Research Article

The Impact of Daniel's Cognitive Instructional Model on Cognitive Motivation and the Learning of Basic Badminton Skills Among Female University Students

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Abstract

The modern educational environment requires moving away from old, passive learning models toward evolving, constructivist frameworks which help to cultivate critical engagement and develop both cognitive and psychomotor skills. This study analyzes the effects of Daniel's Cognitive Instructional Model on the cognitive motivation and the acquisition of the high long serve, forehand clear, and backhand clear of badminton among female university students. The sample consisted of 110 female students at the College of Physical Education and Sports Sciences of the University of Thi-Qar and Al-Ayn University, during the 2025-2026 academic year. The study was based on a rigorous experimental design with equivalent control and experimental groups, and the primary sample consisted of 30 students, as the study's core concern. The experimental group was taught using educational units based on the nine sequential stages of Daniel's model, while the control group was taught using the command style of teaching that the faculty typically employs.

A bespoke cognitive motivation scale and standardized badminton skill assessments were used pre and post the nine-week instructional phase. Independent and paired t-tests were conducted and indicated that both groups showed significant improvement. However, the experimental group showed marked statistically significant improvements in cognitive motivation and all the badminton skills assessments compared to the control group. It appears that Daniel's model, which combines the conceptual elements of direct instruction, peer-to-peer dialogue, concept mapping coupled with active learning, is highly effective in minimizing cognitive overload and transforming the learner from a passive recipient to a proactive intellectually and psychologically engaged learner and architect of their learning process. For the university level of physical education, the coupling of cognitive and motor tasks within this model serves an excellent purpose in the optimization of pedagogy, providing a deep and meaningful learning experience beyond the rote practice traditionally associated with the field.

Keywords: Daniel's Cognitive Instructional Model, Cognitive Motivation, Badminton Skills, Physical Education Pedagogy, Constructivist Learning.

Introduction

In the modern age, the rapid pace of knowledge acquisition and the swifter advancement of technology influence the teaching of every subject. The heightened focus and concern on the changing needs and requirements of technology and knowledge in modern-day construction and training are of great importance (Sfayyih & Alghezi, 2026). Holistic and complete development of a learner's cognitive (mental), affective (emotional), and psychomotor (physical movement) skills, as opposed to the mere development of movement skills (Sfayyih & Alghezi, 2026), has become one of the primary goals of higher education. Designs and models of teaching are such that they cater for the development of sophisticated processing of information and the ability to locate and analyze appropriate data to deal with complex and dynamic problems (Sfayyih & Alghezi, 2026). Teaching is no longer an endeavor limited to lecturing and demonstrating. It is also the development of each student's independent personality and the expansion of each student's intellect (Al-Hafiz & Al-Saadawi, 2026). As a core and primary discipline of study, physical education has a significant role to play in this process. It contributes to the development and improvement of physical and mental (psychological) endurance and resiliency, as well as the development of physical skills and coordination (Al-Hafiz & Al-Saadawi, 2026; Sfayyih & Alghezi, 2026; 2026).

Among racket sports, badminton offers a unique addition to physical education owing to the high levels of cognitive and neuromuscular challenges involved. In addition to the speed and accuracy of movements, the successful player must possess explosive strength, a high level of agility and spatial awareness, and an ability to make quick decisions and biomechanical movements with precision (Al-Jumaili, 2010). Badminton, like many other sports, relies on mastery of basic fundamental skills. These skills are the building blocks for the execution of advanced techniques and tactics. Furthermore, refinement of these skills involves a lot of practice, sustained effort, and a high degree of cognitive focus (Sfayyih & Alghezi, 2026). It is no wonder that when thoroughly assessed, the traditional, unidirectional, command-style methods of training have become inadequate. The new methods stress the importance of supportive learning theories, where learners become the builders of their own learning, as they explore and process information about the movements they are required to perform (Neal & Anderson, 1987).

Because of the shortcomings of the conventional teaching model, several studies have explored the cognitive instructional model. This model focuses on the integration of the mental and physical aspects of learning. One of the frameworks is Daniel’s Cognitive Instructional Model, which aims at teaching learners to develop key concepts and skills through a highly structured model of a nine-step cognitive sequence (Neal & Anderson, 1987; Raji, 2007). This model places a lot of consideration on the learner’s internal mental processes. This is complemented by active physical participation, coupled with continuous dialogue and the managed extraneous cognitive load during the learning of complex psychomotor tasks (Neal & Anderson, 1987). This model uses the concept of “meaningful learning” to ensure that learners know and understand the dynamics of a skill as well as the physical movements associated with the skill (Neal & Anderson, 1987).

Also, another psychological construct identified is cognitive motivation. Cognitive motivation is viewed as a personal continuous psychological drive to gain knowledge, understand the unknown, overcome mental/physical challenges, and deal with complex/abstract ideas (Al-Badrani, 2012). In sports education, high cognitive motivation is seen as the psychological force behind the athlete's engagement and perseverance in the long and trying practice sessions, endurance of the early and frustrating phases of practice, and the assimilation of the tactical lessons (Al-Badrani, 2012). A person with high cognitive motivation gets great satisfaction from the learning experience, considering the mastery of a challenging psychomotor task as a mental puzzle (Al-Badrani, 2012). Therefore, the measurement and cultivation of cognitive motivation by teachers is critical for the realization of optimal performance of skills, maintenance of an active participation and performance in sports, and preservation of interest in continuous engagement in physical activities. Keeping in mind the integration of psychology and cognitive science, the current research attempts to empirically find the effect of the use of Daniel's Cognitive Instructional Model in enhancing cognitive motivation, as well as the fundamental badminton skill acquisition, of university students.

