marginal mean can also show the effect of

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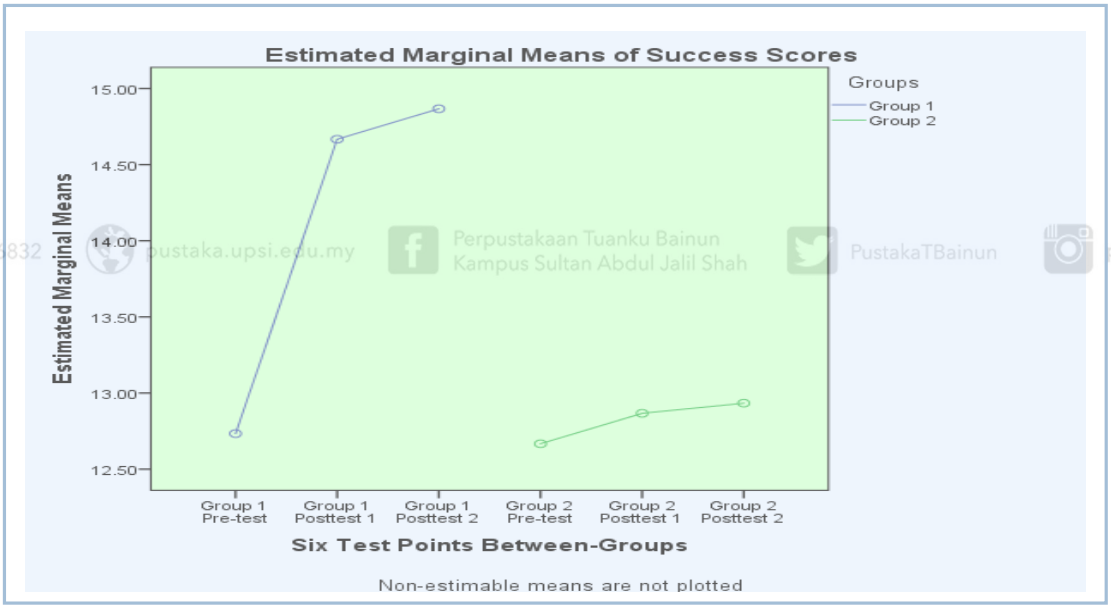
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different training intervention methods on the improvement of badminton players' success score. It can be found from the graph that the badminton special speed training method (BSSTM) established in this experiment has a significant effect on the development and improvement of badminton players' successful scores. However, the badminton traditional speed training method (BTSTM) has no significant effect on the improvement of badminton players' success scores (Figure 4.7).

Figure 4.7

Profile Plots

Profile Plots of Success Scores between Group 1 and Group 2 at Three Test Points



4.3.6 Histogram Frequency of Success Scores of Two Groups at Three Test Points

In this study 1, we introduce the frequency of statistics analysis data of success scores of group 1 and group 2 at three test points through histogram frequency (Figure 4.8). The distribution of observed data (success score) can be further understood by histogram, and the height of each rectangle represents the frequency of each group of data.

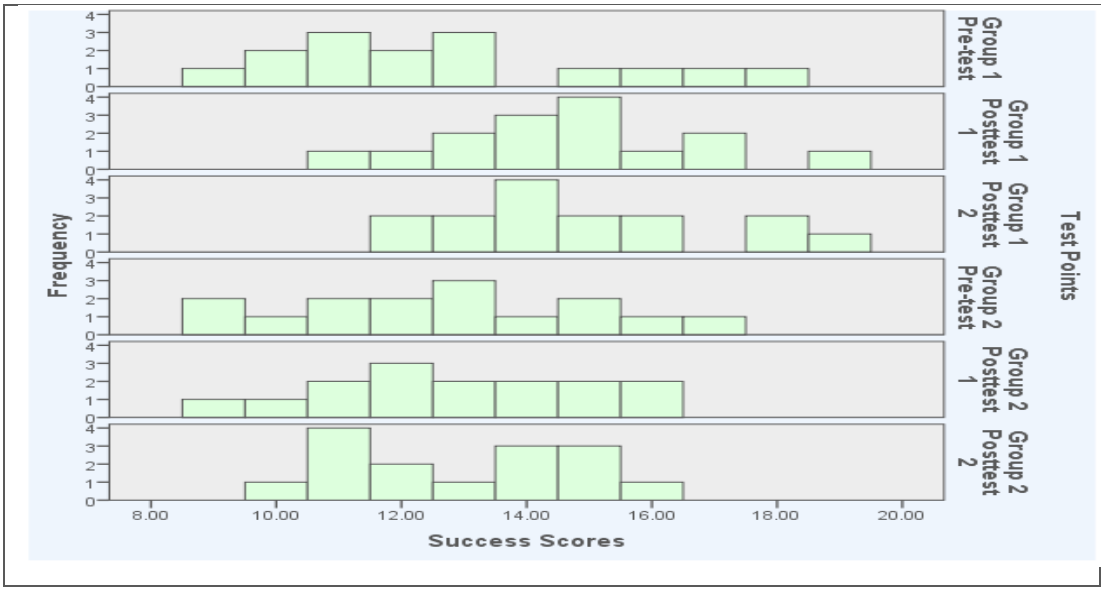
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Figure 4.8

Histogram Frequency

Histogram Frequency of Success Scores of Groups at Three Test Points



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4.4 Multiple Analysis of Variance Was Used on Time Perception Predictive Skills Performance of Drop Point of Badminton Players

In study 2, multiple analysis of variance (MANOVA) with post-hoc comparison will be employed in time perception predictive skills performance (TPPSP) of elite badminton players. Data analysis program of time perception predictive skills performance need to show out the results of six blocks. First block is the results of normality distribution test on time perception predictive skills performance; Second block is the results of hypothesis test (the results of the Box's test of equality of covariance matrices[a.]) of time perception predictive skills performance; Third block is the results of test of homogeneity of variances of the time perception predictive skills performance of drop point of badminton players. Forth block is the result of descriptive statistics on time perception predictive skills performance; Fifth block is the result of tests of between-subjects effects on time perception predictive skills performance; Sixth block is the result of tests of post hoc tests (multiple comparisons) on time perception predictive

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skills performance; Seventh block is mean plots of estimated marginal mean of time perception predictive skills performance. The results of the data analysis are described separately in accordance with these blocks.

4.4.1 Nonparametric Tests on Time Perception Predictive Skills Performance of Drop Point of Badminton Players

Before the multiple analysis of variance (MANOVA) with post-hoc comparison test on time perception predictive skills performance of drop shot points of badminton players at three test points, it is necessary to set the normal distribution test for the data to determine whether the data satisfies the precondition of the multiple analysis of variance (MANOVA). Next, the normal distribution test of the one-sample Kolmogorov-Smirnov (K-S) test is employed in the predictive time threshold of drip shot points of badminton players. In set of this study, test variable of the time perception predictive skills performance by one-sample Kolmogorov-Smirnov, these variables include the time perception predictive skills performance (TPPSP) of drop shot points of serve to rearcourt, the time perception predictive skills performance (TPPSP) of drop shot points of badminton players smash ball, the time perception predictive skills performance (TPPSP) of drop shot points of drop shot of badminton players.

The normal distribution test will be employed the one-sample Kolmogorov Smirnov (K-S) test method on the time perception predictive skills performance of drop point of serve to rearcourt of badminton players. The study can find out the results of the normal distribution test in Table 4.9. The result of K-S test of time perception predictive skills performance of group 1 at pretest shown that $z = 0.136$, $p = 0.200^{c,d} > 0.05$. The result of K-S test of time perception predictive skills performance of group 1 at posttest 1 shown that $z = 0.187$, $p = 0.164^{c} > 0.05$. The result of K-S test of time perception predictive skills performance of group 1 at posttest 2 shown that $z = 0.193$, $p = 0.138^{c} > 0.05$. The result of K-S test of time perception predictive skills performance of group 2 at pretest shown that $z = 0.199$, $p = 0.114^{c} > 0.05$. The result of K-S test of time perception predictive skills performance of group 2 at posttest 1 shown that $z = 0.137$, $p = 0.200^{c,d} > 0.05$. The result of K-S test of time perception predictive skills

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performance of group 2 at posttest 2 shown that z = 0.115, p = 0.200[c,d] > 0.05. From results of test of normality distribution, these results are accepted a normal distribution, the multiple analysis of variance (MANOVA) can be performed.

Table 4.9

Test of Normality Distribution

Test of One-Sample Kolmogorov-Smirnov on TPPSP of Drop Point of Serve to Rearcourt

Variables (DV) (N = 15)	Normal Parameters[a,b] Mean ± Std. Deviation	Test Statistic Z	Sig. (2-tailed)
Group 1 Pre-test	.206±.026	.136	.200[c,d]
Group 1 Posttest 1	.184±.020	.187	.164[c]
Group 1 Posttest 2	.181±.018	.193	.138[c]
Group 2 Pre-test	.206±.026	.199	.114[c]
Group 2 Posttest 1	.203±.025	.137	.200[c,d]
Group 2 Posttest 2	.204±.025	.115	.200[c,d]

a. Test distribution is normal

b. Calculated from data

c. Lilliefors significance correction

d. This is a lower bound of the true significance

The normal distribution test will be employed the one-sample Kolmogorov Smirnov test method on the time perception predictive skills performance of drop point of smash ball of badminton players. The result find out the results of the normal distribution test from Table 4.10. The result of one-sample Kolmogorov-Smirnov (K-S) test of time perception predictive skills performance of drop point of smash ball of group 1 at pretest shown that z = 0.190, p = 0.153[c] > 0.05. The result of K-S test of time perception predictive skills performance of drop point of smash ball of group 1 at posttest 1 shown that z = 0.172, p = 0.200[c,d] > 0.05. The result of K-S test of time perception predictive skills performance of drop point of smash ball of group 1 at

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posttest 2 shown that z = 0.205, p = 0.091[c] > 0.05; The result of K-S test of time perception predictive skills performance of drop point of smash ball of group 2 at pretest shown that z = 0.150, p = 0.200[c,d] > 0.05. The result of K-S test of time perception predictive skills performance of drop point of smash ball of group 2 at posttest 1 shown that z = 0.162, p = 0.200[c,d] > 0.05. The result of K-S test of time perception predictive skills performance of drop point of smash ball of group 2 at posttest 2 shown that z = 0.178, p = 0.200[c,d] > 0.05. These the results is as a normal distribution, multiple analysis of analysis (MANOVA) can be performed.

Table 4.10

Test of Normality Distribution

Test of One-Sample Kolmogorov-Smirnov on TPPSP of Drop Point of Smash

Variables (DV) (N = 15)	Normal Parameters[a,b] Mean ±Std. Deviation	Test Statistic Z	Sig. (2-tailed)
Group 1 Pre-test	.270±011	.190	.153[c]
Group 1 Posttest 1	.255±015	.172	.200[c,d]
Group 1 Posttest 2	.256±010	.205	.091[c]
Group 2 Pre-test	.269±015	.150	.200[c,d]
Group 2 Posttest 1	.268±015	.162	.200[c,d]
Group 2 Posttest 2	.267±017	.178	.200[c,d]

a. Test distribution is Normal

b. Calculated from data.

c. Lilliefors Significance Correction

d. This is a lower bound of the true significance.

The normal distribution test will be employed the one-sample Kolmogorov Smirnov test method on time perception predictive skills performance of drop point of drop shot badminton of badminton players. The study can find out the results of the normal distribution test from Table 4.11. The result of Kolmogorov Smirnov (K-S) test of time perception predictive skills performance of drop point of drop shot badminton of group 1 at pretest shown that z = 0.175, p = 0.200[c,d] > 0.05. The result of (Kolmogorov Smirnov) K-S test of time perception predictive skills performance of

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drop point of drop shot badminton of group 1 at posttest 1 shown that z = 0.199, p = 0.113[c] > 0.05. The result of (Kolmogorov Smirnov) K-S test of the time perception predictive skills performance of drop point of drop shot badminton of group 1 at posttest 2 shown that z = 0.151, p = 0.200[c,d] > 0.05; The result of Kolmogorov Smirnov (K-S) test of time perception predictive skills performance of drop point of drop shot badminton of group 2 at pretest shown that z = 0.134, p = 0.200[c,d] > 0.05. The result of Kolmogorov Smirnov (K-S) test of time perception predictive skills performance of drop point of drop shot badminton of group 2 at posttest 1 shown that z = 0.117, p = 0.200[c,d] > 0.05. The result of Kolmogorov Smirnov (K-S) test of time perception predictive skills performance of drop point of drop shot badminton of group 2 at posttest 2 was shown that z = 0.125, p = 0.200[c,d] > 0.05. These the results is as a normal distribution, multiple analysis of variance (MANOVA) can be performed.

Table 4.11

Test of Normality Distribution

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Test of One-Sample Kolmogorov-Smirnov on TPPSP of Drop Point of Drop Shot

Variables (DV) N=15	Normal Parameters[a,b] Mean ± Std. Deviation	Test Statistic Z	Sig. (2-tailed)
Group 1 Pre-test	.348±013	.175	.200[c,d]
Group 1 Posttest 1	.331±016	.199	.113[c]
Group 1 Posttest 2	.329±017	.151	.200[c,d]
Group 2 Pre-test	.348±015	.134	.200[c,d]
Group 2 Posttest 1	.346±020	.117	.200[c,d]
Group 2 Posttest 2	.347±021	.125	.200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

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All in all, the result of Kolmogorov Smirnov (K-S) test on the time perception predictive skills performance of drop point of serve to rearcourt, smash and drop shot of badminton players. These results indicated that the all significance (2-tailed) value greater than 0.05 ($p > 0.05$) (as shown in Table 4.9, Table 4.10 and Table 4.11). These results is as a normal distribution, multiple analysis of variance (MANOVA) can be performed. Next section, the results of the null hypothesis test mainly show the results of Box's test of equality of covariance matrices[a.]. The Levene's test of equality of error variance for data analysis of time perception predictive skills performance of badminton players. The results of the multiple analysis of variance (MANOVA) of group 1 and group 2 at three test points shown out that of the multiple analysis of variance (MANOVA) on the time perception predictive skills performance (serve to rearcourt, smash and drop shot) of landing point of badminton players.

4.4.2 Null Hypothesis Test

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The results of the null hypothesis test mainly show the results of Box's test of equality of covariance matrices[a]. From the analysis results of Box's test of equality of covariance matrices[a] (as shown in Table 4.12), the result can find $p = .16 > 0.05$, which indicates that the mean value of each dependent variable is the same and can be analyzed by multivariate variance analysis, as shown in Table 4.12.

