

A Multimedia Teaching Model for “Sports Statistics” Based on ARCS Motivation Theory

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Abstract—As a basic specialized course for the major of Sports, “Sports Statistics” is featured by strong theoretical foundation and practical operations. However, there are some problems among students in the teaching of this course, such as insufficient learning motivation, low interest in learning, difficulties in understanding theoretical knowledge, and difficulties in mastering practical operations. Therefore, using the ARCS motivation model as the framework and combining the exploratory learning theory, a systematic ARCS (Attention, Relevance, Confidence, Satisfaction) Motivation Teaching Mode was proposed from the perspectives of Attention, Relevance, Confidence, and Satisfaction. The ARCS Motivation Teaching Mode was constructed from the aspects of system architecture, teaching methods, teaching approaches, effect evaluation, etc. and practically applied in the multimedia teaching of “Sports Statistics” in the four steps including Attention, Relevance, Confidence, and Satisfaction. The results show that the ARCS Motivation Teaching Mode can effectively promote students’ learning motivation, correct their learning attitude, and thereby achieve a positive teaching effect. It is an effective teaching mode for specialized course of Sports.

Keywords—ARCS Motivation Theory, Multimedia Teaching Model, Sports Statistics

1 Introduction

Sports statistics is an academic field that covers two disciplines, including statistics and sports. It mainly studies the different statistical conditions and overall laws that have emerged in sports using mathematical theoretical equation knowledge in statistics. For statistics, sports statistics is a basic statistical discipline [1]. However, with the continuous development of physical education, constant attention has been gradually paid to the necessary research on the overall laws and statistical conditions in sports. Hence, the importance of sports statistics has gradually increased. The current study of physical education includes not only the statistical study of sports activities, but also sports training, sports management and other aspects [2]. Therefore, in the higher education of universities, there are also many courses for sports statistics. Nevertheless, due to the short-term development of sports statistics as a new discipline,

practitioners have not accumulated a corresponding profound teaching foundation. Consequently, in the teaching of sports statistics courses for higher education, the ideal progress has not been achieved in the overall teaching effect. Therefore, from the perspective of course teaching requirements for sports statistics, it is necessary to propose a new teaching model that is suitable for the current trends and teaching trends of sports statistics. Hence, a multimedia teaching model suitable for sports statistics teaching was proposed in this study based on ARCS motivation theory and the widely used multimedia teaching model.

ARCS motivation theory mentioned in this study is a mature psychological theory that studies motivation. The entire ARCS motivation theory mainly includes four aspects: Attention, Relevance, Confidence and Satisfaction [3]. These four aspects are closely related to students' learning motivation in the learning process. During the entire learning process, a good learning motivation is the most important part of promoting the improvement of students' learning efficiency. It enhances students' overall internal learning needs, reinforces their sensitivity and attention to knowledge in the learning process, and thereby is the foundation and motivation source for students to build a complete knowledge structure [4]. Therefore, in this study of a multimedia teaching model for sports statistics, ARCS motivation theory was used as the theoretical basis of the whole teaching model to improve students' interest in learning from four aspects, including students' overall learning attention, knowledge relevance, learning confidence and effect satisfaction, so as to provide a feasible direction for the improvement of the final teaching effect.

2 State of the art

In researches at home and abroad on the teaching model based on ARCS motivation theory, ARCS motivation theory is usually combined with the teaching purpose of the entire teaching. The history of research on the teaching model based on ARCS motivation theory is less than ten years in China. In other words, there are still fewer studies in China. The largest-scale study on the teaching model based on ARCS motivation theory in China can only be found in the study of the basic teaching model in Nanjing, Jiangsu Province. At present, the teaching model based on ARCS motivation theory that has been widely promoted abroad is being applied to Chinese localized teaching. Chen [5] also put forward corresponding viewpoints on the localization of ARCS motivation theory. He believed that the most important thing in the process of using the teaching model based on ARCS motivation theory is to reasonably set up a targeted multimedia teaching model that can influence students' learning motivation based on students' learning foundation and learning attitudes. The entire teaching model needs to effectively combine the advantages and disadvantages of the whole course teaching process and inspire students' interest in learning through a reasonable target evaluation model. Ono et al. [6] proposed a college English course teaching model based on ARCS motivation theory. In this teaching model, students' learning abilities were graded and classified in accordance with students' learning situation in the overall learning process and at the beginning of the learning process. They were

divided into three types, namely, A, B, and C, from the strong to the weak according to their learning ability. C-class students (with poor learning ability) were the main research objects. Through the study of their overall learning characteristics and learning motivation, Wang explored the college English teaching model that can improve the overall teaching level.