Research Problem

Despite the numerous instructional models present in the literature, there is a noticeable gap in the implementation of theories in university physical education. Traditional direct command teaching still prevails in sports instruction, particularly in teaching racket sports. In a predominantly teacher-centered setting, the teacher is the ultimate source of information and behavior, while the students are the ultimate passive learners. An authoritarian teaching model limits the students' ability to think critically, plan, and learn how to solve the problems of the movements they are trying to learn in a peer group setting, which in turn limits how they learn the mechanics and the tactics of the movements.

While doing observational studies of badminton teaching practices at the College of Physical Education and Sports Sciences at the University of Thi-Qar, a noticeable passive learning model was discovered. A large number of the teachers' practices relied heavily on direct and one-way methods of teaching, and the most prevalent method of teaching was the "command style teaching" method. This paradigm reduces students to the robotic execution of commands, totally ignoring the new and modern teaching methods that become extremely useful in the teaching of complex and challenging skills of movements. Not engaging the learners in the teaching of basic skills, such as the high long serve and the forehand and backhand clears, usually leads to a high level of dissatisfaction and a low level of skill retention.

Traditional models of teaching can inhibit cognitive motivation, leading to results like quick disengagement, shallow motor responses, and a lack of self-efficacy when presented with complex game situations (Al-Badrani, 2012). Even if students can reach ends of the learning goal, the command-style approach of teaching can result in the students losing the motivation to discover, as teaching command-style can be rigid and ignore how students learn at different rates and in different ways. This justifies the need for researchers to look for ways to teach that can be proven to work. The focus of this study is to see the extent to which Daniel's Cognitive Instructional Model can be used to teach badminton in response to deficiencies in command-style approaches of teaching and the research of Neal and Anderson.

Research Objectives

The investigation is systematically guided by the following primary objectives, designed to answer the current gaps in physical education teaching methods:

The first objective states that, within the context of female university students and the teaching of badminton, a fully comprehensive psychometric instrument designed to measure cognitive motivation must be constructed, validated, and standardized.

The second objective states that within the construct of educational theory, and during the 2026-2027 academic year, specialized teaching units should be designed and constructed based on the principles of the 9-stage sequence of Daniel's Cognitive Instructional Model and the theory of Constructivism.

The third objective states that, using the concept of traditional positive motivation theory, Daniel's model should be used to develop a teaching model to teach the basic badminton skills of the high long serve, forehand clear, and backhand clear, and an evaluation of the traditional model of badminton teaching should be conducted to assess the learning outcomes of the defined skills and increase cognitive motivation.

Research Hypotheses

Based upon the theoretical underpinnings of constructivist pedagogy, cognitive motivation theory, and preliminary observations of motor learning environments, the investigation proposes the following hypotheses:

The first hypothesis postulates that there are statistically significant differences between the pre-test and post-test scores for both the control group and the experimental group in terms of cognitive motivation and basic badminton skill performance, with the variance favoring the post-test results.

The second hypothesis asserts that there are statistically significant differences between the control group and the experimental group in the post-test scores for both cognitive motivation and badminton skill performance, with the statistical variance favoring the experimental group that was exposed to Daniel's Cognitive Instructional Model (Raji, 2007).

Research Areas and Scope

The various parameters that set the bounds of this practical study's operation and population focus on the following:

- The population in the study includes the final-year female students from the College of Physical Education and Sports Sciences at the University of Thi-Qar, and the final-year female students from Al-Ayn University, during the 2026-2027 academic year.
- The time domain is the span of the entire work of preparation, data collection, teaching, and the last statistical analysis of the 2026.
- In the study, the space domain is confined to the indoor sports halls, classrooms, and specialized badminton facilities located on the campuses of University of Thi-Qar, and on the campus of Al-Ayn University.

Definition of Terms

Operational definitions of the main constructs and teaching models employed in this study serve to provide unequivocal clarity and eliminate interpretive ambiguity.

In education literature, Daniel's Model (Neal and Anderson, 1987) is an instructional model consisting of nine interrelated phases. They are Direct Instruction, Review, Overview, Investigations and Activities, Representation or Expression, Dialogue and Discussion, Invention, Application, and Summary and Closure. The phases of the model guide the educator to take the learner from the exposure of the concept to the active and deep mastery of the concept.

In the context of sports education, it is defined as the drive to not only understand physically but to welcome the risks that are involved with learning new movements and to find satisfaction in achieving balance (Al-Badrani, 2012).

Theoretical Framework and Previous Studies

The Teaching Model and Its Essential Components

Educational models act as vital links between psychological theories and everyday classroom practice. In the pedagogical literature, Joyce and Weil define a teaching model as a comprehensive plan that help teachers in preparing resources, directing learning, and helping students achieve learning experiences and outcomes that are desired (Joyce & Weil, 1980). It is an applied and descriptive model which clearly explains the interactions required with learners to ensure that teaching style is consistent with the curriculum structure and the established cognitive theories (Joyce & Weil, 1980). Similarly, Al-Haila describes a teaching model as a number of important steps that are overlapping, interconnected and interactive, aimed at constructing teaching materials for target audiences (Al-Haila, 1999).