Table 4.12

Equality of Covariance Matrices[a]

Box's Test of Equality of Covariance Matrices[a] on TPPSP of Groups at Three Test Points

Box's M	F	df1	df2	Sig.
41.16	1.24	30	15946.07	.16

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design : Intercept + Test Points

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4.4.3 Test of Homogeneity of Variances

The Levene's test of equality of error variance for data analysis of time perception predictive skills performance of badminton players (serve to rearcourt, smash and drop shot). Data variables of the time perception predictive skills performance include the collection data of serve to the rearcourt, smash and drop shot. From the results of test of homogeneity of variances of the time perception predictive skills performance (serve to rearcourt, smash and drop shot) of drop point of badminton players. The study can find the probability p value are p = .575 > 0.05 (Levene's test of time perception predictive skills performance of serve to rearcourt), p = .194 > 0.05 (Levene's test of time perception predictive skills performance of smash) and p = .392 > 0.05 (Levene's test of time perception predictive skills performance of drop shot) respectively. That is, the univariate tests for homogeneity of variances for each of the dependent measures indicate that homogeneity of variance has not been violated for time perception predictive skills performance (serve to rearcourt, smash and drop shot). Therefore, it can be inferred that the analysis data of the time perception predictive skills performance of drop point of badminton players are from different populations in each of the dependent measures. So, satisfy the premise of MANOVA. In addition, it can be inferred that the homogeneity variance of data analysis of time perception predictive skills performance is true. The next step of multiple variance analysis (MANOVA) can be conducted. The results of Levene's test of equality of error variance on data analysis of time perception predictive skills performance shown in Table 4.13.

Table 4.13

Test of Homogeneity of Variances

Levene's Test of Equality of Error Variances[a] on TPPSP of Groups at Three Test Points

Dependent Variable	F	df1	df2	Sig.
TPPSP of serve to rearcourt	.76	5	84	.57
TPPSP of smash	1.51	5	84	.19
TPPSP of drop shot	1.05	5	84	.39

a. Tests the null hypothesis that the error variance of the dependent variable is equal across groups. b. Design : Intercept + Test Points

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4.4.4 Descriptive Statistics on Time Perception Predictive Skills Performance of Drop Point of Badminton Players

In the table of descriptive statistics of the analysis results, it mainly shows the mean and standard deviation of time perception predictive skills performance values of drop point of badminton players. Details of descriptive statistics show in the Table 4.14.

Table 4.14

Descriptive Statistics

Descriptive Statistics on *TPPSP of Drop Point of Badminton Players at Three Test Points*

DV	Test Points	Intervention	Mean ± SD	N
TPPSP of drop point of serve to rearcourt	Group 1 Pre-test	Without BSSTM	.206 ± .026	15
	Group 1 Posttest 1	BSSTM	.184 ± .020	15
	Group 1 Posttest 2	Without BSSTM	.181 ± .018	15
	Group 2 Pre-test	Without BTSTM	.206 ± .026	15
	Group 2 Posttest 1	BTSTM	.203 ± .025	15
	Group 2 Posttest 2	Without BTSTM	.204 ± .025	15
TPPSP of drop point of smash	Group 1 Pre-test	Without BSSTM	.270 ± .011	15
	Group 1 Posttest 1	BSSTM	.255 ± .015	15
	Group 1 Posttest 2	Without BSSTM	.256 ± .010	15
	Group 2 Pre-test	Without BTSTM	.269 ± .015	15
	Group 2 Posttest 1	BTSTM	.268 ± .015	15
	Group 2 Posttest 2	Without BTSTM	.267 ± .017	15
TPPSP of drop point of drop shot	Group 1 Pre-test	Without BSSTM	.348 ± .013	15
	Group 1 Posttest 1	BSSTM	.331 ± .016	15
	Group 1 Posttest 2	Without BSSTM	.329 ± .017	15
	Group 2 Pre-test	Without BTSTM	.348 ± .015	15
	Group 2 Posttest 1	BTSTM	.346 ± .020	15
	Group 2 Posttest 2	Without BTSTM	.347 ± .021	15

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From the analysis results of descriptive statistics, the results indicated that the sample size of the test of group 1 and group 2 is all equal sample (n = 15). There are three test points in each group that is pre-test, posttest 1 and delay posttest 2. The corresponding relationship between three test points and the training intervention, it shown that the pre-test is that there is no training intervention, the post-test 1 is the effects of intervention of badminton special speed training method on time perception predictive skills performance of drop point of badminton players, and the post-test 2 is the retentive effects of badminton special speed training method on time perception predictive skills performance of drop point of badminton players after the experimental training intervention stopping. In the following paragraphs, the results of the mean values corresponding to within-group and between-group at the three test points. The results of mean value comparison can verify whether there are difference significant of the effects of BSSTM compare to BTSTM on time perception predictive skills performance of drop point of badminton players.

First of all, the results of mean value comparison of time perception predictive skills performance (badminton serve, smash and drop shot) of drop point of group 1 at three test points: (1) the results of mean value comparison of time perception predictive skills performance of drop point of badminton serve of group 1 at three test points. The mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 is 0.206 at pre-test, the mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 is 0.1840 at post-test 1, the mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 is 0.181 at posttest 2. From the mean comparison of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of pretest and posttest of within group 1. The result can find that the time perception predictive skills performance of drop point of badminton serves to the rearcourt of badminton players have been changed in intervention of BSSTM. That is to say, there are the effect of significant of the intervention of BSSTM on time perception predictive skills performance of serve to rearcourt of badminton players, It shows the change of time saving that badminton special speed training method (BSSTM) is the time perception prediction ability of badminton serve of badminton players. (2) The results of mean value comparison of

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time perception predictive skills performance of drop point of badminton smash of group 1 at three test points. The mean of the time perception predictive skills performance of drop point of badminton smash of group 1 is 0.270 at pre-test, the mean of the time perception predictive skills performance of drop point of badminton smash of group 1 is 0.255 at post-test 1, the mean of the time perception predictive skills performance of drop point of badminton smash of group 1 is 0.2567 at posttest 2. From the mean comparison of the time perception predictive skills performance of drop point of badminton smash of pretest and two posttest points. The study can find that the time perception predictive skills performance of drop point of badminton smash of badminton players has been changed in intervention of BSSTM. That is to say, there are the effect of significant of the intervention of BSSTM on time perception predictive skills performance of smash of badminton players, it shows the change of time saving that badminton special speed training method (BSSTM) is the time perception prediction ability of smash of badminton players. (3) The results of mean value comparison of time perception predictive skills performance of drop point of badminton drop shot of group 1 at three test points. The mean of the time perception predictive skills performance of drop point of badminton drop shot of group 1 is 0.348 at pre-test, the mean of the time perception predictive skills performance of drop point of badminton drop shot of group 1 is 0.331 at post-test 1, the mean of the time perception predictive skills performance of drop point of badminton drop shot of group 1 is 0.329 at posttest 2. From the mean comparison of the time perception predictive skills performance of drop point of badminton drop shot of pretest and two posttest points of group 1. The study can find that the time perception predictive skills performance of drop point of badminton drop shot of badminton players have been changed in intervention of BSSTM. That is to say, there are the effect of significant of the intervention of BSSTM on time perception predictive skills performance of drop shot of badminton players, it shows the change of time saving that badminton special speed training method (BSSTM) is the time perception prediction ability of drop shot of badminton players.

Second, the results of mean value comparison within-group 2 of three test points: (1) the results of mean value comparison of time perception predictive skills performance of drop point of badminton serve to rearcourt of group 1 at three test points.

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The mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 is 0.206 at pre-test, the mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 is 0.203 at post-test 1, the mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 is 0.204 at posttest 2. From the mean comparison of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of pretest and posttest of within group 2. The study can find that the time perception predictive skills performance of drop point of badminton serves to the rearcourt of badminton players have not changed in intervention of BTSTM. That is to say, there are not the effect of significant of the intervention of BTSTM on time perception predictive skills performance of serve to rearcourt of badminton players. (2) The results of mean value comparison of time perception predictive skills performance of drop point of badminton smash of group 2 at three test points. The mean of the time perception predictive skills performance of drop point of badminton smash of group 2 is 0.269 at pre-test, the mean of the time perception predictive skills performance of drop point of badminton smash of group 2 is 0.268 at post-test 1, the mean of the time perception predictive skills performance of drop point of badminton smash of group 2 is 0.267 at posttest 2. From the mean comparison of the time perception predictive skills performance of drop point of badminton smash of pretest and two posttest points of group 2. The study can find that the time perception predictive skills performance of drop point of badminton smash of badminton players has not changed in intervention of BTSTM. That is to say, there are not the effect of significant of the intervention of BTSTM on time perception predictive skills performance of smash of badminton players. (3) The results of mean value comparison of time perception predictive skills performance of drop point of badminton drop shot of group 2 at three test points. The mean of the time perception predictive skills performance of drop point of badminton drop shot of group 2 is 0.348 at pre-test, the mean of the time perception predictive skills performance of drop point of badminton drop shot of group 2 is 0.346 at post-test 1, the mean of the time perception predictive skills performance of drop point of badminton drop shot of group 2 is 0.347 at posttest 2. From the mean comparison of the time perception predictive skills performance of drop point of badminton drop shot of pretest and two posttest points of group 2. The study can find that the time perception predictive skills

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performance of drop point of badminton drop shot of badminton players have not changed in intervention of BTSTM. That is to say, there are not the effect of significant of the intervention of BTSTM on time perception predictive skills performance of drop shot of badminton players.

Third, the results of mean value comparison between-group at three test points: (1) the mean of the time perception predictive skills performance of drop point of group 1 at pre-test is similar to that of group 2 at three test points in the results of descriptive statistics. That is, the time perception predictive skills performance of drop point of badminton players did not change in without intervention of BSSTM. though the comparison of mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 and group 2. The study can find that the mean of the time perception predictive skills performance of drop point of badminton serve to the rearcourt of group 1 at pre-test is similar to that of group 2 at three test points in the results of descriptive statistics, that is, the time perception predictive skills performance of drop point of badminton serve to the rearcourt of badminton players did not change in without intervention of BSSTM. (2) There is significant difference in the mean of the time perception predictive skills performance of drop point of group 1 at posttest 1 and posttest 2 compare to that of group 2 at three test points in the results of descriptive statistics.

4.4.5 Multivariate Analysis of Variance (MANOVA) Test

The multivariate tests of significance test whether there are significant group differences on a linear combination of the dependent variables. In fact, Pillai's Trace criterion is considered to have acceptable power and to be the most robust statistic against violations of assumptions. The study 2 obtained a significant multivariate effect for time perception predictive skills performance of drop point of badminton players, there is a significance of each of $p < .001$ of all p values (as shown in Table 4.15).

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Table 4.15

Multivariate Tests[a]

The Results of Multivariate Analysis of Variance (MANOVA) Tests[a] on TPPSP of Groups at Three Test Points

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Interc-ept	Pillai's Trace	.999	24183.010[b]	3.00	82.00	.000	.999
	Wilks' Lambda	.001	24183.010[b]	3.00	82.00	.000	.999
	Hotelling's Trace	884.74	24183.010[b]	3.00	82.00	.000	.999
	Roy's Largest Root	884.74	24183.010[b]	3.00	82.00	.000	.999
Test Point	Pillai's Trace	.406	2.630	15.00	252.00	.001	.135
	Wilks' Lambda	.596	3.122	15.00	226.76	.000	.159
	Hotelling's Trace	.676	3.636	15.00	242.00	.000	.184
	Roy's Largest Root	.672	11.287[c]	5.000	84.00	.000	.402

Design: Intercept + Test points

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4.4.6 Between-Subjects Effects

An examination of the univariate F tests for each dependent variable indicates which individual dependent variables contribute to the significant multivariate effect. It is advisable to evaluate these effects was used a Bonferroni-type adjustment. Adjusting for family-wise or experiment-wise error decreases the chance of type III error. The simple formula that may be applied is alpha/number of tests. In this study, the adjusted alpha is equal to .017 (0.05/3). In the alpha level, this study have a significant univariate main effect for time perception predictive skills performance (TPPSP) of serve to the rearcourt, smash and drop shot of badminton players ($p < .017$).

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Table 4.16

Results of Between-Subjects Effects

Results of Between-Subjects Effects

Source DV	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Correct Model						
TPPSP of Serve	.010[a]	5	.002	3.56	.006	.175
TPPSP of Smash	.003[b]	5	.001	3.24	.010	.162
TPPSP of Drop Shot	.006[c]	5	.001	3.87	.003	.187
Intercept	3.520	1	3.52	5997.51	.000	.986
TPPSP of Serve	6.299	1	6.29	30018.2	.000	.997
TPPSP of Smash	10.513	1	10.51	34052.6	.000	.998
TPPSP of Drop Shot	.010	5	.002	3.56	.006	.175
Test Points	.003	5	.001	3.24	.010	.162
TPPSP of Serve	.006	5	.001	3.87	.003	.187
TPPSP of Smash						
TPPSP of Drop Shot	.049	84	.001			
Error	.018	84	.000			
TPPSP of Serve	.026	84	.000			
TPPSP of Smash						
TPPSP of Drop Shot	3.58	90				
Total	6.32	90				
TPPSP of Serve	10.54	90				
TPPSP of Smash						
TPPSP of Drop Shot	.060	89				
Corrected Total	.021	89				
TPPSP of Serve	.032	89				
TPPSP of Smash						
TPPSP of Drop Shot						

a. R Squared = .175 (Adjusted R Squared = .126). b. R Squared = .162 (Adjusted R Squared = .112). c. R Squared = .187 (Adjusted R Squared = .139). TPPSP = Time Perception Predictive Skills Performance

Therefore, there are significant different of TPPSP of serve, TPPSP of smash and TPPSP of drop shot at itself test points from the results of tests of between-subjects effects. At the same time, according to the results of mean comparison at within-group and between-group, this section research can find out that which factor is the effect factor of significant affect. First of all, we can conclude that training intervention of BSSTM is significantly influenced by training intervention towards time perception

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predictive skills performance of drop shot of serve to the rearcourt of badminton players, $F(5, 84) = 3.560$, $p = .006 < .017$. Second, we can conclude that training intervention of BSSTM is significantly influenced by training intervention towards time perception predictive skills performance of drop shot of badminton smash of badminton players, $F(5, 84) = 3.246$, $p = .010 < .017$. We can conclude that training intervention of BSSTM is significantly influenced by training intervention towards time perception predictive skills performance of drop shot of drop shot of badminton players, $F(5, 84) = 3.875$, $p = .003 < .017$.

In this study, the independent variables involve more than two levels, that is, two intervention of BSSTM and BTSTM at three test points. So, further analytic comparisons are needed to find out which levels are significantly different on the individual dependent variable. These comparisons can be planned (when this study have prior reason for anticipating specific or planned differences) or post hoc (when this study have no prior reason for expecting differences but wish to explore the data further). At the same time, dependent variables of this study on the time perception predictive skills performance is more than one independent variable and the presence of an interaction effect complicate the process. Therefore, the new general linear model procedure does allow this study to perform contrasts using the Contrasts and Post Hoc.

4.4.7 Multiple Comparisons

It is important that MANOVA is an intricate analysis and is more straight-forward when there is only one independent variable and only a few dependent variables. As the number of independent and dependent variables increases, the analysis becomes more complex. When the dependent variables are measured on the same scale, a special form of MANOVA (referred to as profile analysis) is more appropriates. The study of time perception predictive skills performance (TPPSP) of drop points of badminton players planed mainly three dependent variables, that is time perception predictive skills performance (TPPSP) of drop point of serve, smash and drop shot of badminton players. Independent variables is two training intervention of BSSTM and BTSTM, and three test points. There are the independent variables of two training methods and three test

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points in this study, the study explores that the independent variable affects the dependent variable, that is, that test point and that training intervention method affect the change of dependent variable. Therefore, in order to find out that the training methods play a major role in the development and improvement of time perception prediction skills performance of drop point of badminton players, and the degree of influence needs to conduct the Contrasts and Post Hoc.