The United States and Japan are the main foreign countries that have studied the teaching model based on ARCS motivation theory. The main purpose of researches in these two countries is to stimulate and enhance students' interest in learning and learning motivation in the whole learning process through ARCS motivation theory. Salari et al. [7] established a learning interest cultivation model called “Getting Students Interested Learning Model” through ARCS statistical theory. The main concern of this cultivation model is how to improve the interaction between students and teachers throughout the learning process. Statistical analysis of the information interaction between students and teachers can explore students' learning motivation and overall learning interest. This type of teaching model can track students' learning goals and needs. Imriyas [8] studied the motivational process of learning interest in ARCS motivation theory and proposed a course teaching model that can stimulate the learning efficiency of students with poor performance in the learning process. From the aspects of teaching arrangement, student reflection and teaching reflection, this teaching model investigated the feasibility of ARCS motivation theory in teaching. Keller and Suzuki [9] also put forward a new type of teaching model based on ARCS motivation theory. This teaching model mainly contains four aspects: (1) to improve the relevance between teaching knowledge and students' realistic environment in the entire teaching process, (2) to promote the improvement of the entire teaching model through students' mutual evaluation and self-evaluation, (3) to create a learning environment that stimulates students' learning motivation, and (4) to regularly affirm and evaluate students' learning effects, so as to improve their self-confidence in learning. Studies show that the teaching model based on ARCS motivation theory can effectively improve students' learning experience in the learning process and thereby has certain promotion significance and demonstration effect.

3 Sports Statistics Teaching Model Based on ARCS Motivation Theory

The theoretical basis of the multimedia teaching model proposed in this study lies in two aspects, including ARCS motivation theory and “self-actualization” needs put forward by Maslow. For the first aspect, motivation is a very complex psychological process from the perspective of psychology. Therefore, the study of motivation can start from the relationship between environment impact, environmental output and personal characteristics to form the system structure related to motivation and behavior itself [10], as shown in Figure 1.

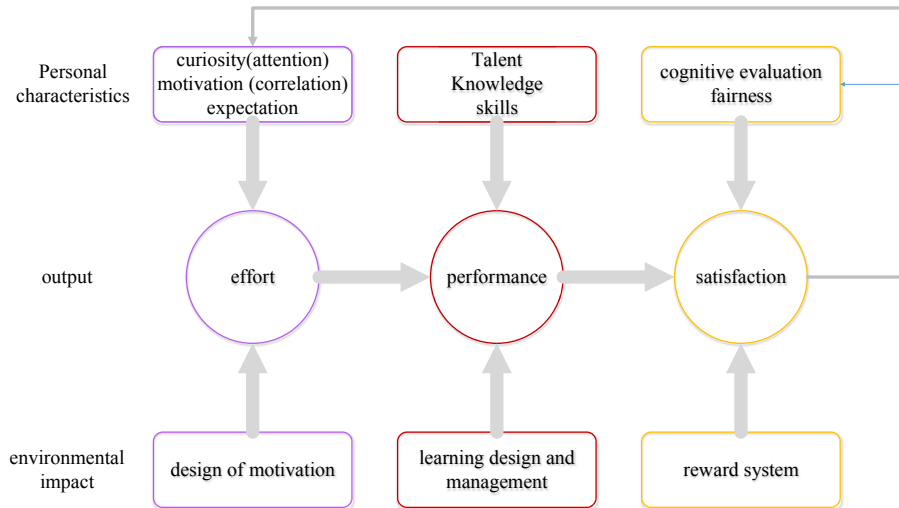


Fig. 1. Structure of the motivation system

For the second aspect, the theoretical basis for the main teaching goal and teaching steps of the entire multimedia teaching model lies in the requirement of “Maslow’s self-actualization” needs [11]. Self-actualization is Maslow’s main content related to humanistic psychology. It divides the current self-needs of life into two categories, namely, the missing needs at the lower level and the growth needs at the higher level. Missing needs can be divided into physiological needs, safety needs, love/belonging needs, and esteem needs according to the level of needs; growth needs can be divided into cognition needs, aesthetic needs, and self-actualization needs.