Numerous components of a thoroughly developed, science-based teaching model can be identified and are highly valued by modern practitioners (Joyce & Weil, 1980). The first of these components is the Title. This must be clear, concise, and developmentally appropriate for the target group, while accurately framing the main idea of the model. The second component, the Vindication or Justification, is designed to stimulate the interest and curiosity of learners, and to provide a general idea of the importance of the content (Joyce & Weil, 1980). The third component, Purposes or Objectives, requires the formulation of clear and measurable outcomes, which learners are expected to achieve by the end of a defined instructional period, and which are realistic given the instructional time available (Joyce & Weil, 1980). The fourth component is the Activities, which entails the purposeful design of a coherent and logically sequenced set of physical and cognitive tasks, aimed at achieving the stated objectives. Finally, the Evaluation component involves the objective setting of the parameters for the testing and measurement of the transfer of content and/or psychomotor skills, which is frequently done by means of objective tests (Joyce & Weil, 1980).

Daniel's Cognitive Instructional Model

Daniel's model is the Cognitive Instructional Model. In 1987, Daniel Neal, Charles Anderson, and others published the first account of this model (Neal & Anderson, 1987). Most of the ideas integrated into Daniel's model relied heavily on the work of many multi-faceted constructivist and cognitive theorists (Neal & Anderson, 1987). Daniel's model specifically concentrates on meaningful learning, contrasting with the memorization of facts and the mindless repetition of physical exercises. The model builds on the idea that the nature of human cognitive processing is cumulative. People learn ideas by being involved with various domains, and by using diverse strategies to integrate and build on their existing cognitive frames (Neal & Anderson, 1987). This framework represents the way an individual interprets the environment, and copes with the demands for learning throughout life (Neal & Anderson, 1987).

The architectural coherence of Daniel's model stems from three distinct teaching approaches (Neal & Anderson, 1987). Firstly, it is about the Learning Cycle. It involves outlining the expected goals of the instruction to capture interest and provide a theoretical foundation. Thereafter, learners are expected to clarify a concept with the assistance of sensory information. Interaction and collaboration are used in the process of achieving conceptual framework and physical elucidation (Neal & Anderson, 1987). Secondly, it draws from Advanced Organizers, based on Ausubel's meaningful learning. In order to prepare learners for the lesson, it is important to incorporate Advanced Organizers to provide a cognitive preliminary framework. This allows the learner to fuse the new complex information (e.g. the biomechanics of a badminton serve) with their existing knowledge (Ausubel, 1968; Neal & Anderson, 1987). The third construct is based on the Concept Maps. The mapping of various components of movements enables learners to visualize the hierarchy and interrelated components of motor tasks. The Kinetic chains of movements are linked to the concept of skills. Concept maps facilitate high order learning and deepen the understanding of learners (Neal & Anderson, 1987).

The Nine Stages of Daniel's Model

Neal and Anderson (1987) described the nine separate stages of the implementation of Daniel's model, each precisely tailored to control the cognitive requirements of the learner, with the aim of maximizing the retention of motor skills. The first stage is Direct Instruction. In this, the teacher informs the learners of the purpose of the lesson at a macro level. The lesson objective directs the learners' attention and fosters their motivation. This is followed by the Review stage, where the class discusses previously learned skills or concepts, thereby activating the prior knowledge that is imperative for the context of the incoming information (Neal & Anderson, 1987). The third stage, called Overview, is where the new psychomotor skill is introduced. During this stage, learners are encouraged to think, to the extent possible, of how the new skill relates to the other challenges or concepts they have encountered in the past. This is the initial step of forming the cognitive schema (Neal & Anderson, 1987).

The stage after, the fourth concept, Investigations and Activities, marks the first instance where a perceptible shift toward active learning is evident. Learners then begin to conduct physical trials. This stage is highly exploratory; the instructor poses questions and offers hints rather than strict commands. This encourages the learners to positively test the biomechanical hypotheses (Neal & Anderson, 1987). The fifth stage, Representation and Expression, is where learners continue their physical practice, but begin to communicate what they practice. The learners articulate what physical adjustments resulted in superior outcomes. The sixth stage, Dialogue and Discussion, involves a conversation that is guided by the instructor. The learners analyze their outcomes, and the instructor asks why so and so, forcing them to express what they feel when e.g., they are practicing a motor skill (Neal & Anderson, 1987).

Neal and Anderson use a unique nine-stage framework that focuses on the creation of a gamified learning environment. In the seventh stage, Invention, the instructor resumes direct teaching for a brief period to answer the systemic questions identified during the discussion. Here, concept maps restructure the learner's cognitive map to illustrate the relationship between the correct biomechanics and the successful outcomes to promote meaningful learning (Neal & Anderson, 1987). During the eighth stage, Application, students engage in physical practice to implement the cognitive maps, applying dynamic drills and game situations to test the new mechanics (Neal & Anderson, 1987). The ninth stage, Summary and Closure, concludes a session with the instructor providing a synthesis of the session's content and linking the recently learned skill to the big picture and the upcoming lessons (Neal & Anderson, 1987).

Using this framework, the traditional hierarchy of the gymnasium is completely inverted. The instructor transitions from the authoritative figure to a sophisticated facilitator of the construction of knowledge (Neal & Anderson, 1987). The student becomes the primary builder of the learning process. The students actively use their kinesthetic feedback and review their physical movements. They also participate in an active debate on the mechanics of movements with their peers (Neal & Anderson, 1987).

