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Practice and Research on the Teaching Strategy of "Semi-finished Product Processing" Oriented to Knowledge System Construction

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ABSTRACT

The development of education informatization has led to the innovation of the teaching mode and learning mode. In this process, the teaching mode based on the knowledge system has become the main direction of the reform of the teaching model in the information age. The "semi-finished product processing" as a teaching strategy which helps learners promote knowledge construction may become a new research perspective to build a teaching model based on the knowledge system. Based on the analysis of the connotation and teaching model of knowledge construction, this research creatively proposes a teaching model based on knowledge system construction and the "semi-finished product processing" strategy. There are three stages in the teaching model including before, during and after class. Collect practice data from personal knowledge acruisition, knowledge construction to knowledge integration, the model was applied in the course of "Multimedia Information Technology-Image Processing" relying on high school information technology teaching. By analyzing the data produced during teaching, it is found that this model can improve students' comprehensive applicable ability andlearning motivation. Finnally, according to suggestions of expert and interview on students, the model was revised and optimized to assure the rigorous and scientific.

Keywords: knowledge construction; semi-finished products; teaching mode; Photoshop teaching

INTRODUCTION

Research Background

Under the traditional teaching model of information technology in middle schools, students may tend to be incomplete in knowledge system and insufficient comprehensive application ability

It is a significant mission of school education in the 21st century to cultivate talents who are not only needed by the new era society but also possess the independent learning capacity and problem-solving capacity. However, in the present information technology teaching of middle school, most schools still organize teaching activities with traditional lectures such as "task-driven" or "lecture and practice" mode. In general, teachers tend to elaborate exposition and repeating demonstration when reflected an important knowledge point. As the result, As the result, students gain knowledge without deep learning from teacher [1] and obtained a lot of fragmentary and immethodical knowledge. Under this circumstances, the connection between prior knowledge and new knowledge can not be found by students. These isolated knowledge points, skills, new knowledge, and new skills are also difficult to be integrated and organized into the existing cognitive structure of students [2]. Facing comprehensive tasks that can not be completed well, they always lack comprehensive application ability [3].

The importance of knowledge construction in the reform of the teaching model

In the 21st-century education reform, the popularization of educational informatization has brought about great changes in teaching activities and the way students obtain learning resources. The traditional teaching model, which ignores students has been greatly impacted [4]. Besides, the "Educational Informationization 2.0 Action Plan" clearly stated that the establishment of a competence-first training policy vigorously promotes the reform of teaching model. Kekang He believes that the teaching concept in the information age needs to be guided by deep learning, under the guidance of "meaningful learning" theory, the traditional learning methods should be reformed [5]. Jonassen pointed out that one of the striking features of "meaningful learning" was "knowledge construction" [6][7]. From the perspective of constructivists, learning is regarded as a kind of knowledge construction activity. Learners are the active constructors of the knowledge system. And teaching should be developed around learners and aims to realize the reform of "learning-oriented" teaching model [1] [8].

The "semi-finished product processing" strategy improves the problem of the construction of the learner's knowledge system

As a crucial deuterogrnic teaching strategy of constructivist learning theory, the "semi-finished product processing" strategy is based on the "meaning construction", which is one of the four elements of constructivist learning theory. On the one hand, it can guide the students to link the scattered knowledge points into the knowledge system, which is conducive to knowledge construction and the integrity of the learning content. On the other hand, the "semi-finished product processing" strategy can also guide students to think from the dimensions of methodology and way of thinking, and help students gradually develop their ability to solve comprehensive tasks [9].

Therefore, no matter from the perspective of reforming the traditional teaching model, or from the perspective of cultivating talents needed in a new era, it is of great benefit to forming a new teaching model based on the construction of a knowledge system utilizing "semi-finished products processing" strategy, which is also the direction of practical teaching.