Among these levels of self-needs, the highest level is self-actualization needs. Maslow identified self-actualization needs as the externality of the full development and potential of human nature. This process of self-actualization includes the process of continuous improvement and development of a person. Maslow’s self-actualization needs were used in this study to define the basic teaching method of the entire teaching model.

Through the construction of the theoretical basis above for the overall multimedia teaching model, ARCS motivation theory was combined with the SPSS multimedia teaching of sports statistics to form a new multimedia teaching model with learning motivation as the core. Throughout the teaching process, students’ learning motivation is always treated as the core and fully motivated to permeate throughout the entire learning process. Figure 2 shows the basic architecture of the entire multimedia teaching model.

The basic framework of the entire multimedia teaching model based on ARCS motivation theory focuses on four aspects, namely, attention, relevance, confidence and satisfaction, which are also the basis of ARCS theory. The setting of the entire learning background and learning environment is the process of combining the teaching content of the entire sports statistics course with learners’ current learning motivation. Through the setting of the learning background and learning environment, the motiva-

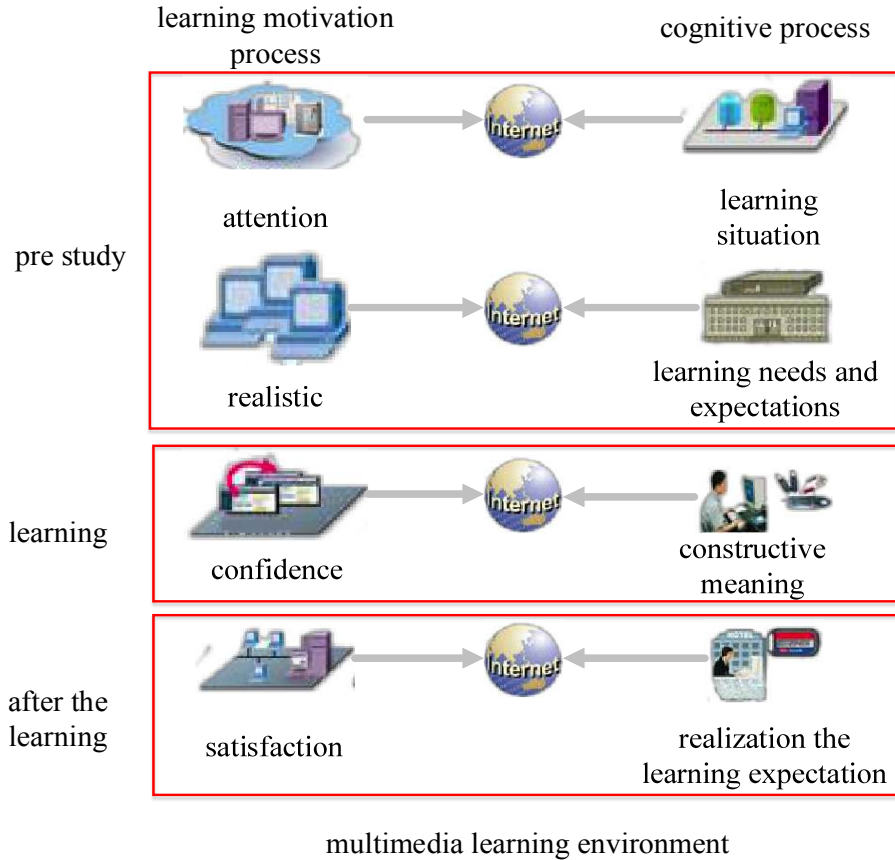


Fig. 2. Architecture of the multimedia teaching model based on ARCS motivation theory

tion of learners can be motivated and their attention can be improved. Then the entire learning process can be promoted through the relevance between the learning content and learners themselves and learners’ confidence. Eventually, when learners complete reach the corresponding learning objectives, they can have learning satisfaction.

For the multimedia teaching model based on ARCS motivation theory, its main feature is the ability to combine students’ overall learning process of acquiring knowledge with the entire learning motivation, to improve the entire learning effect and enhance the learning motivation through their complementary functions, and thereby to form a virtuous circle of knowledge acquisition. In the overall learning process, learners’ learning motivation is not a constant factor. With the continuous improvement of the learning effect, their motivation can be improved to varying degrees.

In this study, the multimedia teaching model based on ARCS motivation theory takes learners’ own learning motivation as the starting point, and enhances students’ learning motivation to improve their final learning effect. The basic functional pattern of the entire learning environment is shown in Figure 3.