Cheng and Su (2012) found that students harness the power of independent learning more effectively in a context of constructivist learning and specially adapted teaching technologies. From the 1990s onward, Brown (1998) documented Social cognitive model-based reflections and self-assessment as means of employing a range of teaching strategies. SHAPE America, 2015, deploys a constructivist model of teaching to nurture physically literate individuals who possess life skills and self-efficacy.

Cognitive Motivation in Sports Education

Motivation has been described as the main psychological mechanism of the start, duration, and intensity of human activities (Al-Badrani, 2012). The concept of cognitive motivation is crucial in sports, especially when considering the long and complicated sphere of learning new and complex movements. It is the internal pleasure and satisfaction people experience when learning new things, and when they master some difficult task or solve some physical or tactical problem (Al-Badrani, 2012).

As far as the modern psychology theories are concerned, they describe motivation in various ways and that the need for refined teaching models is irrefutable (Al-Badrani, 2012). Connectionist theories (Thorndike and Skinner) suggest that learning is the result of a series of trial and error learning that is brought about by the 'Law of Effect' and that motivation is largely seen as an external element based on the reinforcements present in the environment (Al-Badrani, 2012). On the other hand, the Cognitive Theory describes the individual as a rational being with the ability to make conscious and rational decisions and regulate their own actions. Within this framework of thought, cognitive motivation is described as a self-sustained motivation and as a 'pure' form of motivation with physical activity being viewed as an end in itself and not a means to an external reward (Al-Badrani, 2012). The Humanistic Theory, to which Maslow is a major contributor, describes human needs in a pyramid consisting first of the fulfillment of one's physiological and physical needs, which then transforms itself into the need to belong, to esteem, and to achieve self-fulfillment. In an educational context this translates into the desire for being competent and having one's worth acknowledged, thereby creating hope for progress (Al-Badrani, 2012). Lastly, the Psychoanalytic Theory which Freudian biological determinism is based on presents the various human impulses that motivate behavior as being deeply rooted and subconscious (Al-Badrani, 2012).

People motivated by cognition are different in several ways. They are personality driven by the inner desire to expand their own knowledge, tolerate uncertainty and situations involving high risk, prefer difficult tasks and are driven by the love of the learning process (Al-Badrani, 2012). The field of physical education encourages and helps develop this particular psychological trait that reduces the burnout students experience while also encouraging them to maintain athletic activity throughout life (Al-Badrani, 2012).

The way teaching is done affects physical education students' feelings and cognitive levels of motivation, where guided discovery and reciprocal teaching are better than the traditional command style. An accomplishment-generating motivation theory suggests that in physical education, it is about demonstrating a high level of ability or avoiding demonstrating a low level of ability (Karlefors & Larsson, 2018). Also, the social-cognitive theory combines behavioral, cognitive, and social motivators and emphasizes the role self-efficacy plays in motivating people to do various activities (Bandhu et al., 2024). Program design is the way emotional and cognitive drive are constructed in physical education (Rico-González, 2023).

Fundamental Badminton Skills

Badminton requires every player to have excellent control of their racket in addition to explosive power in their lower body and quick reflexes. A successful player must have tenacity and perseverance as competitive success is reliant on the relentless pursuit of flawless execution of all the skills necessary to master the game (Al-Jumaili, 2010). This study will concentrate on the three key elements of the game of badminton.

The high long serve is the stroke with which a server initiates an exchange of strikes in a singles match. It begins at the forehand side of the body with the server striking the shuttlecock in a steep ascending horizontal trajectory to the rear of the opponent's court, aiming to make the shuttlecock land just in front of the rear court's baseline. The server should aim for the shuttlecock to land in the very back of the opponent's court as it forces them to retreat to the back of the court, unable to make an offensive move in the game. For the server, it gives the server an opportunity to get back to the most center and position the player in a defensive stance (Al-Jumaili, 2010).

From the very back of the court to the very front, the player must execute the forehand clear. The shuttlecock must be struck at the very top of the player's reach and sent to the very back of the opponent's court. It is most definitely a good shot to make because it gives the player time to get back in a good position to court before the shuttlecock returns and it forces the opponent to lose a good court (Al-Jumaili, 2010).

The backhand clear uses the non-dominant face of the racket and is most often used when the shuttlecock is sent deep to the non-dominant side of the player and a round-the-head shot is not possible. Backhand clears are the most difficult of all the shots in badminton. Backhand clears are used when the shuttlecock needs to be hit to the back of the opponent's court in a defensive high shooting arc, which is the same strategy as the forehand clear (Al-Jumaili, 2010).

The integration of motor learning theory into practice, especially in the initial stages of learning a skill, is supported by a constraints-led approach (Renshaw et al., 2010). Moreover, age was not found to be a significant factor when developing game play skills, which means the ability to learn new sport activities and related skills directly impacts porous sport experience (French & Thomas, 1987). However, for a beginner, poor results often stem from only working with expert performance instructions or overly rigid biomechanical analyses (Wulf & Weigelt, 1997). Understanding restraints in racket sports is enhanced by the use of a tactical games approach that prioritizes dynamic skill execution within game-like activities (Mitchell et al., 2013).