4.4.7.1 Multiple Comparisons of TPPSP of Drop Point of Badminton Serve to Rearcourt

The flowing step is to show the multiple comparison of the time performance predictive skills performance of drop point of badminton serve to the rearcourt between group 1 and group 2 by least significance difference (LSD) at three test points (pre-test, posttest 1 and posttest 2). On the premise of the significant level of 0.05, next, the least significance difference (LSD) of the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt show in table 4.17. The details contents will be indicated in the follows two section.

First section is multiple comparisons within-groups by least significance difference (LSD) test. The following comparisons within-groups will be presented the results of the significance difference of the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt by least significant difference (LSD) test. Firstly, within-group 1, the mean difference of pre-test compare to between posttest 1 and posttest 2, the mean difference are 0.022^{*}, 0.025^{*} respectively. There is a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt between the pre-test and the two posttest points of group1 through the LSD (least significant difference) test, the probability p values are 0.012 and 0.005 respectively ($p = .012 < 0.05$, $p = .005 < 0.05$); Secondly, there is no a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt to the rearcourt between posttest 1 and posttest 2 of group 1 through LSD test, the probability p value are 0.764 ($p = 0.764 > 0.05$); Thirdly, within group 2, the mean difference of

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pre-test compare to between posttest 1 and posttest 2, the mean difference are 0.003 and 0.002 respectively. There is no a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt between the pre-test and the two posttest points of group 2 through the LSD (least significant difference) test, the probability p values are 0.707and 0.822 respectively ($p = .0.707 > 0.05$, $p = .822 > 0.05$); In addition, There is no a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt between posttest 1 and posttest 2 of group 2 through LSD test, the probability p value are 0.882 ($p = 0.882 > 0.05$).

Second section is multiple comparisons between groups by least significance difference (LSD) test. The following comparisons between groups will be presented the results of the significance difference of the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt by least significant difference (LSD) test. First of all, the mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to the rearcourt of group 1 at pre-test compare to group 2 at three test points, the mean difference are 0.000, 0.003 and 0.002 respectively. Multiple comparisons through LSD in table 4.34 shown that the probability p values were 1.00, 0.707 and 0.822 respectively ($p = 1.00 > 0.05$, $p = .707 > 0.05$ and $p = .822 > 0.05$). So, in the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt, there is no a significant difference between group 1 at pre-test and group 2 at three test points through the LSD (least significant difference) test ($p > 0.05$); Secondly, the mean difference (MD) of the time performance predictive skills performance of drop point of badminton serve to the rearcourt of group 1 at posttest 1 compare to group 2 at three test points, the mean difference are $-.022^{*}$, $-.019^{*}$ and $-.020^{*}$ respectively. Multiple comparisons through LSD in table 4.34 shown that the probability p values were 0.012, 0.032 and 0.022 respectively ($p = .012 < 0.05$, $p = .032 < 0.05$ and $p = .022 < 0.05$). So, in the mean of the time performance predictive skills performance of drop point of badminton serve to the rearcourt, there is a significant difference between group 1 at posttest 1 and group 2 at three test points through the LSD (least significant difference) test ($p < 0.05$); Thirdly, the mean difference (MD) of the time performance predictive skills performance of drop point of badminton serve to the rearcourt of group 1 at posttest 2

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compare to group 2 at three test points, the mean difference are -.025*, -.022* and -.023* respectively. Multiple comparisons through LSD in Table 4.17 shown that the probability p values were 0.005, 0.015 and 0.010 respectively ($p = .005 < 0.05$, $p = .015 < 0.05$ and $p = .010 < 0.05$). So, in the mean contrast of the time performance predictive skills performance of drop point of badminton serve to the rearcourt, there are all significant difference between group 1 at posttest 2 and group 2 at three test points through least significant difference test (LSD) ($p < 0.05$). Last step, profile plots of the time performance predictive skills performance of drop point of badminton serve to the rearcourt (Figure 4.14). We can also find that there are difference significant of the effects of training intervention of BSSTM) compare to BTSTM) on the time performance predictive skills performance of drop point of badminton serve through profile plots.

Table 4.17

Multiple Comparisons

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Time Perception Predictive Skills Performance of Drop Point of Serve to Rearcourt

(I) Test Points	(J) Test Points	MD (I-J)	Std. Error	P
Within-Group 1				
TPPSP of G1 at Pre-test	TPPSP of G1 at Posttest 1	.022*	.008	.012
	TPPSP of G1 at Posttest 2	.025*		.005
TPPSP of G1at Posttest 1	TPPSP of G1 at Posttest 2	.002		.764
Within-Group 2				
TPPSP of G2 at Pre-test	TPPSP of G2 at Posttest 1	.003		.707
	TPPSP of G2 at Posttest 2	.002		.822
TPPSP of G2 at Posttest 1	TPPSP of G2 at Posttest 2	-.001		.881
Between-Groups				
TPPSP of G1 at Pre-test	TPPSP of G2 at Pre-test	.000		1.000
	TPPSP of G2 at Posttest 1	.003		.707
	TPPSP of G2 at Posttest 2	.002		.822
TPPSP of G1 at Posttest 1	TPPSP of G2 at Pre-test	-.02*		.012
	TPPSP of G2 at Posttest 1	-.01*		.032
	TPPSP of G2 at Posttest 2	-.02*		.022
TPPSP of G1 at Posttest 2	TPPSP of G2 at Pre-test	-.02*		.005
	TPPSP of G2 at Posttest 1	-.02*		.015
	TPPSP of G2 at Posttest 2	-.02*		.010

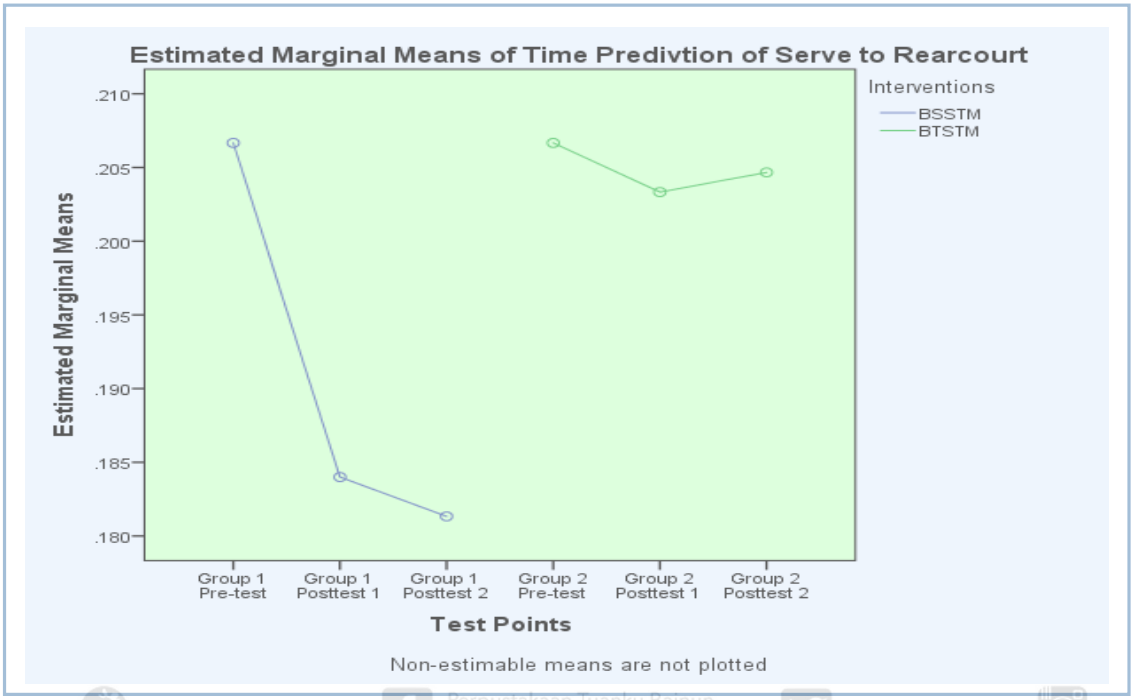
Note：*. The mean difference is significant at the 0.05 level.

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Figure 4.9

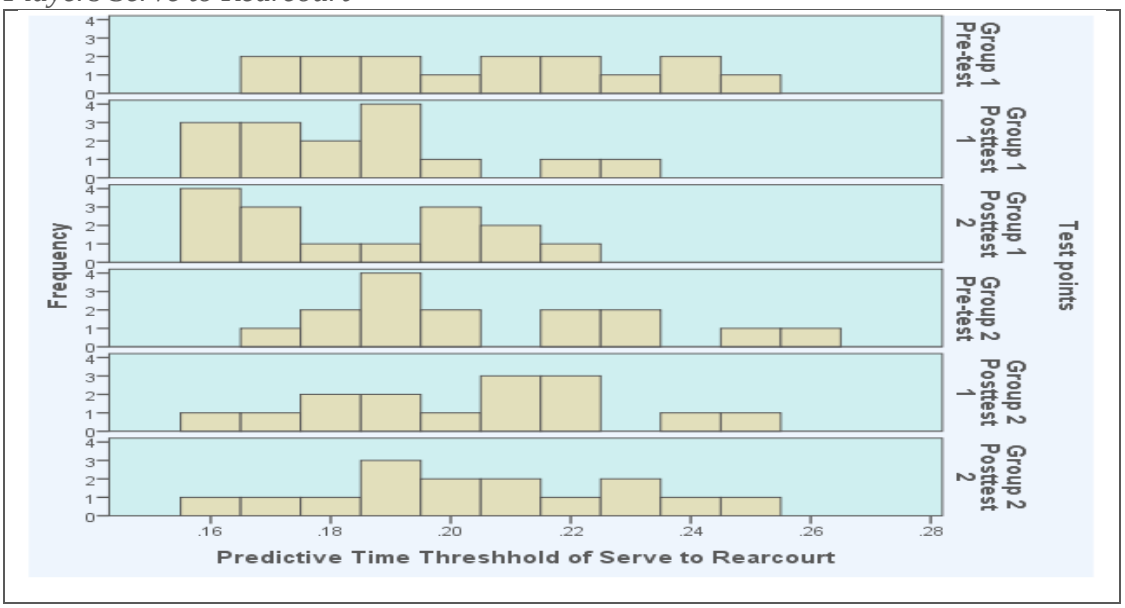
Profile plots of the time perception predictive skills performance of drop point of badminton serve to the rearcourt



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Figure 4.10

Histogram of time perception predictive skills performance of Drop Point of Badminton Players Serve to Rearcourt



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4.4.7.2 Multiple Comparisons of TPPSP of Drop Point of Badminton Smash

The fourth step is to show the multiple comparison of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between group 1 and group 2 by least significance difference (LSD) at three test points (pre-test, posttest 1 and posttest 2). On the premise of the significant level of 0.05, next, the least significance difference of the mean of the time performance predictive skills performance of drop point of badminton serve rearcourt of drop points of badminton smash show in table 4.18. The details contents will be indicated in the follows two section.

First section of the fourth step is multiple comparisons within groups by least significance difference (LSD) test. The following comparisons within single group will be presented the results of the significance difference of the mean of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop points of badminton smash by LSD test. Firstly, within-group 1, the mean difference of pre-test compares to between posttest 1 and posttest 2, the mean difference is 0.015^{*}, 0.014^{*} respectively. There is a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between the pre-test and the two posttest points of group1 through the LSD test, the probability p values are 0.005 and 0.01 respectively ($p = .005 < 0.05$, $p = .01 < 0.05$); Secondly, there is no a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between posttest 1 and posttest 2 of group 1 through LSD test, the probability p value are 0.802 ($p = 0.802 > 0.05$); Thirdly, within-group 2, the mean difference of pre-test compare to between posttest 1 and posttest 2, the mean difference are 0.001 and 0.002 respectively. in the mean contrast of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash, the probability p values are 0.802 and 0.706 respectively ($p = .802 > 0.05$, $p = .706 > 0.05$). So, There are no significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between the pre-test and the two posttest points of group 2 through the LSD (least

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significant difference) test; In addition, There is no a significant difference in the mean of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between posttest 1 and posttest 2 of group 2 through LSD test, the probability p value are 0.90 ($p = 0.90 > 0.05$).

Second section of the fourth step is multiple comparisons between groups by least significance difference (LSD) test. The following comparisons between groups will be presented the results of the significance difference of the mean of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop points of badminton smash by least significant difference (LSD) test. First of all, the mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to rearcourt of group 1 at pre-test compare to group 2 at three test points, the mean difference is 0.001, 0.002 and 0.003 respectively. So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash, multiple comparisons through LSD in table 4.24 shown that the probability p values were 0.802, 0.615 and 0.530 respectively ($p = .802 > 0.05$, $p = .615 > 0.05$ and $p = .530 > 0.05$). So, in the mean contrast of the time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash, there are all not a significant difference between group 1 at pre-test and group 2 at three test points through the least significant difference (LSD) test ($p > 0.05$); Secondly, the mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to rearcourt of group 1 at posttest 1 compare to group 2 at three test points, the mean difference (MD) are $-.014^{*}$, $-.012^{*}$ and $-.012^{*}$ respectively. From the results of multiple comparisons through LSD of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between groups, multiple comparisons through least significance difference (LSD) in table 4.18 shown that the probability p values were 0.010, 0.019 and 0.026 respectively ($p = .010 < 0.05$, $p = .019 < 0.05$ and $p = .026 < 0.05$). So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash, there are all significant difference between group 1 at posttest 1 and group 2 at three test points through the LSD (least significant difference) test ($p < 0.05$). Thirdly, the results of multiple comparisons

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between posttest 2 of group 1 and three test points of group 2 by least significance difference (LSD) test. First of all, The mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to rearcourt of group 1at posttest 2 compare to group 2 at three test points, the mean difference are -.012*, -.011* and -.010* respectively. From the results of multiple comparisons through LSD of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash between group at posttest 2 and group 2 at three test points (as shown Table 4.18), multiple comparisons through least significant difference (LSD) in table 4.18 shown that the probability p values were 0.019, 0.035 and 0.047 respectively ($p = .019 < 0.05$, $p = .035 < 0.05$ and $p = .047 < 0.05$). So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash, there are all significant difference between group 1 at posttest 2 and group 2 at three test points through the least significant difference (LSD) test ($p < 0.05$).