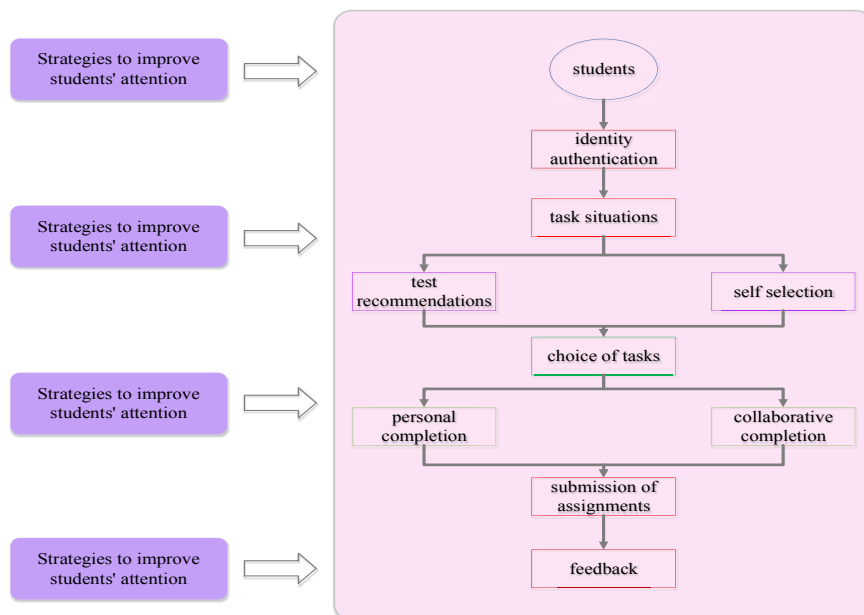


Fig. 3. Basic functional pattern of the multimedia teaching model based on ARCS motivation theory

As can be seen from Figure 3, the basic functional pattern of the entire teaching model mainly includes three aspects: system support, learning process and cognition tools. According to the characteristics of system support and cognition tools, learning content available to learners from the multimedia teaching model can be divided into four stages: learning pretest, situational experience, significance construction, and evaluation feedback. For the specific process of these four stages, during the use of the multimedia teaching model for learning, the entire teaching system can determine the appropriate learning task according to the current learning status and motivation of the learner after the learner has browsed the overall learning task information in the early stage. The system can present relevant course information according to the student’s current learning task, and at the same time, determine whether the learning task is completed in the form of a group or individual. Learners can request system resources and help from teachers and classmates during the entire learning process. After the current learning task is completed, there will be corresponding evaluation by the teacher, self-evaluation, and evaluation by peers. After the evaluation process is completed, the learners can engage in self-reflection based on the evaluation results. The entire teaching model also sets standards for the next learning task according to the student’s learning results and learning performance.

After the completion of the teaching environment by the multimedia teaching model based on ARCS motivation theory, as shown in Figure 4, the architecture of the entire teaching model was divided into three main layers in this study, including the user interface layer, support layer and data service layer from the basic conditions of the entire teaching environment.

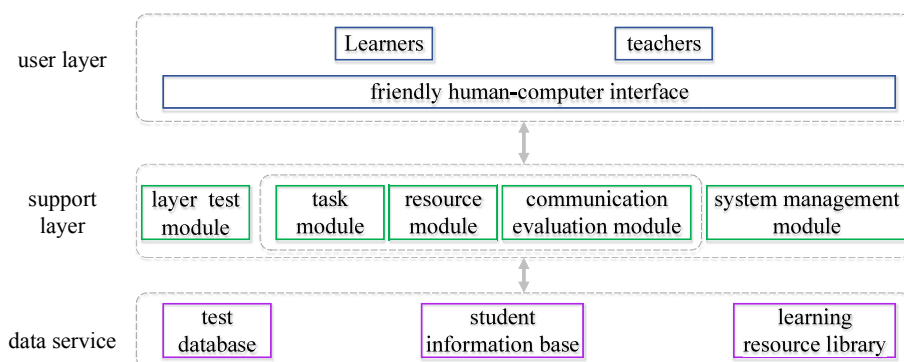


Fig. 4. Architecture of the multimedia teaching model based on ARCS motivation theory

As shown in Figure 4, the user interface layer mainly covers two aspects of user interface: student interface and teacher interface. This interface is based on the IE browser, and receives and transmits the user’s operation information and system server’s feedback information. The support layer is the basic task logic of the entire multimedia teaching model, and also contains the design of basic teaching modules. The data service layer is used to store students’ learning motivation information, basic learning information, and learning resource information.