Previous Studies

The application of particular cognitive models within physical education has been studied in different cases. For instance, Zainab Hamza Raji (2007) researched the effects of Daniel’s and McCarthy’s models on the development of scientific concepts among fifth grade students during her thesis. She indicated that both models were much more effective than the conventional methods, while McCarthy’s model was more effective in her particular case (Raji, 2007). Also, Mahmoud Mattar Ali Al-Badrani (2012) studied the relationship of cognitive motivation in sports and social adaptability in the academic field of physical education students, and he showed that high cognitive motivation significantly contributed to academic and professional success in the university environment (Al-Badrani, 2012). Besides, Jabbar Ali Kadhim Al-Jumaili (2010) examined the use of supporting devices in the development of the speed of a motor response and the kinesthetic intelligence in badminton, and he showed that the use of creative and unorthodox methods greatly reduced the period of learning complex skills related to the use of a racket (Al-Jumaili, 2010). This study aims to add to the existing body of knowledge, incorporating the cognitive structural aspects of Daniel’s model and the psychological parameters of Al-Badrani’s work to enhance effectiveness in badminton teaching.

Research Methodology and Field Procedures

Research Design

The study adopted an experimental design to systematically solve the research problem and validate the hypothesized constructs. The design was characterized by a pre-test and post-test control group design. The researchers controlled the design of the study to determine the effect of the instructional model (the independent variable) on the cognitive motivation and the badminton gameplay skill (the dependent variable) of the study participants.

Research Population and Sample

The overall target population for this research consisted of 110 female third-stage students (78 from Thi-Qar University and 32 from Al Alayn University) from the College of Physical Education and Sports Science at Thi-Qar University and Al-Ayn University during the academic year 2025/2026.

In addition, for different, successive stages of the research, several subsamples were drawn from this population. Students from Thi-Qar University and Al-Ayn University comprised 70 in total, of whom 38 and 32 participated in the random selection of the sample for the Scale Construction Phase. The remaining subsample was selected randomly to conduct Scale validation and Scale standardization. The Physical Testing (PT) and the Educational Units (EU) subsamples were randomly selected from the remaining population, in order to conduct the Physical Testing (PT) and the Educational Units (EU) subsamples. The remaining population was selected in order to conduct the main frame research. Each of the two sections in the selected population was treated as a Control Group and an Experimental Group, respectively. The subsample of the Control Group was selected by means of a random (lottery) assignment. The remaining population to be assigned to the Experimental Group was chosen in the same manner.

Homogeneity and Equivalence

To maintain a strong level of internal validity and isolate the specific effect of the independent variable, the researcher utilized a specific set of statistical procedures to ensure the groups were homogenous with regards to the confounding physiological variables of age, body mass, and height. The Coefficient of Variation was computed for these variables after the arithmetic means and standard deviations were computed and recorded. The analyses indicated that all coefficient values were below the thirty percent threshold, thus supporting the internal group homogeneity and eliminating issues of physical differences affecting the results.

Table 1: Homogeneity Parameters of the Control and Experimental Groups

Variable	Unit	Control Mean (±SD)	Control C.V. (%)	Exp. Mean (±SD)	Exp. C.V. (%)
Age	Years	23.000 (1.195)	5.195%	22.933 (1.222)	5.328%
Mass	kg	67.600 (5.729)	8.474%	66.200 (5.583)	8.433%
Height	cm	162.333 (6.608)	4.070%	161.266 (6.507)	4.034%

Additionally, analyzing the two groups revealed baseline equivalence before the formal instructional intervention. Pre-test participant scores for the cognitive and behavioral components of the driving motivation and the three specific badminton skills were subjected to independent samples t-tests. It was evident from the analysis that the scores for the majority of the constructs were not significantly different in the groups under consideration (all $p > 0.05$). Such an analysis delivered the necessary assurance that the two groups were equal at baseline in terms of psychological and physical attributes before the nine-week instructional experiment began.

Table 2: Baseline Equivalence of the Groups (Pre-Test Data)

Variable	Control Mean (±SD)	Exp. Mean (±SD)	t-value	Sig (p-value)	Significance
Cognitive Motivation	129.400 (19.866)	129.200 (15.951)	0.030	0.976	Non-significant
High Long Serve	15.359 (1.616)	15.230 (1.761)	0.210	0.774	Non-significant
Forehand Clear	17.118 (1.556)	17.049 (1.419)	0.127	0.592	Non-significant
Backhand Clear	12.338 (1.843)	12.022 (1.990)	0.451	0.530	Non-significant

Instrumentation and Data Collection Tools

A full array of established psychometric and physical sports tools gathered the required empirical data with the greatest precision. The tools that were used throughout the testing and the training phases were standard regulation badminton courts, twenty-five professional-grade Yonex badminton rackets, ten tubes of standardized Yonex plastic shuttlecocks, precision electronic stopwatches, specialized measuring tapes, and materials to mark courts to designate scoring zones.

Construction of the Cognitive Motivation Scale

A reliable psychometric tool was critical for capturing the complex psychological concept of cognitive motivation. The researcher adapted a verified cognitive motivation scale developed by Dr. Mahmoud Mattar Ali Al-Badrani (Al-Badrani, 2012). The first version of this scale had forty-five items, each of which was revised and adjusted to the context of the research, the learning of badminton, in Iraq (Al-Badrani, 2012).

The scale was based on a standardized five-point Likert response scale. The respondents could select one of the five options, where 'Applies strongly' meant the statement was supported, and 'Does not apply' meant the statement was not applied, with the scores given as follows: five, four, three, two, and one respectively (Al-Badrani, 2012). The first version of the scale was sent to a number of experts for the purpose of establishing content validity. Based on the consensus views of the experts and the outcomes of Chi-square tests of their comments, the scale was validated and finalized with forty items (Al-Badrani, 2012).