Table 4.18

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Multiple Comparisons

LSD on Time Perception Predictive Skills Performance of Drop Point of Smash

(I) TPPSP	(J) TPPSP	MD (I-J)	Std. Error	P
Within Group 1	Group 1 at Posttest 1	.015*	.00529	.005
Group 1 at Pre-test	Group 1 at Posttest 2	.014*		.010
	Group 1 at Posttest 2	-.001		.802
Group 1 at Posttest 1				
Within group 2	Group 2 at Posttest 1	.001		.802
Group 2 at Pre-test	Group 2 at Posttest 2	.002		.706
	Group 2 at Posttest 2	.000		.900
Group 2 at Posttest 1				
Between groups	Group 2 at Pre-test	.001		.802
Group 1 at Pre-test	Group 2 at Posttest 1	.002		.615
	Group 2 at Posttest 2	.003		.530
Group 1 at Posttest 1	Group 2 at Pre-test	-.014*		.010
	Group 2 at Posttest 1	-.012*		.019
	Group 2 at Posttest 2	-.012*		.026
Group 1 at Posttest 2	Group 2 at Pre-test	-.012*		.019
	Group 2 at Posttest 1	-.011*		.035
	Group 2 at Posttest 2	-.010*		.047

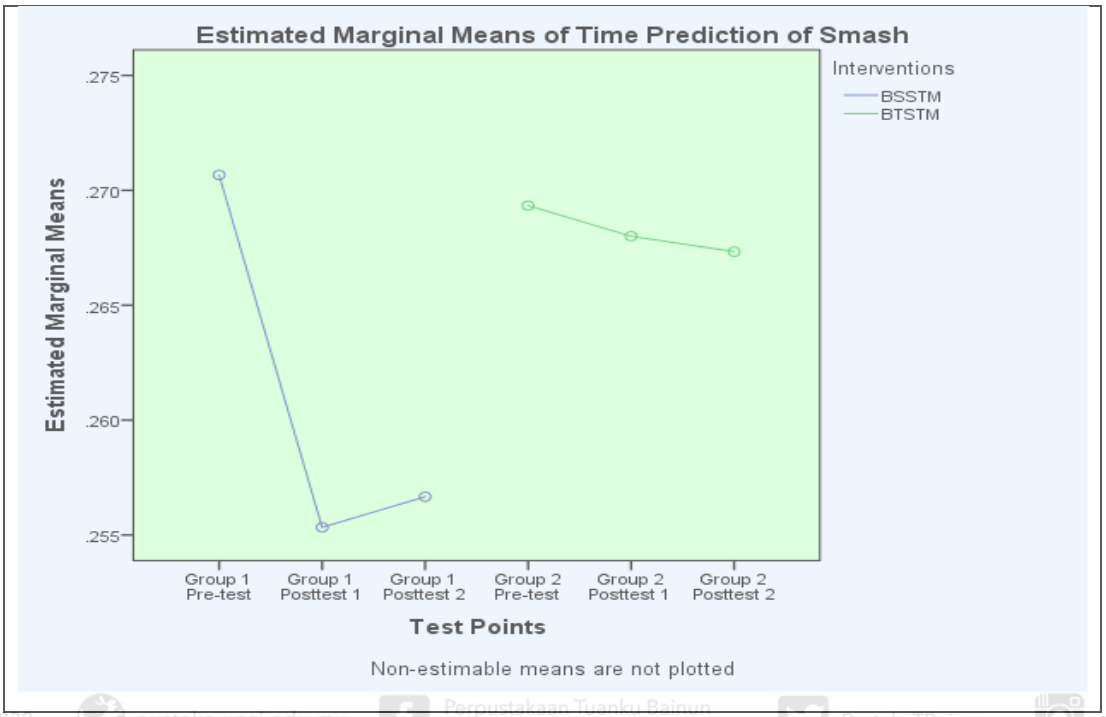
Note：*. The mean difference is significant at the 0.05 level. TPPSP = Time Perception Predictive Skills Performance

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Figure 4.11

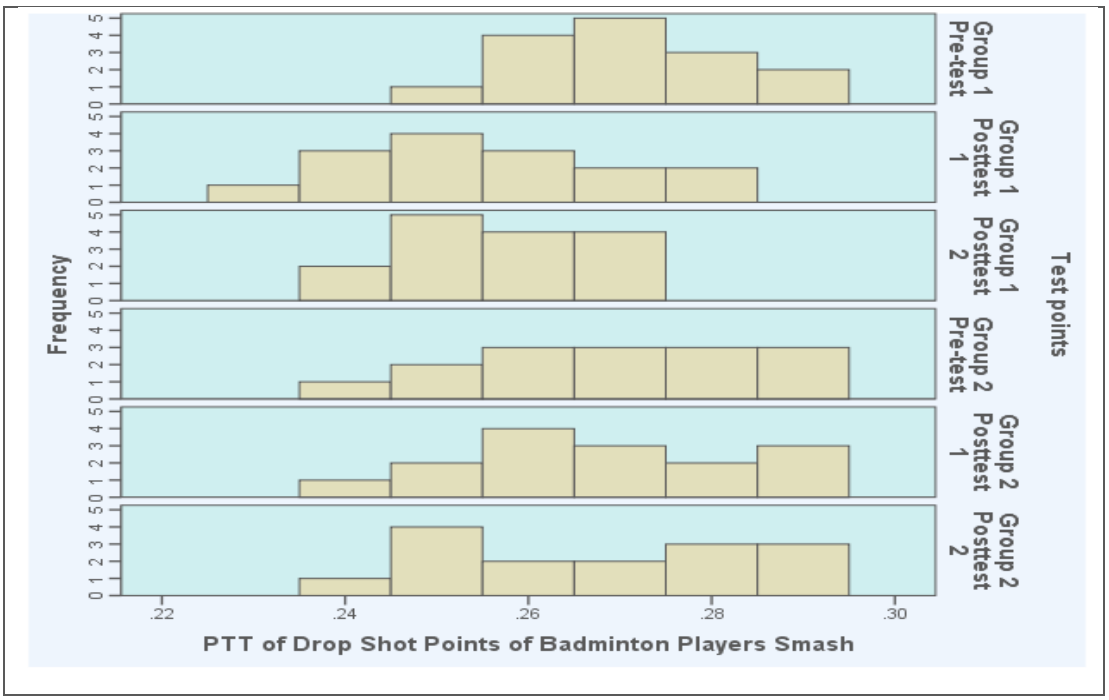
Profile plots of Time Performance Predictive Skills Performance of Drop Point of Badminton Smash



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Figure 4.12

Histogram of Time Predictive of Drop Points of Smash of Badminton Players



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4.4.7.3 Multiple Comparisons of TPPSP of Drop Point of Drop Shot

The fourth step is to show the multiple comparison of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between group 1 and group 2 by least significance difference (LSD) at three test points (pre-test, posttest 1 and posttest 2). On the premise of the significant level of 0.05, next, the least significance difference of the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop points of badminton smash show in table 4.19. The details contents will be indicated in the follows two section.

First section of the fourth step is multiple comparisons within groups by least significance difference (LSD) test. The following comparisons within-groups will be presented the results of the significance difference of the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop points of badminton drop shot by least significant difference (LSD) test. Firstly, within-group 1, the mean difference (MD) of pre-test compare to between posttest 1 and posttest 2, the mean difference is 0.016^{*}, 0.018^{*} respectively, the probability p values are 0.011 and 0.005 respectively ($p = .011 < 0.05$, $p = .005 < 0.05$). So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot, there is a significant difference in the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between the pre-test and the two posttest points of group1 through the LSD (least significant difference) test; Secondly, the mean difference (MD) of posttest 1 compare to posttest 2 are 0.00200, the probability p value are 0.756 ($p = 0.756 > 0.05$). So, there is no a significant difference in the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between posttest 1 and posttest 2 of group 1 through LSD test; Thirdly, within-group 2, the mean difference of pre-test compare to between posttest 1 and posttest 2, the mean difference are 0.002 and 0.001 respectively, the probability p values are 0.679 and 0.836 respectively ($p = .679 > 0.05$, $p = .836 > 0.05$). So, in the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop

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point of badminton drop shot, there is no a significant difference in the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between the pre-test and the two posttest points of group 2 through the LSD (least significant difference) test. At the same time, the mean difference (MD) of posttest 1 compare to posttest 2 are 0.001, the probability p value are 0.836 ($p = 0.836 > 0.05$). So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton smash, there is no a significant difference in the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between posttest 1 and posttest 2 of group 2 through LSD test.

Second section of the fourth step is multiple comparisons between-groups by least significance difference (LSD) test. The following comparisons between-groups was presented the results of the significance difference of the mean of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop points of badminton drop shot by least significant difference (LSD) test. First of all, the mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to rearcourt of group 1 at pre-test compare to group 2 at three test points, the mean difference are -0.000, 0.002 and 0.000 respectively, multiple comparisons through LSD on the pretest of group 1 and three test points of group 2 shown that the probability p values were 0.917, 0.756 and 0.917 respectively. So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot, there are all no a significant difference between group 1 at pre-test and group 2 at three test points through the least significant difference (LSD) test ($p = .917 > 0.05$, $p = .756 > 0.05$ and $p = .917 > 0.05$); Secondly, the mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to rearcourt of group 1 at posttest 1 compare to group 2 at three test points, the mean difference are $-.017^{*}$, -.014 and -.016 respectively. From the results of multiple comparisons through LSD of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between-groups (as shown Table 4.19), multiple comparisons through LSD in table 4.19 shown that the probability p values were 0.008,

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0.025 and 0.015 respectively. So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot, there are all significant difference between group 1 at posttest 1 and group 2 at three test points through the LSD (least significant difference) test ($p = .008 < 0.05$, $p = .025 < 0.05$ and $p = .015 < 0.05$). Thirdly, the results of multiple comparisons between the posttest 2 of group 1 and three test points of group 2 by least significance difference (LSD) test. First of all, the mean difference (MD) of time performance predictive skills performance of drop point of badminton serve to rearcourt of group 1at posttest 2 compare to group 2 at three test points, the mean difference are $-.019^{*}$, $-.016^{*}$ and $-.018^{*}$ respectively. From the results of multiple comparisons through LSD of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot between groups (as shown Table 4.19), multiple comparisons through LSD in table 4.19 shown that the probability p values were 0.003, 0.011 and 0.006 respectively. So, in the mean contrast of time performance predictive skills performance of drop point of badminton serve to rearcourt of drop point of badminton drop shot, there are all significant difference between group 1 at posttest 2 and group 2 at three test points through the LSD (least significant difference) test ($p = .003 < 0.05$, $p = .011 < 0.05$ and $p = .006 < 0.05$).

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Table 4.19

Multiple Comparisons

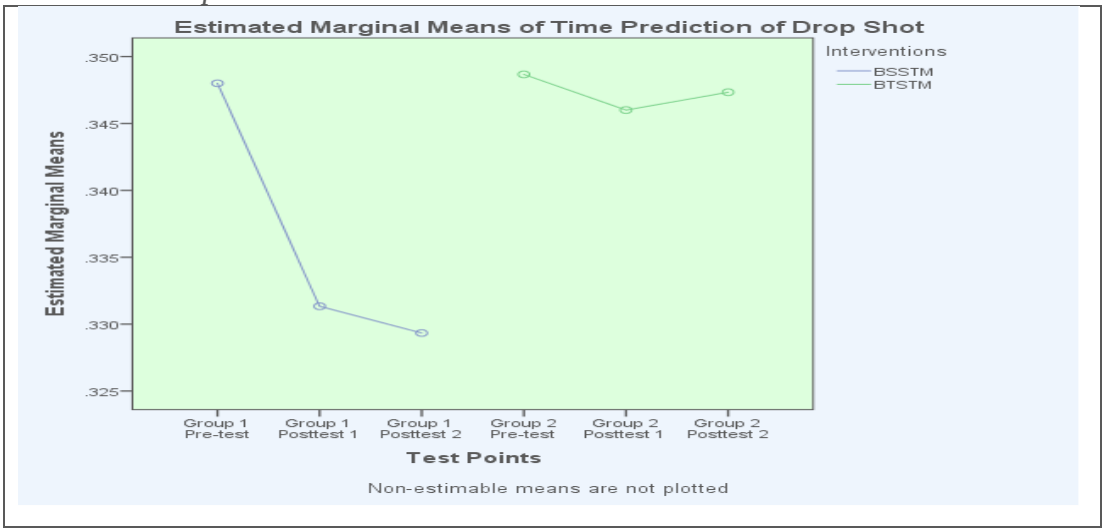
LSD on Time Perception Predictive Skills Performance of Drop Point of Drop Shot

(I) Three Test Points	(J) Test Points	MD (I-J)	Std. Error	Sig.
Within Group 1				
TPPSP of Group 1 at Pre-test	TPPSP of Group 1 Posttest 1	.016*	.006	.011
	TPPSP of Group 1 Posttest 2	.018*		.005
TPPSP of Group 1 at Posttest 1	TPPSP of Group 1 Posttest 2	.002		.756
Within group 2				
TPPSP of Group 2 at Pre-test	TPPSP of Group 2 Posttest 1	.002		.679
	TPPSP of Group 2 Posttest 2	.001		.836
TPPSP of Group 2 at Posttest 1	TPPSP of Group 2 Posttest 2	-.001		.836
Between groups				
TPPSP of Group 1 at Pre-test	TPPSP of Group 2 Pre-test	.000		.917
	TPPSP of Group 2 Posttest 1	.002		.756
	TPPSP of Group 2 Posttest 2	.000		.917
TPPSP of Group 1 at Posttest 1	TPPSP of Group 2 Pre-test	-.017*		.008
	TPPSP of Group 2 Posttest 1	-.014*		.025
	TPPSP of Group 2 Posttest 2	-.016*		.015
TPPSP of Group 1 at Posttes 2	TPPSP of Group 2 Pre-test	-.019*		.003
	TPPSP of Group 2 Posttest 1	-.016*		.011
	TPPSP of Group 2 Posttest 2	-.018*		.006

Note： *. The mean difference is significant at the 0.05 level

Figure 4.13

Profile Plots of Time Performance Predictive Skills Performance of Drop Point of Badminton Drop Shot