The basic functional modules of the entire multimedia teaching model mainly include three modules: test module, learning module and system management module. In the learning module, there are three sub-modules including task module, resource module, and exchange evaluation module.

3.1 Test module

The test module mainly contains tests of learning motivation. As shown in Figure 5, the main testing procedure is entry into the test module for testing before the student begins to learn. Before testing, the entire teaching system can select appropriate questions from the prepared test questions. After the student makes choices, the student’s learning motivation is appropriately judged by screening the answers. The result of the entire judgment is then transmitted to the suggestion generating module, to provide learning suggestions for the learner in relevant lessons of sports statistics, so that the learner can choose his or her own way of learning.

3.2 Learning module

The learning module is the most important part of the multimedia teaching model. The main content in course learning lies in the learning module. The learning module can be specifically divided into three sub-modules: task module, resource module, and exchange evaluation module. These sub-modules were elaborated in this study.

Task module: The main content of the task module is to implement assignment of targeted learning tasks in accordance with the test results of learning motivation pre-

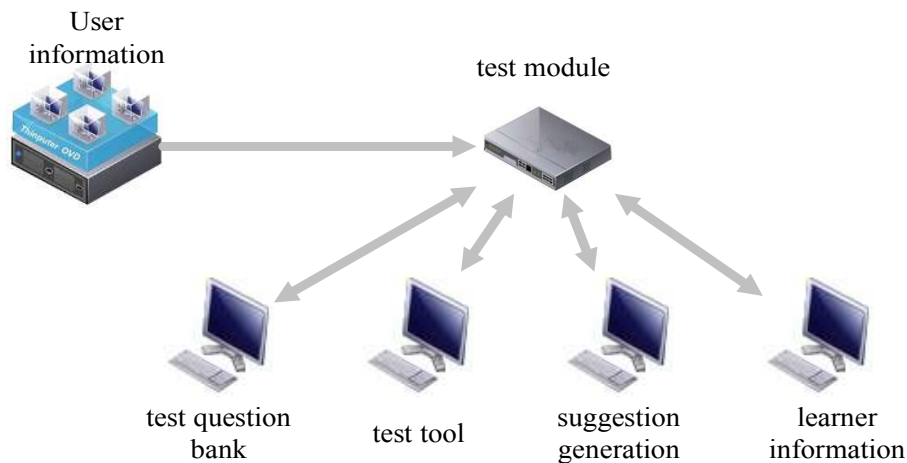


Fig. 5. Functional structure of the test module

sented in the test module. These tasks themselves have certain difficulties, but the student can complete them by learning and making effort. The design of the student’s entire learning task includes two aspects of ARCS motivation theory: relevance and confidence. The entire learning task is closely related to the student’s current learning situation and learning conditions, and the student gain an improvement in learning confidence after completing corresponding learning tasks.

The main functions of the entire task module include demonstrating learning tasks (showing the student the task objective, difficulty and significance of the current learning process through the browser interface of the system), providing learning tasks (providing targeted learning tasks according to the student’s learning motivation status displayed in the test module), and recording learning tasks (recording the completion of the student’s learning tasks, and providing feedback for the design of the following learning tasks).

Resource module: The main content of the resource module is to effectively store and manage the teaching resources required in the learning process. The entire resource module contains examination database resources, material database resources, information database resources, and intelligent Q&A resources. In the learning process, the resource module can provide appropriate resources according to the student’s current learning needs and problems to facilitate learning. The entire resource module is also an important support component for the improvement of students’ confidence. The main structure of the learning resource module is shown in Figure 6.