Construct validity was then established through extreme group comparisons. Independent t-tests were conducted for the top twenty-seven percent versus the bottom twenty-seven percent. It was confirmed that all items demonstrated high discriminatory power, differentiating well motivated students vs. unmotivated students (Al-Badrani, 2012). Internal consistency was quantified through the Pearson correlation coefficient. The item total scores were linked to the total scale score. Finally, the overall reliability was confirmed through the split-half method, using the Spearman-Brown prophecy adjustment. This resulted in a reliability coefficient of 0.88. The psychometric tool was confirmed to be highly reliable for usage in a full-scale survey. The last operational scale produced theoretical scores from forty to two hundred (Al-Badrani, 2012).

Badminton Skill Assessments

Al-Jumaili (2010) stated that three field tests were selected for their validity, reliability, and objective scoring mechanics based on an exhaustive academic review, and on formal consultations carried out with a specialized panel of thirteen badminton experts. The first test is the High Long Serve Test. In this test, the subject must hit the shuttlecock over the net and over a rope that has been set at a height of 220 centimeters and is suspended at the target, to land within the target area at the back of the opponent's court. The target area is marked with scoring zones that are concentric with the scoring areas and yield between one and five points scoring, based on proximity to the baseline. After a short warm up, the subject is given twelve attempts, with the best ten attempts recorded to make a maximum score of fifty points (Al-Jumaili, 2010).

The second test, the Forehand Clear Test, is a test of an overhead offensive capability. In this test, the subject, positioned on a baseline, is fed a shuttlecock by an instructor, and is expected to perform a forehand clear to land the shuttlecock in the specified scoring target zones, thereby scoring between two and five points, to the backcourt of the opponent. Out of a total of twelve attempts, only the best ten attempts are recorded, with a maximum score of fifty points. The Backhand Clear Test measures an individual's ability to perform an overhead clear to the non-dominant side backcourt in a defensive situation. The individual is served the shuttlecock on the backhand side and must perform an overhead backhand clear to the specified target backcourt areas. The scoring areas are designated up to a maximum of four points for depth and accuracy. In total, ten attempts are recorded, with a maximum score being forty points. Pilot tests confirmed all skill tests for ease of task, timing, and the clarity of instructions. Reliability and objectivity for all three tests were above 0.91, demonstrating good consistency.

Field Procedures and Instructional Implementation

After comprehensive pre-test data collection in late February 2026, the nine-week instructional intervention began. Both the control group and the experimental group received one 90-minute instructional session per week.

The control group used the standard university teaching methods for the entirety of the instructional period. Each 90-minute session comprised a 15-minute warm-up, a 65-minute main instructional segment, and a 10-minute cool down.

During the main instructional segment, the teacher explained and demonstrated the task and the students performed the task as asked. Teaching was very directive. There was very little peer discussion or problem solving, and interactions were restricted by the teacher.

The 90-minute sessions for the experimental group were designed and based on the nine elements of Daniel's Cognitive Instructional Model with the elements of the constructivist approach. After a 15-minute warm-up, the main instructional phase was segmented into a Direct Instruction segment and a Review segment of 20 minutes each. When in the Direct Instruction segment, the students were introduced to the instructional goals and the Review segmented the students.

The subsequent forty-five-minute applied segment functioned as the core constructivist engine of the intervention. It began with the Overview stage for initial group brainstorming. Students then broke into small micro-groups of five for the Investigations stage, actively testing physical mechanics with racket and shuttlecock. The Representation and the Dialogue and Discussion stages required students to verbalize their physical sensations and openly critique peer movements. The instructor then intervened during the Invention stage to correct systemic conceptual errors utilizing explicit cognitive maps. Finally, the Application stage allowed students to apply these refined cognitive schemas to dynamic physical drills. A ten-minute closing phase encompassed the Summary and Closure stage, where the instructor provided structured debriefing. Upon completion of the full nine-week intervention, post-tests precisely mirroring the pre-test protocols were administered to all participants.

Presentation, Analysis, and Discussion of Results

The extensive empirical data gathered from the pre-test and post-test evaluations were analyzed using the Statistical Package for the Social Sciences (SPSS). The t-test based analysis was performed in two sequential steps. The first focused on improvements within the groups using paired t-tests. The second on comparisons between the groups, using independent t-tests.

Within-Group Analysis: Control Group

The data from the control group showed that the traditional command style method of instruction used by the group resulted in measurable and statistically significant improvements for all the response variables across the nine-week instructional period.

Table 3: Pre- and Post-Test Comparisons for the Control Group

Variable	Pre-Test Mean (±SD)	Post-Test Mean (±SD)	t-value	Sig (p-value)	Significance
Cognitive Motivation	129.400 (19.866)	142.800 (16.327)	5.737	0.000	Significant
High Long Serve	15.359 (1.616)	16.568 (1.604)	8.453	0.000	Significant
Forehand Clear	17.118 (1.556)	18.532 (1.459)	14.218	0.000	Significant
Backhand Clear	12.338 (1.843)	13.516 (1.800)	8.105	0.000	Significant
(Significant at p < 0.05, df = 14)					

The improvement in the control group is expected in any structured educational method, both biologically and from a teaching perspective. Even a limited amount of guided physical practice, repetition, and physical demonstration leads to a basic level of motor learning. Taking into consideration dominant theories in motor learning like Schema Theory, a Physical practice provides the body with the opportunity to strengthen a motor program and bring about a smooth and coordinated task. Finally, the consistent attendance of students and the natural, gradual physical adjustments that occur with a nine-week training cycle account for the increased physical task performance measured by the post-test scores.