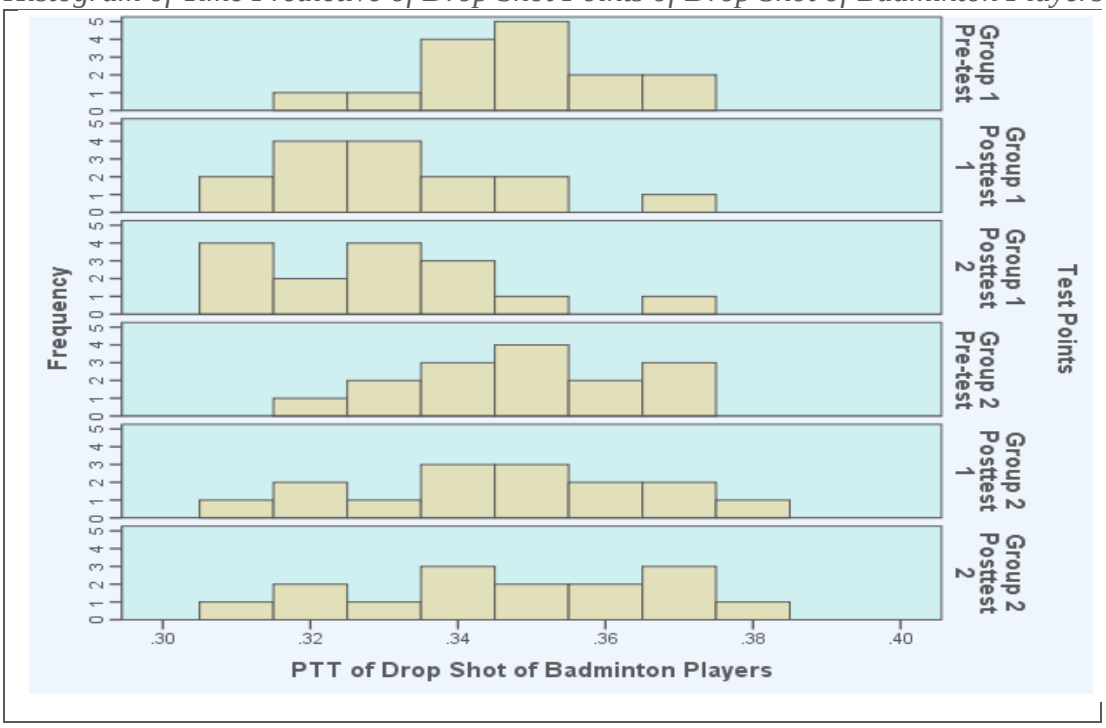


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Figure 4.14

Histogram of Time Predictive of Drop Shot Points of Drop Shot of Badminton Players



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4.5 Summary of Research Hypotheses Test

The main objective of the study 1 was to explore whether there are the significant difference of the effect of badminton special speed training method compare to badminton traditional speed training method towards success score of China elite badminton players， and to know how badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) in 3 month duration length of the experimental training intervention influence on success scores of China elite badminton players. The results of study 1 hypothesis test came from the path testing of two-way between-groups analysis of variance (ANOVA) on success scores. In Table 4.6 of study 1 states the F value of the correction model is 3.10, p = .01, which reaches a very significant level, it can be inferred that at least one of the factors in the analysis has the significant effect on the improvement of success score of China elite badminton players at the different test points. But the study needs to further clarify which factors affect the success score of badminton athletes and the extent to which

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they are affected. Table 4.8 answers these questions, that is, the multiple comparison tables of post-hoc analysis mainly show which factors are affected on dependent variables (success score) and the degree of significance of the influence (details as shown Table 4.8). At the same time, the research has been found out the main effect factors of success scores of badmintons in this study design from the results of mean comparison and the "multiple comparison". Study 1 can find out there is the effect factor on success scores of Chinese badminton elite players through multiple comparison of post hoc. This independent factor of the influence on success scores of badminton players is badminton special speed training method (BSSTM). At the same time, the path way of multiple comparison analysis can also find out the still retention of the training effect of BSSTM on success scores of Chinese elite badminton players at posttest 1 compare to posttest 2. The results of the analysis path way of multiple comparison analysis examined Hypotheses 2 and reply on research question 2.

The main objective of the study 2 was to explore whether there are the difference significant of the effect of badminton special speed training method compare to badminton traditional speed training method towards time perception predictive skills performance (TPPSP) of China elite badminton players and to know how badminton special speed training method (BSSTM) and badminton traditional speed training method (BTSTM) in 3 month duration length of the experimental training intervention influence on time perception predictive skills performance (TPPSP) of China elite badminton players. The results of study 2 hypothesis test came from the path testing of multiple analysis of variance (MANOVA) with post hoc on-time perception predictive skills performance of badminton players. In addition, the path way of multiple comparison analysis find out whether there is the retention of the training effect of BSSTM) compare to BTSTM on time perception predictive skills perception (TPPSP) at posttest 1 and posttest 2. In this study 2 obtained a significant multivariate effect for time perception predictive skills performance of drop point (serve, smash and drop shot) of badminton players are, a significance of each of $p < .001$ of all p values (as show in Table 4.15). Next step, we can now interpret the univariate tests of between-subjects' effects. In tests of between-subjects' effects (as show in Table 4.16), the adjusted alpha is equal to .017 (0.05/3). Using this alpha level, this study has a significant univariate main effect for TPPSP of serve, smash and drop shot of badminton players ($p < .017$).

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From a significant univariate main effect for time perception predictive skills performance (TPPSP) of Chinese elite badminton players, it can be inferred that at least one of the factors in the analysis has the significant effect on the improvement of time perception predictive skills performance (TPPSP) of China elite badminton players at the different test points. But the study needs to further clarify which factors affect the time perception predictive skills performance (TPPSP) of China elite badminton players and the extent to which they are affected. This section research has been found out the main effect factors of time perception predictive skills performance (TPPSP) of China elite badminton players from the results of mean comparison and the multiple comparison. This independent factor of the influence on time perception predictive skills performance (TPPSP) of China elite badminton players of badminton players is badminton special speed training method (BSSTM) was built in this study. However, there is no significant of the effect independent of badminton traditional speed training method (BTSTM) on time perception predictive skills performance (TPPSP) of China elite badminton players of badminton players. At the same time, the path way of multiple comparison analysis can also find out the still retention of the training effect of BSSTM on TPPSP at posttest 1 compare to posttest 2. The results of the analysis path way of multiple comparison analysis examined Hypotheses 4 and reply on research question 4.

In the current study, the hypotheses 1 and hypotheses 2 of study 1 were tested through making sure the results two-way between-groups analysis of variance (ANOVA) in the predicted way. The hypotheses 3 and hypotheses 4 of study 2 were tested through making sure the results multiple analysis of variance (MANOVA) in the predicted way. The hypotheses tests results are capitulated in Table 4.20. The examined results analysis of research hypothesis indicated in the next section.

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Table 4.20

Results of Research Hypothesis Tests

Summary of Research Hypotheses Tests on Success Scores and TPPSP

Hypotheses	Description	Level	Results
H1	SS of G 1 and G 2 at pre-test and posttest 1 by ANOVA	Significant difference at the 0.05 level	Accepted
H2	SS of G 1 from posttest 1 to posttest 2 by ANOVA	Significant difference at the 0.05 level	Accepted
H3	TPPSP of G 1 and G 2 at pre-test and posttest 1 by MANOVA	Significant difference at the 0.05 level	Accepted
H4	TPPSP of G1 from posttest 1 to posttest 2 by MANOVA	Significant difference at the 0.05 level	Accepted

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H1: There is the significance difference in the effect of badminton special speed training method (BSSTM) on success score of badminton players from pretest to posttest 1

Hypothesis H1 accepted by results of two-way between-groups analysis of variance (ANOVA) with the multiple comparison table of post-hoc (in Table 4.8). That is, results of mean comparison of success scores of within-group 1 from pre-test to posttest 1 indicated that there is significant difference of the effect of training intervention of badminton special speed method on success scores ($p = .021 < .05$). In addition, the results of mean comparison of success scores of between group 1 and group 2 at posttest 1 indicated that there is the effect of training intervention of badminton special speed training method compare to badminton special speed training method on success scores of Chinese elite badminton players ($p = .031 < .05$), which reaches a very significant level. Therefore, H1 is accepted by the check results of data analysis.

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H2: There is the retentive effect of badminton special speed training method (BSSTM) on success score of badminton players from post-test 1 to delay post-test 2

Hypothesis H2 accepted in Table 4.8 by the results of the multiple comparison table of post-hoc. The results of mean comparison of success scores of group 1 at posttest 1 and posttest 2 indicated that there is the retention of training intervention effect of badminton special speed training method (BSSTM) on success score of Chinese elite badminton players ($p = 0.808 > .05$) after the stopping training intervention a week, that is to say, the results of mean difference comparison at posttest is no a significant. In other words, the effect of the training intervention of badminton special speed training method (BSSTM) on success scores of Chinese elite badminton is the results of the true experiment. That is, the effect of badminton special speed training method on the improvement of success scores of elite badminton players can be come true the retention effect of the training intervention after stop training intervention. Therefore, H2 is accepted by the check results of data analysis.

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H3: There are the significance difference in the effect of badminton special speed training method (BSSTM) on TPPSP of drop point of badminton players from pretest to posttest 1

Hypothesis H3 accepted in Table 4.16 by the results of tests of between-subjects' effects. In this study the adjusted alpha is equal to .017 (0.05/3). Using this alpha level, this study has a significant univariate main effect for TPPSP of serve, smash and drop shot of badminton players ($p < .017$). That is, there is significant difference of time perception predictive skills performance of drop point of serve to rearcourt ($p = .006 < .017$), smash ($p = .010 < .017$) and drop shot ($p = .003 < .017$) between group 1 and group 2 at posttests. In addition, hypothesis H3 accepted by the results of the multiple comparison tables of post-hoc (as show in Table 4.17, Table 4.18 and Table 4.19). First of all, the results of the multiple comparison in Table 4.17 indicated that there is significant difference of time perception predictive skills performance of drop point of serve to rearcourt of group 1 from pre-test to posttest 1 ($p = .012 < .05$). At the same time, there is significant difference of time perception predictive skills performance of

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drop point of serve to rearcourt of badminton players between group 1 and group 2 at posttest 1 ($p = .032 < .05$). Second, the results of the multiple comparison in Table 4.18 indicated that there is significant difference of time perception predictive skills performance of drop point of smash of group 1 from pre-test to posttest 1 ($p = .005 < .05$). At the same time, there is significant difference of time perception predictive skills performance of drop point of smash of badminton players between group 1 and group 2 at posttest 1 ($p = .019 < .05$). Third, the results of the multiple comparison in Table 4.19 indicated that there is significant difference of time perception predictive skills performance of drop point of drop shot of badminton players group 1 from pre-test to posttest 1($p = .011 < .05$). At the same time, there is significant difference of time perception predictive skills performance of drop point of drop shot of badminton players between group 1 and group 2 at posttest 1 ($p = .025 < .05$). These reaches a very significant level. Therefore, H3 is accepted by the check results of data analysis.

H4: There are the retentive effect of badminton special speed training method (BSSTM) on TPPSP of drop point of badminton players from post-test 1 to delay post-test 2

Hypothesis H4 accepted by the results of the multiple comparison table of post-hoc (show in Table 4.17, Table 4.18 and Table 4.19). First of all, the results of the "multiple comparison in Table 4.31 indicated that there is the retention of the training intervention effect of time perception predictive skills performance of drop point of serve to rearcourt of within-group 1 at posttest 1 and posttest 2, that is, $p = .746 > .05$. Second, the results of the "multiple comparison in Table 4.18 indicated that there is the retention of training intervention effect of time perception predictive skills performance of drop point of smash of group 1 at posttests ($p = .802 > .05$). Third, the results of the multiple comparison in Table 4.19 indicated that there is the retention of training intervention effect of time perception predictive skills performance of drop point of drop shot of badminton players group1 at posttests ($p = .756 > .05$), which results are no significant difference. Therefore, H4 is accepted by the check results of data analysis.

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4.6 Summary

Two-way between-groups analysis variance (ANOVA) of study 1 revealed that success scores of elite badminton players have been improved by training intervention of badminton special speed training method (BSSTM). However, success scores of elite badminton players have not been improved by training intervention of badminton traditional speed training method (BTSTM). First of all, based on the results of multiple comparison of mean of success scores of within-groups and between-groups at three test points by path of two-way between-groups analysis variance (ANOVA) with post hoc, we can find out that there is significant difference of the effect of badminton special speed training method compare to badminton traditional speed training method on success score of Chinese players. Therefore, H1 is accepted by the check results of data analysis. Next, the results of multiple comparison of mean of success scores of within-groups and between-groups at posttest 1 compare to posttest 2 by path with post hoc also further indicated that there is the retention of the training effect of badminton special speed training method of elite badminton players on success scores in study 1. That is, the effect of badminton special speed training method on the improvement of success scores of elite badminton players can be come true the still retention effect of the training intervention after stop training intervention. Therefore, H2 is accepted by the check results of data analysis.

Multiple analysis of variance of study 2 revealed that time perception predictive skills performance of elite badminton players has been improved by training intervention of badminton special speed training method (BSSTM). However, time perception predictive skills performance (TPPSP) of elite badminton players have not been improved by training intervention of badminton traditional speed training method (BTSTM). First of all, based on the results of multiple comparison of mean of time perception predictive skills performance of within-groups and between-groups at three test points by path of multiple analysis of variance (MANOVA) with post hoc, we can find out that there is significant difference of the effect of badminton special speed training method compare to badminton traditional speed training method on TPPSP of Chinese players. Therefore, H3 is accepted by the check results of data analysis. Next, the results of multiple comparison of mean of TPPSP of within-groups and between-

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groups at posttest 1 compare to posttest 2 by path with post hoc also further indicated that there is the retention of the training effect of badminton special speed training method of elite badminton players on TPPSP in study 2. That is, the effect of badminton special speed training method on the improvement of time perception predictive skills performance of elite badminton players can be come true the still retention effect of the training intervention after stop training intervention. Therefore, H4 is accepted by the check results of data analysis.

All in all, this chapter stated the results of data analysis on success scores and time perception predictive skills performance of elite badminton players by analysis of variance and multiple comparisons. Summary of the hypothesis's tests on success scores and time perception predictive skills performance. Next, In five chapter, through analyze and discuss the results of data analysis of the study 1 and study 2 in chapter 4, to sum up the results of descriptive statistical and difference significant tests and to answer research questions. The research further stated the major findings of this study. At the same time, theoretical evaluation of application effect of badminton special speed combination training method, recommendations for future research and the study conclusion are also discussed at the end section of this chapter. The badminton special speed training method can improve and develop on the success score and time perception predictive skills performance of badminton players, the really reasons of the results of badminton special speed training method on success score and time perception predictive skills performance of badminton players further discussed in five chapter.

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CHAPTER 5

SUMMARY AND FINDING, DISCUSSION AND ANALYSIS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

In five chapter, the main content is to sum up the results of descriptive statistical and difference significant tests. Firstly, to check and answer research questions through discussion and analysis on the results of data analysis of the study 1 and study 2. At the same time, the major research findings further analyzed discussed in this chapter. On the other hand, theoretical evaluation of the application effect of badminton special speed combination training method, recommendations for future research and the study conclusion are also discussed at the end section of this chapter.

5.2 Summary of Major Research Finding

In this study, summary of the major study 1 finding for the effect of badminton special speed training method on success scores of elite badminton players. The current study 1 attained its objectives and exposed the major research findings through analysis of variance (ANOVA) on success scores of badminton players. On the other hand, summary of the major study 2 finding for the effect of badminton special speed training method on time perception predictive skills performance (serve, smash and drop shot) of badminton drop point of elite badminton players. Study 2 attained its objectives and

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exposed the major research findings through multiple analysis of variance (MANOVA) on time perception predictive skills performance (serve, smash and drop shot) of drop point of badminton players. This section stated two aspects, the first section is summary of the research results, and the main content is the influence of badminton special speed training method on success score and time perception prediction skills performance of badminton players. The other section is the major research finding, and the main content is the effects of badminton special speed training method on Success Scores and time perception predictive skills performance of drop point of badminton players.