Exchange evaluation module: The entire exchange evaluation module contains two aspects. The first aspect is the exchange between students and students and between students and teachers. In this function of the exchange evaluation module, students can express their current problems and learning experience according to their current learning situation. The entire exchange function is mainly realized through two forms, namely emails and forums. Meanwhile, this function enables users to share information and resources. The second aspect of the exchange evaluation module is that

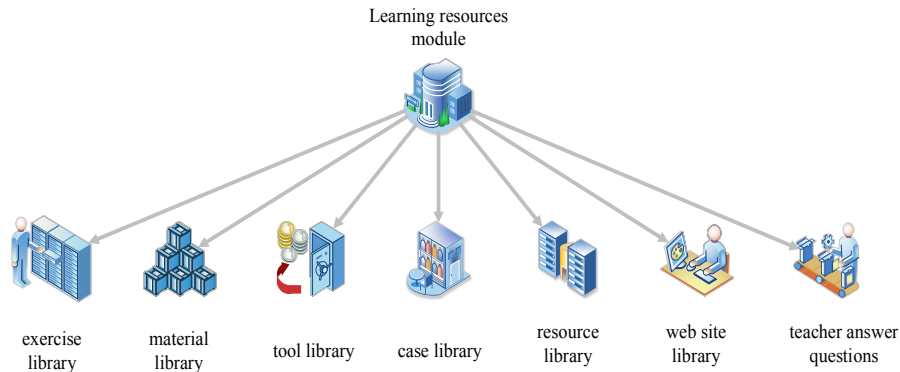


Fig. 6. Main content of the resource module

users of the entire system can engage in evaluations. The functions of the exchange evaluation module can effectively improve students’ satisfaction in the learning process, and the evaluation results can be stored in the database, for the managers of the entire teaching model platform or teachers to carry out corresponding modification and improvement of learning tasks and resources.

4 Teaching Example and Teaching Effect

After the multimedia teaching model based on ARCS motivation theory was constructed in this study, the first-year students of the university’s physical education college were treated as the experiment objects, and “Learning and Use of SPSS Software”, an experiment course of sports statistics, was selected as a teaching example of the multimedia teaching model proposed in this study, to explore the actual teaching effect of this teaching model.

4.1 Teaching Example

In the teaching of “Learning and Use of SPSS Software”, the overall learning characteristics of SPSS software were taken into consideration to determine the design thought of the entire multimedia teaching system, as shown in Figure 7.

The basic content of ARCS motivation theory ran through the process of learning and using SPSS software. The comprehensive evaluation focused on how to improve students’ attention, relevance between the course knowledge and their own conditions, and their confidence and satisfaction with the learning effect in the overall learning process. The arrangement of the entire SPSS software course content is shown in Figure 8.