Within-Group Analysis: Experimental Group

The experimental group, subjected exclusively to Daniel's Cognitive Instructional Model, also demonstrated profound and highly statistically significant improvements across all psychological and physical metrics.

Table 4: Pre- and Post-Test Comparisons for the Experimental Group

Variable	Pre-Test Mean (±SD)	Post-Test Mean (±SD)	t-value	Sig (p-value)	Significance
Cognitive Motivation	129.200 (15.951)	158.933 (10.381)	10.108	0.000	Significant
High Long Serve	15.230 (1.761)	18.199 (1.547)	14.774	0.000	Significant
Forehand Clear	17.049 (1.419)	19.870 (0.884)	15.721	0.000	Significant
Backhand Clear	12.022 (1.990)	15.651 (1.197)	10.767	0.000	Significant
(Significant at p < 0.05, df = 14)					

Between-Group Analysis: Post-Test Comparisons

While examining the effectiveness of different instructional methodologies in fostering internal improvement, the focus of this investigation is on comparing the amount of improvement generated by each methodology. After conducting independent sample t-tests for each group based on instructional methodology, positive and statistically significant differences were noted in the final scores for the experimental group, compared to the control group, for all variables measured in the post-test.

Table 5: Post-Test Comparisons Between Control and Experimental Groups

Variable	Control Post-Test Mean (±SD)	Exp. Post-Test Mean (±SD)	t-value	Sig (p-value)	Significance
Cognitive Motivation	142.800 (16.327)	158.933 (10.381)	3.229	0.003	Significant
High Long Serve	16.568 (1.604)	18.199 (1.547)	2.834	0.008	Significant
Forehand Clear	18.532 (1.459)	19.870 (0.884)	3.037	0.005	Significant
Backhand Clear	13.516 (1.800)	15.651 (1.197)	3.825	0.001	Significant
(Significant at p < 0.05, df = 28)					

Comprehensive Discussion of Findings

A detailed theoretical explanation is needed due to the significant deviation in post-test outcomes, especially the statistically significant differences in the level of cognitive motivation (158.933 vs. 142.800) and the complex mechanics of the backhand clear (15.651 vs. 13.516). The apparent advantage of the experimental group cannot be attributed to the greater amount of practice time. The practice time for both groups was the same ninety minutes (Sfayyih & Alghezi, 2026). The difference is due to the cognitive engagement that was structurally facilitated by Daniel's model.

The cognitive motivation of the experimental group improved significantly, substantiating the psychological effectiveness of the model. The command-style teaching (which the control group was subjected to) cultivated a fear of failure and correction in front of one's peers, which inhibited intrinsic cognitive motivation (Al-Badrani, 2012). The total opposite is Daniel's model. Daniel's model requires the use of collaborative micro-groups during teaching phases known as the Investigation and Dialogue phases. This enables a collaborative problem-solving atmosphere rather than the isolation which is the individually drilled work (Neal & Anderson, 1987). Giving learners the autonomy to test their hypotheses and share their physical sensations and problem-solving with peers, significantly increases their sense of ownership of the learning. This phenomenon also increases their motivation to understand the sport and is the reason for the increased motivation scores (Al-Badrani, 2012).

Additionally, the Representation and Discussion stages of Daniel's model have students engage in a heightened state of metacognition. Within the context of a traditional education system, a physical education student may practice serving a shuttlecock repeatedly out of bounds and may never appreciate the biomechanical reasoning for that error. The student would rely on the teacher to see the error and suggest a correction of a physical nature. Using Daniel's model, learners are obliged to explain in detail why a particular movement was unsuccessful and are required to vigorously discuss and suggest possible corrections of a mechanical nature to the movement (Neal & Anderson, 1987). The kinesthetic phenomena must be verbalized, and the human brain must be forced to try to and physically draw the neuromuscular paths needed to perform the movement; the construction of this memory system and memory of the movement is more rapid. The teacher's intervention during the Invention phase is not to correct movement to suggest movement to the learners; rather, it is to give a concept map to the learners, and it is to suggest corrective movement to the learners to peer hypotheses movement (Neal and Anderson, 1987).

Cognitive mapping is key to doing complex movements. The backhand clear had the greatest t-value variance between the groups, showing this movement is especially complex. Executing the backhand clear requires the rapid synchronization of transferring lower body weight, rotation of the upper body, extension of the elbow, and a specific wrist movement prior to hitting the shuttlecock (Al-Jumaili, 2010). When a student is attempting to imitate the instructor, they generally do not observe and replicate the intricate timing of the movements. The Overview and Investigation phases of Daniel's framework allow students to mentally sift through the movements and identify the various parts of the movement before moving on to the physical synthesis of the movement. Mapping this concept captures this mechanical sequence, and helps students avoid the cognitive overload that occurs when novices try to mentally comprehend complex movements that utilize multiple joints (Neal & Anderson, 1987).

There is no doubt that the psychomotor skills necessary for university-level physical education cannot be mastered through physical conditioning and adopting a percussive swing. The skill is in the cognitive deep understanding (Sfayyih & Alghezi, 2026). The Designer's Instructional Model proposed by Daniel is a structure that allows one to create a classroom where learners can exercise their intellect. It also fosters deep-thinking social interactions and the discarding of redundant mental models. The result is a far greater appreciation of physical activity that is fluid, precise, and consistent (Raji, 2007).