5.2.1 Summary of Research Results

Summary of the research results of the influence of badminton special speed training method on success score and time perception prediction skills performance of badminton players. First of all, analysis of variance (ANOVA) indicated there is significant difference of the effect of badminton special speed training method (BSSTM) on success scores of badminton players at pre-test and post-test 1 ($p = .021 < .05$ show in Table 5.1). At the same time, there is significant difference of the effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on success scores of badminton players at post-test 1 ($p = .031 < .05$ show in Table 5.1). So, the current study 1 attained its objectives and exposed the major research findings through analysis of variance (ANOVA) on success scores of badminton players.

Next, multiple analysis of variance (MAOVA) indicated there is significant difference of the effect of badminton special speed training method (BSSTM) on time perception predictive skills performance (serve, smash and drop shot) of badminton drop point of badminton players at pre-test and post-test 1(as show in Table 5.1). At the same time, there is significant difference of the effect of badminton special speed training method (BSSTM) compare to badminton traditional speed training method (BTSTM) on time perception predictive skills performance of badminton drop point of badminton players at post-test 1 (as show in Table 5.1). So, study 2 attained its objectives and exposed the major research findings through multiple analysis of

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variance (MANOVA) on time perception predictive skills performance (serve, smash and drop shot) of drop point of badminton players. Summary of the effects of BSSTM and BTSTM on success scores (SS) and time perception predictive skills performance indicated research results in Table 5.1 bellow.

Table 5.1

Summary of Research Results

Summary of the Effects of BSSTM and BTSTM on SS and TPPSP

DV	Intervention	Comparison of Groups	Test Point	Sig.
SS of Study 1	BSSTM	Within-Group1	Pre-test vs Posttes 1	.021
	BSSTM vs BTSTM	Between-Groups	Posttest 1	.031
TPPSP of Study 2	BSSTM	Serve of Group1	Pre-test vs Posttes 1	.012
	BSSTM vs BTSTM	Serve of Between-Groups	Posttest 1	.032
TPPSP of Study 2	BSSTM	Smash of Group 1	Pre-test vs Posttes 1	.005
	BSSTM vs BTSTM	Smash of Between-Groups	Posttest 1	.019
TPPSP of Study 2	BSSTM	Shot Drop of Group 1	Pre-test vs Posttes 1	.011
	BSSTM vs BTSTM	Shot Drop of Between-Groups	Posttest 1	.025

Note. BSSTM = Badminton Special Speed Training Method; BTSTM = Badminton Traditional Speed Training Method; SS = Success Scores; TPPSP = Time Perception Predictive Skills Performance; Between Groups = Group 1 and Group 2.

All in all, summary of the major finding and research results of study 1 and study 2 have been given in sections 5.1 above. The following section will discuss and analyze on the major finding of research and research results.

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5.2.2 The Major Research Finding

5.2.2.1 The Major Research Finding of Effects of Badminton Special Speed Training Method on Success Scores of Badminton Players

In study 1 for training intervention experiment of a period of three months, badminton special speed training method (BSSTM) were used to train and intervene the elite badminton players in the experimental group. Badminton traditional speed training method (BTSTM) were used to train and intervene the elite badminton players in the control group. The experimental group and the control group collection success scores of three test points (pre-test, post-test 1 and delayed post-test 2) were analyzed by two-way between-groups analysis of variance (ANOVA). the results of data analysis show there is significant differences in success scores (SS) of elite badminton players between the pre-test and the post-test by adopting badminton special speed training method (BSSTM). So, the results of experimental study 1 find that badminton special speed training method can develop and improve the success score of elite badminton players. On the other hand, there was no significant difference in the success score between the posttest 1 and the delayed posttest 2 in the experimental group, the result of research finding of study 1 at posttest 1 and posttest 2 show there is the retention effect of training intervention of badminton special speed training method on success scores of elite badminton players. That is to say, the effect of this study 1 is true experiment. However, the results of data analysis show that there is no significant difference in the success scores of elite badminton players between the pre-test and the post-test points by using the traditional speed training method.

Although badminton special speed training methods and badminton traditional speed training methods are around speed quality training. However, the badminton special speed training method designed in this experiment combines the badminton special skills training of the hitting the ball to the target position. Through the results of study 1, it is found that the badminton special speed training method can make badminton players better grasp the batting opportunity and improve the ability of controlling the ball when hitting the ball. At the same time, the success score of the

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experimental group is significantly higher than that of the control group, because the badminton special speed training method adopted in the experimental group is beneficial to improve their the ability of controlling ball and the perceptive ability of action skills. The perceptive ability is reflected in the improvement of the agreement of badminton players turning and stopping footwork in the rapid moving, thus improving the ability of badminton players to predict time of the landing point of the coming ball, so as to improve the number of success in hitting the ball to the target position.

5.2.2.2 The Major Research Finding of the Effects of Badminton Special Speed Training Method on Time Perception Predictive Skills Performance of Drop point of Badminton Players

In study 2, the experimental group was adopted the training intervention of badminton special speed training method for 3 months, and the combined skills training method of the hitting ball to the target position was carried out in the process of training intervention. In this experiment, the design mode of pre-test and post-test experiment was adopted, and this experiment study 2 was collected data of time perception predictive skills performance of drop point of the service to rearcourt, smash and drop shot ball of badminton players at three test points. The collecting data was tested by multivariate analysis of variance (MANOVA). First of all, the results of multivariate analysis of variance find that the badminton special speed training method used in this experiment is beneficial to the development and improvement of badminton ability of time prediction skills. At the same time, the results of study 2 find that the time perception predictive skills performance of drop point of badminton players is more economical through BSSTM training intervention, that is to say, the prediction time is relatively advanced and shortened, thus improving the time perception predictive of drop point of badminton players.

Second, study 2 find the time perception predictive skills performance of drop point of badminton players is related to the flying speed of badminton, and the faster of the flying speed, the longer of the prediction time, that is to say, The faster of the flying speed of badminton, the longer it takes to predict time on the drop point of badminton.

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This result of finding study is related to the flying speed of badminton, the faster of the flying speed is, it is the more difficult that badminton players predict the drop point take longer time. On the other hand, the level of time perception predictive skills performance of drop point of badminton players is related to the perceptual prediction time threshold of badminton players. But, time prediction threshold needs be carried out in the future.

5.3 Discussion and Analysis

Discussion and analysis of the research results of the effect of badminton special speed training method on success score and time perception prediction skills performance of badminton players. Current research discuss and analysis the research results and the major research finding from analysis on the control of teaching and training objectives, analysis on the application of teaching and training principles (optimal combination Principle of Training Contents, the principle of gradual and orderly progress, the principle of timely feedback and strengthening and analysis of training principle of improving success scores). Analysis of Training Intervention Methods; Analysis from the perspective of teaching and training methods; Analysis of Application effect of BSSTM Training Intervention; Analysis of cognitive psychology. Discussion and analysis of the research results of badminton special speed training method (BSSTM) on success scores and time perception predictive skills performance of drop point of elite badminton players is stated in the following. Discussion and analysis of the major findings and the research results on the current study 1 and study 2 is illustrated below.

5.3.1 Discussion and Analysis of Coaching of BSSTM

In this study, Appendix B section A block schedule of training Intervention of BSSTM clearly stated the lesson plan, the main training contents, the progress of the training course. And length of the training intervention time. The training content mainly include serve to target position, footwork training, fast moving and kill, drop shot to target position and smash to target position, cross-court drop shot, underarm net shots,

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forehand and backhand drive and the training of rally for 2 minutes (fast movement forwards and backwards, the forehand overhead slow drop shot, forehand and backhand underarm net shots; fast movement forwards and backwards, the forehand overhead fast drop shot and smash, return of smash forehand and backhand underarm clear).

Appendix C section A is the control of teaching and training objectives and the conceptual framework of skills coaching for the training intervention of BTSTM on experimental badminton players. The control of teaching and training objectives and the conceptual framework of skills coaching of BTSTM include tactical problems, Skill performance focus of BSSTM, Coaching objective dimensions and coaching process assessments system of BSSTM. Tactical problems mainly indicate the strategy of success score, create batting opportunities, create a favorable attack space and defending space, attempted winner; Skill performance focus of badminton special speed training method (BSSTM); Coaching objective dimensions mainly indicate the skills (master all kinds of serve techniques to improve service stability and scoring, further improve ball control ability), tactical (badminton players can active attack, creative shot or attempted winner in compete), social (develop confidence and players responsibility) and fitness (players' metabolism and sports quality can be promoted). Coaching process assessments system of BSSTM (reflections during each coaching class to improve and formative adapted BSSTM assessments system; Coaching to carry on orderly, coaching procedure is clear reasonable movement load).

All in all, the control of teaching and training objectives of skills coaching of BTSTM include the tactical problems, skill performance focus of BSSTM, coaching objective dimensions and coaching process assessments system of BSSTM. However, the control of the teaching and training objectives of the BTSTM is carried out in the effect of the training intervention method of the badminton special speed on the success score and the time perception prediction skills performance. So, the research finds the improvement of success score and time perception predictive skills performance through the training control of the tactical problems, skill performance focus of BSSTM, coaching objective dimensions and coaching process assessments system of BSSTM.

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5.3.2 Discussion and Analysis of Training Principles

Analysis on the application of teaching and training principles of current study indicate in the following:

(A) Discussion and Analysis of the Optimal Combination Principle of Training

In this experiment, the badminton special speed training method adopts the speed and the special skills optimized combination training, which footwork moves combines all kinds of batting techniques, the training intervention time and the length. And the training intensity is strictly controlled. In addition, the batting to the target position improves the player's batting control ability and grasps the best batting time, thus improving the batting success rate. After repeated training many times, the students have established the space-time perceptual performance ability of badminton drop point prediction, and developed and improved the landing time prediction ability of badminton players. Therefore, the combination of badminton special and technical training is helpful for students to master technical movements and improve successful scores.

(B) Discussion and Analysis of the Principle of Gradual and Orderly Progress

The course content of badminton special speed training method adopts the principle of gradual and orderly progress: from the basic pace training to the special technical training, secondly, combination training method of the various batting techniques, which are service ball to target position and return of the service, stroke ball to target position and return of the stroke, skill to the target position and return of the skill, smash to the target position and return of the smash, drop shot to the target position and return of the drop shot. This combination training is helpful to improve the ability of badminton players to control the ball and the development of the perception of time and space.

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(C) Discussion and Analysis of Principle of Timely Feedback and Strengthening

In the process of badminton special speed training method, we should immediately give feedback to each reaction of the students, and make a comparative analysis and positive thinking on their own movements through the learning of the contents of the special speed training methods compiled by the students who have problems. Find out the solution to the problem. The correct teachers should be affirmed in time, so that timely feedback and strengthening can make students form the correct dynamic stereotyping, the faster the feedback, the greater the effect of reinforcement. This kind of reinforcement is helpful to improve students' confidence in learning. However, timely feedback and strengthening is helpful to improve students' success scores (SS) and time perception predictive skills performance (TPPSP).

(D) Discussion and Analysis of Training Principle of Improve on Success Scores

In the compilation of badminton special speed training, the training content is divided into logical sequence units, so that the students can master the technical cognition and technology step by step, so as to reduce the difficulty of teaching and training, and improve the learning confidence and the success rate of practice. On the other hand, badminton speed training, batting to the target position and the combination of batting are more conducive to improving the success rate of batting and developing the ability of players to control the ball. By hitting the target position and hitting back the pull training method can develop the athletes' ability to predict the landing time.

5.3.3 Discussion and Analysis of Effects of BSSTM

Through the experimental study on the effect of badminton special speed training method and traditional speed training method on the success score and time perception prediction skill performance of badminton players. The experimental results show that the effect of badminton special speed training method on the success score and time perception prediction skill performance of badminton players is more significant effect

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than the traditional speed training method. The traditional speed training focuses on improving the physical speed quality, and the traditional speed training generally does not combine with the special technical training. Therefore, although the traditional speed training is an important guarantee for the development performance of athletes. But, it is more important that develop and improve special speed training for elite athletes. At the same time, combining technical training with special speed training can improve and develop athletes' successful score and ball control ability. In addition, the successful score and time perception prediction ability of badminton players can be improved and developed through pull training method of the combination of batting to target position and return of batting in training intervention experiment of badminton special speed training method.

5.3.3.1 Discussion and Analysis of the Theoretical Evaluation of Training Intervention by BSSTM

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(A) Adaptive effect of pull training from hitting to Target position and hitting back in Training Intervention of BSSTM

In the process of the implementing the badminton special speed training method (BSSTM), the students should first be made to understand the practice task. The teacher usually observes the students' practice, classifies the students' wrong actions, and corrects the collective wrong actions. And strengthen the correct action in time. Through the combined pull training of speed and batting technology, students gradually form action adaptation and automation. At the same time, through the training of hitting to the target position and returning of the hitting, the ability of badminton players to control the batting and predict the dropping point is improved. Therefore, the success score and time perception prediction skill performance of badminton players are improved.

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(B) BSSTM is Helpful to Improve Success Scores of Elite Badminton Players

In this study, according to the combination of badminton special speed and special technology, teachers carry out the content of speed and batting to the target position in the whole teaching. In the teaching steps of each unit, it always revolves around improving the movement speed of feather players, the ability to control the ball, the timing of hitting and the ability to judge the timing and position of hitting back. Moreover, fully mobilize the initiative and enthusiasm of students. Therefore, through the repeated combination of badminton speed and batting to the target position, the success score and time perception prediction ability of badminton players can be improved. On the other hand, study 2 found that the time prediction threshold at posttest became smaller than that before training intervention. That is to say, it is more economical that the predictive time of the dropping point of badminton players at post test data analysis of BSSTM.

5.3.3.2 Discussion and Analysis of Theoretical Evaluation of Application Effect of BSSTM on Time Perception Predictive Skills Performance of Elite Badminton players

(A) Discussion and Analysis of Influence of BSSTM Training Intervention on Non-Time Elements of Badminton Players

Non-time factors include stimulation status, influence of stimulation dimensions on time perception, attention, awakening level, working memory capacity. In the combination training intervention of badminton special speed, there will be different stimulation states and intensity. At the same time, when athletes accept different training task requirements, athletes will produce different attention and wake-up levels. Through repeated practice and action strengthening tension training, athletes have formed a long memory of the content of action combination practice. That is to say, repeated speed and skill combination training can improve the attention of athletes, the level of awakening of sports skills and the degree of motor memory.

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(B) Discussion and Analysis of Effect of Training Intervention of BSSTM and Repeated Test on Athletes' Time Prediction Performance

The research indicates that the training intervention of BSSTM is relationship with time predictive of short time. In study 2, the research find that repeated speed and skill combination training can improve and develop the level of time perception predictive skills performance of elite badminton players.

5.3.4 Discussion and Analysis of the Current Study Impacts

The impacts of current study come from the significant effect of badminton special speed training method on the successful scores and time perception predictive skills performance of badminton players. The impacts of this study are presented from the impacts of training method practice and training method theory.