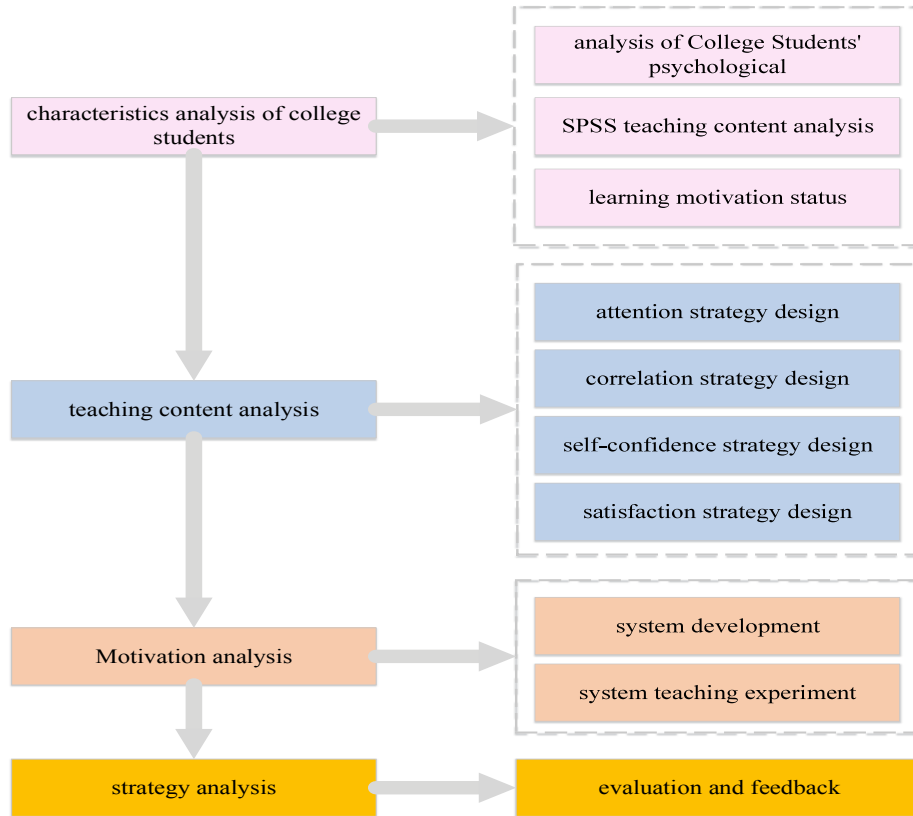


Fig. 7. Design thought of the multimedia teaching system

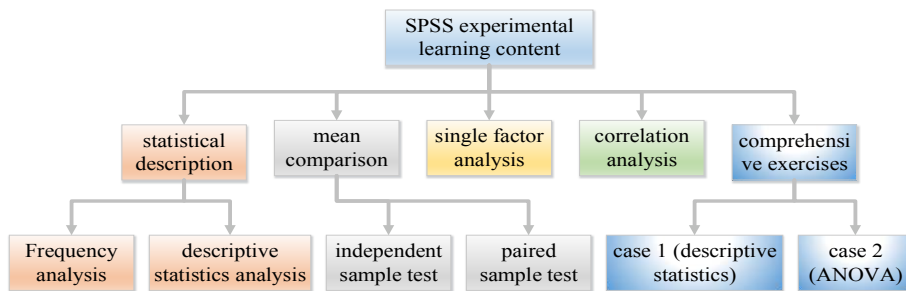


Fig. 8. Arrangement of the course content of “Learning and Use of SPSS Software”

The specific study content for the entire software learning course is: 157 year-one, sophomore and junior students were randomly selected from the sports college to measure their relevant information of sprint, 5km long-distance running and shot put, and these physical measurement information data were used in statistical analysis. It was required to calculate and obtain the mean, standard deviation, maximum value, and minimum value of the three indicators of the three grades. Comparison and analy-

sis of these data were conducted to determine whether there are significant differences in the average scores of year-one, sophomore and junior students in the sports college.

Before each class was started, the students filled out the questionnaire distributed to assess their own knowledge and evaluate their own motivation. After the assessment of self-learning motivation was completed, the students used the multimedia teaching system to watch the basic operating procedures of using SPSS software, and the SPSS teaching content displayed on the multimedia screen is shown in Figure 9-10.

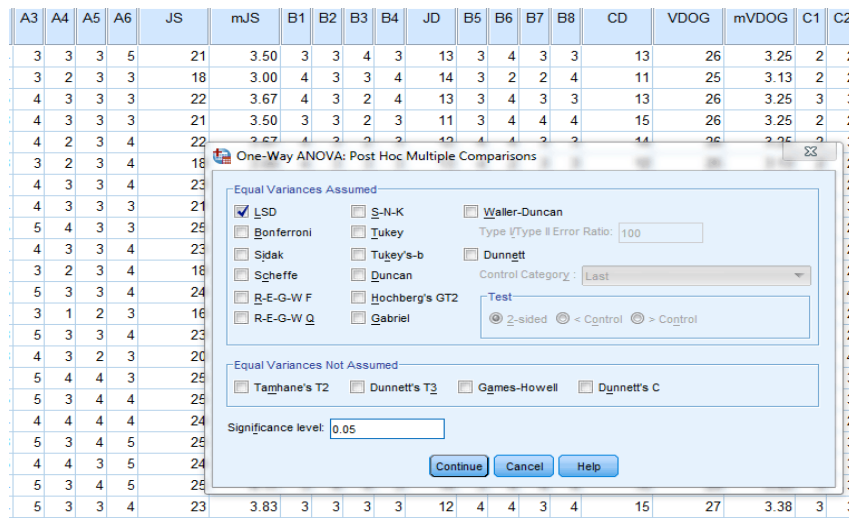


Fig. 9. SPSS software teaching content displayed on the multimedia teaching screen