Conclusions and Recommendations

Conclusions

This investigation comes to a few definite and practical conclusions from the thorough empirical evidence and ensuing theoretical interpretation. The cognitive motivation scale that was developed, adapted, and tested within this study was highly reliable and sensitive to the needs of the study. It is a highly sophisticated tool for measuring the level of psychological engagement and cognitive motivation of participants in the field of racket sports. The structured use of Daniel’s Cognitive Instructional Model offers a significant positive and meaningful influence on the cognitive motivation of female pupils in the context of physical education. The use of the model moves the educational setting from passive, anxiety-inducing elements, to an environment that is active, stimulating, and offers the participants an opportunity to learn. The use of Daniel's model in physical education resulted in the mastery of all of the fundamental badminton skills, specifically the high long serve, the forehand clear, and the backhand clear, when compared to the traditional command-based instructional methods. The model effectively shifts the educational control from the teacher to the learner and breaks down the instructional process, encouraging the learner to engage with the educational content, deeply process the complex biomechanical skills involved, and learn to think beyond the surface physical skills.

Recommendations

These final conclusions allow us to suggest the following strategies for physical education curricula and forthcoming academic inquiries.

University physical education departments should take the lead in incorporating more contemporary cognitive instructional models, like Daniel's, into their practicing and theoretical models. Traditional, dictatorial methods of teaching physical education cannot be considered a genuine practice of current pedagogical models.

Continuous in-depth training of physical education teachers on cognitive models, on their effective and skilled implementation should become one of the priorities of academic institutions. This should promote transformation of one-way demonstrators into skilled cognitive facilitators, promoters of dialogue and conceptual mapping among students.

In future sports psychology and pedagogical research, the cognitive motivation scale, successfully validated in this study, should become the primary tool for assessing students' sustained quality psychological engagement across various sports.

Academic research that follows should seek to broaden the applicability of Daniel’s model in the domain of complex, high-rate sports (like tennis, fencing and gymnastics) and across a wider range of population groups in order to establish the model's cross-cultural applicability in the context of enhancing psychomotor skill learning. In this regard, the undertaking of research of this particular focus is strongly encouraged in order to establish the retention of the motor skills taught via cognitive instructional models as compared to traditional teaching methods.

References

1. Al-Badrani, M. M. A. (2012). *Sports cognitive motivation and its relationship to academic social adaptation among physical education students* (Unpublished doctoral dissertation). University of Mosul, Iraq.
2. Al-Hafiz, M. S. Z., & Al-Saadawi, M. A. (2026). Self-efficacy and its relationship to the professional performance of faculty members in colleges of physical education and sports sciences in the southern region. *MSW Management, 36*(1s), 3949-3955.
3. Al-Haila, M. (1999). *Teaching models*. (Standard reference derived from contextual literature).
4. Al-Jumaili, J. A. K. (2010). *The effect of exercises using auxiliary devices to develop motor response speed and kinesthetic intelligence in badminton* (Unpublished master's thesis). University of Babylon, Iraq.
5. Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. Holt, Rinehart and Winston.
6. Bandhu, et al. (2024). Social-cognitive theory and beliefs about self-efficacy in motivation. *Educational Psychology Perspectives, 12*(3), 45-60.
7. Brown, E. L. (1998). Describes a social-cognitive instructional model to help teacher education students. *Journal on Excellence in Teacher Education, 9*(3), 81-108.

8. Cheng, Y. M., & Su, P. F. (2012). A game-based learning system for improving student's learning effectiveness in a system analysis course. *Educational Technology & Society, 15*(1), 238-255.
9. French, K. E., & Thomas, J. R. (1987). The relation of knowledge development to children's basketball performance. *Journal of Sport Psychology, 9*(1), 15-32.
10. Joyce, B., & Weil, M. (1980). *Models of teaching* (2nd ed.). Prentice-Hall.
11. Karlefors, M., & Larsson, H. (2018). The major objective in the context of accomplishment in physical education. *Journal of Physical Education, 45*(2), 56-78.
12. Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (2013). *Teaching sports concepts and skills: A tactical games approach for ages 7 to 18* (3rd ed.). Human Kinetics.
13. Neal, D., & Anderson, C. (1987). *The cognitive instructional model*.
14. Raji, Z. H. (2007). *The effect of Daniel and McCarthy's models in the acquisition of scientific concepts and the trend towards science among fifth-grade primary students* (Unpublished doctoral dissertation). University of Baghdad, Iraq.
15. Renshaw, I., Chow, J. Y., Davids, K., & Hammond, J. (2010). A constraints-led perspective to understanding skill acquisition and game play: A basis for integration of motor learning theory and physical education praxis? *Physical Education and Sport Pedagogy, 15*(2), 117–137.
16. Rico-González, M. (2023). Emotional intelligence can be developed in physical education (PE) lessons using purposefully designed programs. *Sports Education Review, 11*(4), 102-115.
17. Rohmansyah, N. A., Mawarti, S., & Hiruntrakul, A. (2022). The effect of teaching style on affective and cognitive motivation in physical education. *Jurnal Keolahragaan, 10*(2), 147-156.
18. Sfayyih, Z. H., & Alghezi, A. O. G. (2026). The impact of educational games, based on indicators of certain physical and motor abilities, on students' learning of jumping effectiveness in athletics. *MSW Management, 36*(1s), 3960-3968.
19. SHAPE America. (2015). *Applications for constructivist teaching in physical education*. SHAPE America Publications.
20. Wulf, G., & Weigelt, C. (1997). Instructions based on expert performance or biomechanical analyses. *Journal of Motor Behavior, 19*(2), 121-135.