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5.3.4.1 Discussion and Analysis of the Practical Impact of Training Intervention of BSSTM

The findings of the current study show that there is need to adopt the pull combination training method between badminton special speed training method and hitting to target to purpose position. Firstly, in this study, the reasonable training plan is formulated according to the acceptance ability of the athletes, and the reasonable training length, training measure and intensity are set. And combining the characteristics of badminton projects, the combination of the special speed and technology of sports is prepared. The main aim of this study is to improve and develop the ball-control ability and preemptive hitting position of badminton player. The method of the training intervention improves the success score of badminton player. At the same time, this study according to the rapidly changing and uncertain sports characteristics of badminton, this experiment is based on the combined pull training method of badminton special speed and badminton technical action. The purpose of this training method is to improve and develop badminton players' batting ability and preemptive position. In order to improve the

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success score of badminton players. In the game, badminton mobilization can give full play to the reaction speed, displacement speed, action speed and batting control ability, as well as take advantage of the favorable batting position. To create a chance for badminton players to win. Secondly, combined with the characteristics of badminton landing point time prediction, the combined training method of predicting landing point and hitting back shot is designed in the experiment. The results show that the combined pull training method of badminton landing point time prediction and return hitting can improve and develop the time prediction and judgment ability of badminton players. So, badminton special speed training method (BSSTM) can make the time predictive skills performance of the landing point of badminton players shorter and more economical. To sum up, the special speed training method of badminton adopted in this experiment has practical guiding significance for the future training method discipline, the reasonable design and application of special speed training method is beneficial to improve the success score of athletes. In addition, the training method of fast hitting to the target position and time predicting of landing point in ball sports is helpful to improve the time prediction ability of athletes, which also has the influence of enlightening and innovating the practice of ball training methods. This study also further verified the fast response of tennis experts to temporal and spatial perception (Wang, 2012). At the same time, this study found that BSSTM can change the ability of perception of sports This study found that badminton special speed combination training method can change the athlete's ability to predict the sports space-time clues. This improves the athlete's ability to predict the time of drop.

5.3.4.2 Theoretical Impact of Training Intervention Method of BSSTM

Based on the theories of badminton special training (Xiao, 2005) and the cognition theoretical model of time perception. The design of this study was established, the theoretical contribution of current study is to investigate the effect of badminton special speed training method on successful score and time perception predictive skills performance of elite badminton players. The research results show that the training method of badminton special speed and the hitting to the target position are beneficial to improve the successful scores and time prediction ability of landing point of

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badminton players. This study has theoretical guidance and enlightenment for the improvement of the theoretical system of special speed training and the construction of the dimension of the training theoretical system in the future. In addition, based on the theory of training, this study speculated that the athlete's drop-time prediction skill performance was related to the ability to predict the spatial and temporal clues. Then, whether the predictive ability of sports space-time clue is the intermediary effect of badminton special speed training method on the performance of success score and time prediction skill needs further research and determination.

5.4 Recommendations

Through this experimental study, it is proved that the special speed training method of badminton can improve and develop the success score and time perception prediction technical performance of badminton players. At the same time, the comparative study of badminton special speed training method and traditional speed training method. The results show that the effect of badminton special speed training method on success score and time perception prediction is better than that of traditional speed training method. However, this teaching experiment is carried out under the condition of small sample and specific teaching design, and the experimental conclusion has certain limitations. It is suggested that it is necessary to increase the sample size and select different levels of badminton players in future research. Members carry out research to improve the reliability and validity of the study. In addition, the results of this study 2 found that badminton special speed training methods have a significant impact on the time perception limits of badminton players, but the specific landing time perception limits need to be further studied. For badminton landing time limit research, the author plans to continue to expand the research as a research topic in the future. In addition, the research topic of time perception prediction belongs to the category of cognitive psychology, and it is suggested that a new research designer scheme should be established. Finally, although this study has completed the set research purpose and solved the research questions. However, due to the limitation of my time and my ability, it is necessary to further increase the depth and difficulty of the experiment, so the lack of this study is inevitable.

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In addition, this study also arrived the research objectives and replied current research questions. But, many the several limitations of the current study also need to be addressed. Firstly, this study only selected 30 boys of elite badminton players as experimental subjects. However, this study did not select novice badminton players or girls' badminton players as experimental subjects. Secondly, the stopwatch measurement tool is used in the data collection of the time perception prediction skill performance of study 2, and the error value will be produced when the stopwatch is used for the collection data of study 2. Although in order to overcome the error value in the experimental data collection of predicting the falling point time, The research adopts the method of repeated measurement, and randomly selects a set of data for data analysis in the research data analysis, but the future research need to improve the data collection tool and to improve inter-scorers reliability of the prediction time of badminton dropping point.

5.5 Conclusion

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Assessment includes successful scores and time perception predictive skills performance of drop point of elite badminton players. Two-way between-groups analysis of variance (ANOVA) on successful scores of elite badminton players at three test points showed that badminton special speed training method had a significant effect on the improvement of successful score of elite badminton players. Multivariate analysis of variance (MANOVA) on time perception predictive skills performance of dropping point of elite badminton players at three test points showed that badminton special speed training method has a significant effect on time perception prediction skills performance of drop point of elite badminton players. Based on the first analysis, the first study found that the badminton specialized speed training method (BSSTM) improves badminton players' motivation to hit the ball, in other words, develops the ability of badminton players to occupy the advantageous striking timing and position. The first study also found that the combination of hitting the ball to the target position and moving speed can improve the stoke control ability and success score of badminton players. The second analysis indicated that badminton specialized speed training method (BSSTM) narrows the time threshold of drop point predicting, in other words,

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brings the prediction time ahead. The second study also found the further evidence that badminton flight speed is related to the athlete's time perception skills performance of drop point, that is, the faster the badminton flies, the more difficult for badminton player to predict the drop point. This study can be concluded that group was received badminton special speed training method (BSSTM) showed better effect compare to badminton traditional speed training method (BTSTM) toward success score and time predictive of elite Chinese badminton players.

This study has theoretical guidance and enlightenment for the improvement of the theoretical system of special speed training and the construction of the dimension of the training theoretical system in the future. In addition, in this study, the researchers put forward that the predictive ability of sports space-time clues is the intermediary effect of badminton special speed training method (BSSTM) on the effects of success score (SS) and time prediction skill performance (TPPSP). In order to further understand the combination training method of badminton special speed and hitting the ball to the target position, how to improve the successful score and time prediction skill performance of drop point of badminton players? The study found that athletes' success scores and time-prediction skills were associated with athletes' ability to capture sports space-time cues. The researchers will further investigate this new research proposition in the future.

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Appendix A

Expert Questionnaire

Serial number:_____

The Effect of BSSTM towards Success Score and Time Perception Predictive Skills Performance among Badminton Players

Respect Expert:

I am a Ph.D. student in the faculty of sports science, University Pendidikan Sultan Idris (UPSI). Title of research thesis is "The effects of badminton special speed training method (BSSTM) towards success score and time perception predictive skills performance of badminton players". The purpose of survey questionnaire is to confirm the validity and reliability of research independent variable items and test method items of dependent variables. The questionnaire was self-designed by the researcher. The research questionnaire includes **Part A、B and C** (**refer to Appendix A**). Items of Part A (BSSTM) of expert Questionnaire come from the contents of specialized speed training method in《Badminton theory and practice》 (Xiao, 2005) 、《Badminton steps to success》 (Grice & Grice, 1996) and the recommended content of some senior badminton experts. In this study, 13 items of **Part A** for badminton specialized speed training method (**BSSTM**). In the process of designing the **Part A of** expert Questionnaire, selecting items of research questionnaire have to combine the characteristics of badminton techniques and tactics, the feasibility and systematization of training methods and scientific principles. 4 items of in **Part B** of expert questionnaire for successful score (**SS**) test method of badminton athletes come from 《Badminton steps to success》 (Grice & Grice, WA, 1996). 4 items of **Part C** of expert questionnaire for test method of badminton athletes' time perception predictive skills performance (**TPPSP**) come from the doctoral thesis (Wang，2009). In this study, there are four kinds of questionnaire that have been selected by expert interview.

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In this study, research questionnaire includes badminton expert Questionnaire (part A、part B and part C). The details of these expert questionnaire are shown in Appendix A. **Part A** in appendix A is badminton special speed training method (**BSSTM**). It is a total of 13 items of badminton special speed training method; **Part B** in appendix A is the test method of the effect of Badminton Specialized Speed training Method on Badminton player's Success Score (**SS**), it is 5 items of test method of success score; **Part C** in appendix A is test method of the effect of badminton special speed training method on badminton player' Time Perception Predictive Skills Performance (**TPPSP**), it is 3 items of test method of Time Perception Predictive Skills Performance (**TPPSP**).

Kindly be informed that there is on right or wrong, answer to any of the item in this questionnaire. The method of choosing priority is adopted in filling out the questionnaire, and the optimal selection use style of **Likert Scale** ranging from strongly agree (Valued 5) to strongly disagree (valued 1). Each item of questionnaire can only select one priority score. This questionnaire will not involve your privacy, after the questionnaire is returned for the experiment only Data statistics, do not do any other uses. You need only fill in the actual situation and ideas. Your answer will be kept confidential, please complete the questionnaire answer. Thank you for your full cooperation.

Your basic information:

1、Sex: male □ female □

2、Your age: 25-35 □ 36-45 □ 46-60 □

3、Record of formal schooling: technical secondary □ junior college □ university □ Master □ doctor □

4、Source of work before physical education teaching and training: sportsman □ Sports colleges and universities □ other □

5、Your highest sports experience: National champion □ one-level sportsman □ two-level sportsman □ not have □

6、Teaching years: Less than 10 years □ 10-15 □ 15-20 □ More than 20 years □

7、Are you engaged in badminton teaching or training: yes □ no □

8、Your job title: □ Adjunct professor □ Professor □ Senior coaching □ Lecture

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Validation Rubric for Expert Panel

ASSESSOR GUIDE:

1. Please provide an answer for all statements by marking (√) in the relevant columns.
2. Please use the comments and suggestions section to recommend revisions.

Appendix A: Badminton Experts Validate Questionnaire for the Training Intervention of BSSTM

Part A: Badminton Special Speed Training Method (BSSTM) Training Intervention

No.	Items of Badminton Specialized Speed Training Methods （BSSTM）	Score 1=Strongly Disagree (SD) 2=Disagree (D) 3=Undecided (UD) 4=Agree (A) 5=Strongly Agree (SA)				
		1	2	3	4	5
1	Training of fast serve to target position (the forehand and backhand low serve, the high serve, the flick serve, the drive serve).					
2	Train backward footwork with visual or auditory signals: ①Run backward. ②Skip backward. ③Slide footwork backward.					
3	Footwork training to move to one side of the racket and to the side of the non-racket.					
4	Training of the fast lunge and recovery. A deep lunge into the forecourt and recovery、lunge into the right forecourt and recovery、lunge into the left forecourt and recovery.					

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5	Move to 6 positions and place the shuttlecock. Success 2 to 1 times = 1 point.					
6	Fast net kills (Shuttle above top of net) and the overhead forehand Fast kill in the two corners of rear court in 30 seconds.					
7	The forehand overhead fast drop shot to target position and smash to target position					
8	The overhead backhand fast drop shot and underhand backhand drop shot.					
9	Cross-court drop shot at net and tumble drop shot at net.					
10	Movement forewords and backwards, the forehand overhead clear and underarm net shots.					
11	Fast movement push or the forehand and backhand drive.					
12	Rally for 2 minutes: Movement forwards and backwards, the forehand overhead slow drop shots, forehand and backhand underarm net of the return of stroke training.					
13	Rally for 2 minutes: Movement forwards and backwards, the forehand overhead fast drop shot and smash, return of smash, forehand and backhand underarm the return of clear ball.					

Comments and Suggestions

I hereby validate this questionnaire ***can / cannot** be used based on the evaluation level of each section in this form.

Yours sincerely,

Stamp:

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Appendix A: Badminton Experts Validate Questionnaire for Research Instrument of Success Score

Part B: *Success Score Test Method for Badminton Players*

No.	Items of Test Method of Success Score For badminton players	Score 1=Strongly Disagree (SD) 2=Disagree (D) 3=Undecided (UD) 4=Agree (A) 5=Strongly Agree (SA)				
		1	2	3	4	5
1	Forehand serve to target position in rearcourt in 1 minute. Success Score Check: Success 15 to 13 times = 5 points; Success 12 to 10 times = 4 points; Success 9 to 6 times = 3 points; Success 5 to 3 times = 2 points; Success 2 to 1 times = 1 point.					
2	Using 1.5 frequency of the serve machine, serve to the midcourt. Record the successful times of drop shots to target position in 1 minute. Success Score Check: Success 15 to 13 times = 5 points; Success 12 to 10 times = 4 points; Success 9 to 6 times = 3 points; Success 5 to 3 times = 2 points; Success 2 to 1 times = 1 point.					
3	Using the 1.5 frequency of serve machine to serve to the two corners of badminton rearcourt in 1 minute. Record successful times of return kill. Success Score Check: Success 15 to 13 times = 5 points; Success 12 to 10 times = 4 points; Success 9 to 6 times = 3 points; Success 5 to 3 times = 2 points; Success 2 to 1 times = 1 point.					
4	Place the shuttlecock in the four corners of the left court, each corner with 4 shuttlecocks as touching target. After listening to the signal, start to touch target of four corners from starting position, finish to touch all targets, and then go back to the starting position. Record time of touching all target. Check your Score: 27.51 to 28.50 seconds = 5 points; 28.51 to 29.50 seconds = 4 points; 29.51 to 30.50 seconds = 3 points; 30.51 to 31.50 seconds = 2 points; 31.51 to 32.50 seconds = 1 point.					
5	Using 2.0 frequency of the serve machine, serve to the midcourt. Record the successful times of Smash to target position in 1 Minute. Success Score Check: Success 10 to 9 times = 5 points; Success 8 to 7 times = 4 points; Success 6 to 5 times = 3 points; Success 4 to 3 times = 2 points; Success 2 to 1 times = 1 point.					

Comments and Suggestions

I hereby validate this questionnaire ***can / cannot** be used based on the evaluation level of each section in this form. Yours sincerely,

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Appendix A Badminton Experts Validate Questionnaire for Research Instrument of Time Perception Predictive Skills Performance

Part C: *Time Perception Predictive Skills Performance (TPPSP) Test Method for Badminton Players*

No.	**Items of Test Method of Time Perception Predictive Skills Performance**	**Score** **1=Strongly Disagree (SD)** **2=Disagree (D)** **3=Undecided (UD)** **4=Agree (A)** **5=Strongly Agree (SA)**				
		1	**2**	**3**	**4**	**5**
1	The 1.5 serve frequency of the serve machine is used to serve the high serve to the target in the rear-court, so that the object can predict the landing time of the high serve. Record your Predict Time:					
2	The 1.5 serve frequency of the serve machine is used to serve to the target of the rear-court, the forehand Smash in badminton rearcourt. Predict landing time of forehand smash. Record your Predict Time:					
3	The 1.5 serve frequency of the serve machine is used to serve to the target of the rear-court, the forehand drop shot in badminton rearcourt. Predict the landing time of badminton forehand drop shot. Record your Predict Time:					

Comments and Suggestions

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_____

I hereby validate this questionnaire ***can / cannot** be used based on the evaluation level of each section in this form.