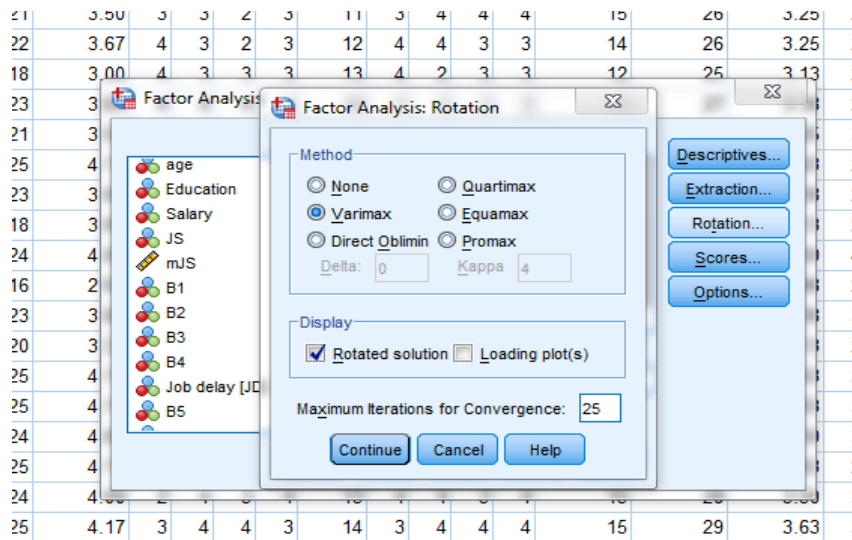


Fig. 10.SPSS software teaching content displayed on the multimedia teaching screen

After the end of an hour, the students submitted the SPSS software analysis report via computer. There was a 20-minute time before the start of the next hour for the teacher and the students to summarize the effect of the last multimedia course learning, which would improve the students’ satisfaction and confidence to a certain degree.

4.2 Teaching Effect

Copies of the questionnaire were distributed between the two hours in this study, to investigate those students who participated in the course “Learning and Use of SPSS software” using the multimedia teaching model based on ARCS motivation theory. The students in the experimental group used the multimedia teaching model, while the students in the control group did not use the multimedia teaching model. There are 46 students in the experimental group and 48 students in the control group. In this study, the students of the two groups were surveyed in terms of their evaluation on the learning process and learning effect of practical learning of SPSS software, as shown in Table 1.

Table 1. Evaluation of the teaching process and teaching effect by the two groups of students (person/%)

Investigation content	Experimental group (n=46)			Control group (n=48)		
	<i>Agree</i>	<i>Mid</i>	<i>Disagree</i>	<i>Agree</i>	<i>Mid</i>	<i>Disagree</i>
Like this teaching method	45 (97.8)	1 (2.2)	0 (0.0)	28 (58.3)	10 (20.8)	10 (20.8)
Necessary to carry out such courses	46 (100.0)	0 (0.0)	0 (0.0)	38 (79.2)	10 (20.8)	0 (0.0)
Improve independent learning ability	44 (95.6)	2 (4.2)	0 (0.0)	18 (37.5)	20 (41.7)	10 (20.8)
Improve the ability to solve problems	46 (100.0)	0 (0.0)	0 (0.0)	10 (20.8)	10 (20.8)	28 (58.3)
Foster teamwork spirit	45(97.8)	1(2.2)	0 (0.0)	2 (4.2)	12 (25.0)	34 (70.8)
Improve thinking skills	45 (97.8)	1 (2.2)	0 (0.0)	36 (75.0)	12 (25.0)	0 (0.0)

From the comparison of the investigation results of the two groups, it can be seen that after the students in the experimental group used the multimedia teaching model based on ARCS motivation theory presented in this study, their corresponding scores significantly improved, which proves that the multimedia teaching model proposed in this study can be effectively applied to classroom teaching and application of sports statistics courses. Therefore, the multimedia teaching model based on ARCS motivation theory proposed in this study can effectively meet students’ needs for learning effect in the learning process.

5 Conclusions

From the teaching effect of using the multimedia teaching model based on ARCS motivation theory in the course of “Learning and Use of SPSS Software”, we can see that this multimedia teaching model can effectively improve students’ ability of inquiry learning and promote the comprehensive development of both students and teachers.

1. From the perspective of ARCS theory, this multimedia teaching model can effectively improve students’ ability to seek and explore knowledge. When encountering corresponding problems, they can find the answers to the questions by data reviewing, group discussions and other forms. This means that this teaching model can greatly enhance students’ attention and confidence in the entire learning process.
2. The multimedia teaching model can cultivate students’ ability to combine their own situations and knowledge, and integrate students’ own learning motivation and learning enthusiasm into the entire teaching process, playing an indispensable role in improving students’ comprehensive capacity.
3. In the multimedia teaching model based on ARCS motivation theory, teachers can serve as defenders of the entire teaching model. They can obtain teaching experience from real-time feedback of students’ learning motivation, and can also promote the improvement of their own ability. The model can provide a link between teachers and students, allowing teachers and students to think together and make progress together.

6 Acknowledgment

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