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Appendix B Section (A)

Block Schedule of BSSTM Training Intervention

TM	M	1												2												3											
	W	1			2			3			4			5			6			7			8			9			10			11			12		
	C	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
BSSTM 1		×			×			×			×			×			×			×			×			×			×			×			×		
BSSTM 2			×			×			×			×			×			×			×			×			×			×			×			×	
BSSTM 3				×			×			×			×			×			×			×			×			×			×			×			×
BSSTM 4			×			×			×		×			×			×			×			×			×			×			×			×		
BSSTM 5		×			×			×				×			×			×			×			×			×			×			×			×	
BSSTM 6				×			×			×			×			×			×			×			×			×			×			×			×
BSSTM 7			×			×			×			×			×			×			×			×			×			×			×			×	
BSSTM 8		×			×			×			×			×			×			×			×			×			×			×			×		
BSSTM 9				×			×			×			×			×			×			×			×			×			×			×			×
BSSTM 10			×			×			×			×			×			×			×			×			×			×			×			×	
BSSTM 11		×			×			×			×			×			×			×			×			×			×			×			×		
BSSTM 12				×			×			×			×			×			×			×			×			×			×			×			×
BSSTM 13			×			×			×			×			×			×			×			×			×			×			×			×	

Note: BSSTM = Badminton Special Speed Training Method; TM = Training Method; M = Month; W = Week; C = Class.

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Appendix B Section (B):

Block Schedule of BTSTM Training Intervention

TM	M	1												2												3											
	W	1			2			3			4			5			6			7			8			9			10			11			12		
	C	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
BTSTM 1		×			×			×			×			×			×			×			×			×			×			×			×		
BTSTM 2			×			×			×			×			×			×			×			×			×			×			×			×	
BTSTM 3				×			×			×			×			×			×			×			×			×			×			×			×
BTSTM 4			×			×			×			×			×			×			×			×			×			×			×			×	
BTSTM 5		×			×			×				×			×			×			×			×			×			×			×			×	
BTSTM 6				×			×			×			×			×			×			×			×			×			×			×			×
BTSTM 7			×			×			×			×			×			×			×			×			×			×			×			×	
BTSTM 8		×			×			×			×			×			×			×			×			×			×			×			×		
BTSTM 9				×			×			×			×			×			×			×			×			×			×			×			×
BTSTM 10			×			×			×			×			×			×			×			×			×			×			×			×	
BTSTM 11		×			×			×			×			×			×			×			×			×			×			×			×		
BTSTM 12				×			×			×			×			×			×			×			×			×			×			×			×
BTSTM 13			×			×			×			×			×			×			×			×			×			×			×			×	

Note: BTSTM = Badminton Traditional Speed Training Method; TM = Training Method; M = Month; W = Week; C = Class.

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Appendix C Section (A)

The Control of Teaching and Training Objectives and the Conceptual Framework of Skills Coaching for BSSTM Training Intervention

Unit	BSSTM	Tactical Problems	Skill Focus	Coaching Objective Dimensions	Coaching Process Assessments
1	BSSTM1, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM1: - Strategy of success score - the Create batting chance and attempted winner	BSSTM1: Forehand or backhand Serve: -The High serve or Low serve -The flick or the drive serve -Foul serves	Skill: Master all kinds of serve techniques to improve service stability and Scoring, further improve Ball control ability. Tactical: badminton players can actively attack, Creative shot or attempted winner in compete. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system (Coaching to carry on orderly, coaching procedure is clear, reasonable movement load).
2	SSTM2, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM2: -Scoring strategy -Create a favorable Attack Space and Defending Space -The chance to deprive opponents of time	BSSTM2: - Backward footwork With visual or auditory signals: ① Run backward. ② Skip backward. ③ Slide footwork.	Skill: Players can to execute footwork backwards by running, skipping or a chasse movement. Tactical: badminton players can actively attack, Creative shot or attempted winner in compete. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system
3	BSSTM3, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM3: - Scoring strategy -Create Defending Space - The return shots killing ball	BSSTM3: Footwork sideways - Movement to the racket side and movement to the non-racket side.	Skill: Players can to execute Footwork sideways though Movement to the racket side and movement to the non-racket. Tactical: badminton players can actively Create a Defending Space, formed the return shots killing ball. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system

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4	BSSTM4, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM4： - Scoring strategy - Defending strategy - Creative shot or Attempted winner	BSSTM4： Fast lunge and recovery - A deep lunge into the right forecourt and recovery. -lunge into the left forecourt and recovery.	Skill: Players can to execute Fast lunge and recovery, according to create the condition of scoring and defense transfer to Attack. Tactical: badminton players can actively Create a Defending Space, Defense transfer to Attack situation can be formed. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system
5	BSSTM5, Bouts, duration energy system rest, RPE, % HR max, volume of training BSS training Method. MSSTM5 : training (Figure 3.1)	Scoring and Defending strategy - Good footwork can Create Attack / Defending Space Tactical Problems -deprive opponents of time	BSSTM5: - Fast move to 6 positions and touch the shuttlecock Skill Performance Focus	Skill: Players can develop badminton special movement footwork and improve movement speed. Tactical: badminton players can actively Create a Defending Space, The chance to deprive opponents of time, defense transfer to Attack situation can be formed. Coaching Objective Dimensions. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system Coaching Assessments system of BSSTM
6	BSSTM6, Bouts, duration energy system rest, RPE, % HR max, volume of training - Figure3.1	BSSTM6： - Scoring strategy -High clear Creative shot. Defense. -Backhand shots Creative shot or attempted winner, in Singles and doubles.	BSSTM6: Forehand clear (Hitting technique: Whip) and backhand overhand Slow drop (Hitting technique: Push).	Skill: (High serve) Player can adopt Whip hitting technique will play from front of Midcourt to Rear of Midcourt or Rear. Point of impact will be executed well out to front of non-racket leg. (Slow drop): Player can adopt push hitting technique will play from Rear of Midcourt or Rear to Forecourt. Point of impact will be executed above racket shoulder. Tactical: Creative shot or attempted winner and use attack. Social: Develop confidence and players responsibility.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system (Whether can organize coaching to carry on orderly, coaching procedure is clear. The reasonable design movement load).

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7	BSSTM7, Bouts, duration energy system rest, RPE, % HR max, volume of training.	BSSTM7: - Scoring strategy - Creative shot , Attack, common in all match.	BSSTM7: Forehand and backhand net hook shot (Push).	Skill: (Net shot): Player can adopt push hitting technique will play from Forecourt to Forecourt. Point of impact will be executed well out to front high as possible. Tactical: Creative shot or attempted winner and use attack. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system
8	BSSTM8, Bouts, duration energy system rest, RPE, % HR max, volume of training.	BSSTM8: Fast drop attempted winner, Attack, in Singles /mixed doubles. Smash Attempted winner.	BSSTM8: Forehand overhead fast drop shot (Tap) and smash (Whip) to target.	Skill: Player can adopt Tap hitting technique will play from Rear of Midcourt or Rear to Midcourt. Point of impact will be executed above and in front of racket shoulder. Tactical: Creative shot or attempted winner and use attack. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Coaching Process Assessments system of BSSTM
9	BSSTM9, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM9: Attempted winner, in all games.	BSSTM9: Net kill (Hitting technique: Tap).	Skill: Player can adopt Tap hitting technique will play from Forecourt to Midcourt. Point of impact will be executed well out to front high as possible. Tactical: Creative shot or attempted winner and use attack. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system
10	BSSTM10, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1). BSS training Method	BSSTM10: Attempted winner or creative shot, in all games. Tactical Problems	BSSTM10: Overhead Clear and Net Shots (Overhead Clear, hitting technique: Whip or Tap, Net Shots - Push). Skill Performance Focus	Skill (Overhead Clear): Player can adopt Whip or Tap hitting technique will play from Rear of midcourt or Rear to Rearcourt. Point of impact will be executed Above and just in front of racket shoulder. (Net Shots): Player can adopt Push hitting technique will play from forecourt to forecourt. Point of impact will be executed well out to front high as possible. Tactical: Creative shot or attempted winner and use attack. Social: Develop confidence.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system (Coaching organize carry on orderly and clear). Coaching Process Assessments system of BSSTM

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11	BSSTM11 Bouts, duration energy as Figure 3.1).	BSSTM11: Attempted winner or creative shot, most common in Doubles.	BSSTM1: The Drives, Hitting technique: Whip or Tap.	Skill: - Coaching objectives Dimensions of BSSTM6 and BSSTM7 are performed as Same described above class 1 in fourth week.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments
12	BSSTM12 Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM12: Slow drop shots: Attempted winner or creative shot, most common in Single and level Doubles. - Underarm Net Shots: creative shot.	BSSTM12: Slow Drop Shots and Net Shots, Hitting Technique: Push.	BSSTM12 (Slow drop shots and Net shots): The player stands in the midcourt. The feeder stands in the front of the opposite midcourt. The feeder hits a high serve (1) to the rearcourt. The player moves back to the rearcourt, hits a forehand overhead slow drop shot (2) to the opposite forecourt, and return to midcourt. The feeder hits either a net shot (3) to the forecourt or a clear (4) to the rearcourt. The player moves accordingly and plays either a drop shot (5) or a net shot (6) to the forecourt and recovers. The feeder repeats the net shot or clear to continue the rally. Creative shot or attempted winner and use attack. Social: Develop confidence and responsibility. Fitness: Players metabolism and quality can be promoted. Fitness**:** Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system (Whether can organize coaching to carry on orderly, coaching procedure is clear. The reasonable design movement load).
13	BSSTM13, Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	BSSTM13: - (Fast Drop shots) Creative shot or attempted winner (Smash). Underarm Clear, Creative shot or 'hit and hop.	BSSTM13: Movement Forwards and Backwards, the Forehand Overhead fast Drop Shot and Smash, return of Smash, Forehand and Backhand Underarm Clear. Hitting Technique: Tap or Whip.	BSSTM13: The player stands in the midcourt. The feeder stands in the opposite midcourt and hits high serves (1) to the rear court. The player moves back to the rear court, hits a forehand overarm fast drop shot (2) and returns to the midcourt. The feeder blocks (3) to the forecourt. The player moves from the midcourt, lunges into the forecourt, plays am underarm clear (4) to the opposite rear court and then returns to the midcourt. The feeder plays a fast drop shot (5) to the midcourt. The player blocks to the forecourt (6) and remains in the midcourt. The feeder clears (7) high to the rear court. The player moves back to the rear court and hits a forehand overarm fast drop shot to repeat the sequence. Tactical: Creative shot or attempted winner and use attack. Social: Develop confidence and players responsibility.	Reflections during Each coaching class to improve and formative adapted BSSTM assessments system (Whether can organize coaching to carry on orderly, coaching procedure is clear. The reasonable design movement load).

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Appendix C Section (B)

The Conceptual Framework of Skills Coaching for BTSTM Training Intervention

Unite	BTSTM	Tactical Problems	Skill Performance Focus	Coaching Objective Dimensions	Coaching Process Assessments system of BTSTM
1	BTSTM1: (Transform signal variable speed run). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop running speed and reaction speed, improve physical speed quality.	Fast reaction speed and movement speed	Skill: Badminton player can adopt Transform signal variable speed run. Tactical: Develop running speed, reaction speed for winner, and improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
2	BTSTM2: (Listen to signal and touch the target). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop running speed and reaction speed	Fast reaction and movement speed	Skill: Badminton player can Listen to signal and touch the target. Tactical: Develop running speed and reaction speed, to improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
3	BTSTM3: (60m running). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop running speed and improve physical speed quality.	Fast movement speed	Skill: Badminton player can Fast movement speed. Tactical: Develop running speed and reaction speed for winner, improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
4	BTSTM4: (Jump rope fast for 1 minute). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop jumping speed and Starting ability.	Fast starting and speed jumping ability	Skill: Badminton player can Jump rope fast and finish target. Tactical: Develop jumping ability and improve physical quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments

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5	BTSTM5: (Standing high and running for 15 seconds / each group exercise). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop starting speed and movement speed	Fast starting speed and Fast movement speed	Skill: Badminton player can finish Standing high and running according to exercise target. Tactical: Develop starting speed and movement speed. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
6	BTSTM6: (Fast recumbent push for 20 seconds). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop upper limb burst strength and strength endurance	Fast action speed	Skill: Badminton player can Fast recumbently push for 20 seconds. Tactical: Develop fast action speed and improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
7	BTSTM7: (Jump and hit the target ball). Bouts, duration energy system rest, RPE, %HR max, volume of training (as Figure 3.1)	Develop jumping ability and improve the ability of controlling ball	jumping ability and the ability of controlling ball	Skill: Badminton player can Jump and hit the target ball. Tactical: Create jumping ability and the ability of controlling ball. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
8	BTSTM8: (Two corners of the forecourt move and jump to kill ball). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Scoring strategy, Creative Fast Jumping and push kill ball	Jumping ability and control ability of push kill ball	Skill: Badminton player can fast move to forecourt and jump to kill ball. Tactical: Fast move and create of chance of killing shot ball. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
9	BTSTM9: (Move two corners in the backcourt and kill). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Scoring strategy, Creative shot or Attempted winner	Fast speed Jumping ability and kill ball	Skill: Player can Move two corners in the backcourt and kill the target ball. Tactical: Creative shot or Attempted winner, improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments

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10	BTSTM10: (Weight-bearing strength training). Bouts, duration energy system rest, RPE, %HR max, volume of training (as Figure 3.1)	Develop fast movement speed and jumping speed	Fast speed Jumping ability and physical speed quality	Skill: Badminton player can finish exercise of the weight-bearing strength. Tactical: Create jumping speed and improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
11	BTSTM11: (Throw shuttlecock in the distance). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Develop badminton ball practice and develop batting assistant practice	Familiar with badminton ball and batting practice	Skill: Badminton player can Continuous throw shuttlecock in the distance. Tactical: Familiar with badminton ball and batting practice. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
12	BTSTM12: (Move to 6 positions and place the shuttlecock). Bouts, duration energy system rest, RPE, % HR max, volume of training (as Figure 3.1)	Scoring strategy, Creative shot or Attempted winner	Fast movement footwork, create shot space and defense space	Skill: Player can adopt Transform signal variable speed run. Tactical: Create running speed and reaction speed for winner, improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments
13	BTSTM13: (Fast stroke badminton training on the wall). Bouts, duration energy system rest, RPE, %HR max, volume of training (as Figure 3.1)	Scoring strategy, Creative shot and Attempted winner	Develop batting action and improve action speed	Skill: Player can adopt Transform signal variable speed run. Tactical: Create running speed and reaction speed for winner, improve physical speed quality. Social: Develop confidence and players responsibility. Fitness: Players' metabolism and sports quality can be promoted.	Reflections during Each coaching class to improve and formative adapted BTSTM assessments

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Appendix D Badminton for the Basic P.E. Quality of Badminton Players

The Basic P.E. Quality Test for Badminton Players

Experiment subjects	Your age	Height (cm)	Weight (kg)	Standing long jump (cm)	60 meter run seconds	backward put the shot (m)

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