Research Question

Based on the review and analysis of relevant literature and materials about the constructivist teaching model, and the problems existing in the construction of the learner's knowledge system, the research mainly focus on the following two aspects:

1. According to the model of knowledge construction and the development of teaching activity based on the "semi-finished product processing" strategy, construct the "semi-finished product processing" strategy teaching model oriented to the construction of the knowledge system.
2. Based on the practical application of teaching, explore the influence of this mode on students' ability of comprehensive application, knowledge construction, and self-efficacy intensity, so as to cultivate students' ability of comprehensive application and improved students' sense of self-efficacy.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

Related research on the model of the knowledge construction

The definition of "Knowledge Construction"

The phrase "Knowledge Construction" was widely used in business research at first, and was first put forward at the beginning of the 1980s in education by professors Marlene Scardamalia, and Bereiter at the University of Toronto in Canada [8]. According to their ideas, knowledge construction is a process of producing or creating some thoughts and opinions that are invaluable for communities [10]. However, Law and Wong state that knowledge construction is a collaborative activity with specific aim, which analyses the advantages, limitations, and potential of knowledge to stimulate learning [11]. In addition, Chinese researchers have different interpretations of knowledge construction. Huajian Zhao thinks it means that individuals cooperate with each other and participate in some purposeful activities (such as learning tasks, problem-solving, etc.) in some specific communities, and finally form some idea, theory or hypothesis and other intelligent products [12].

While Zhijian Zhong holds the view that knowledge construction refers to the process and result that learners produce new and meaningful revelence [7], combination or integration of new and old knowledge based on learning tasks. According to the above definition, although researchers have different perspectives on knowledge construction, they explicitly emphasize the value of knowledge construction and the process of knowledge construction.

The process model of knowledge construction

There is a multiplicity of views on the process of knowledge construction. Gunawardena believes that the process of knowledge construction consists of four stages: sharing and comparing information, analyzing differences, proposing viewpoints, and reaching consensus among members [13]. Stahl thinks knowledge construction includes 11 stages such as individual construction, social knowledge construction, etc [14]. Beers and his research team proposed a four-stage process model of knowledge construction for externalization, internalization, negotiation, and integration [15]. Youru Xie and her research team defined knowledge construction as a spiraling process including five stages: share, demonstration, negotiation, creation, and reflection [8]. From the perspective of self-organization theory, Haifeng Li and Wei Wang put forward a five-stage model including "problem identification—problem analysis—implementation strategy -- scheme generation—assessment practice" [16]. Yongcheng Gan and Zhiting Zhu perceive that learners construct

knowledge by acquiring and sharing information, discussing problems, raising new ideas, exchanging and arguing, and achieving consensus [17].

From these process models of knowledge construction, it can be seen that knowledge construction stresses that learners can improve their ability by acquiring knowledge and producing new wisdom or valuable ideas and views based on the acquired knowledge [5].

Teaching procedures based on "semi-finished product processing"

Based on a research of children cognitive development, constructivism has formed some learning theories, teaching theories, teaching models, and methods through years of enrichment and development. Scaffolding instruction is a comparative mature form of teaching organization in the constructivism teaching model. And the "semi-finished product processing" strategy is a common teaching strategy in scaffolding instruction. The teaching based on "semi-finished product processing" is usually carried out in accordance with the general process of scaffolding instruction. Scaffolding instruction generally contains the following five parts: ①Scaffolding—establish a conceptual framework according to the requirements of the "zone of proximal development" focused on the current learning topic; ②Into the situation—introduce students into a certain problem situation (one node in the conceptual framework); ③Independent exploration—guide students explore independently; ④Collaborative learning—consult and discuss in small groups and then have a relatively comprehensive and accurate understanding of the current concept on the basis of sharing the collective thought achievement, namely, finally complete the meaning construction based on what they have learned; ⑤Effect evaluation—implement students' self-evaluation and other members in small group' evaluation towards the individual learning [18].

In combination with the general process of teaching design, the following steps should be completed in advance on the basis of scaffolding instruction process:

- Analysis of learners—Before practical teaching, teachers need to know about students' acquired knowledge and skills, learning style, learning ability, etc. through communicating with students or questionnaire, so as to determine the teaching objectives, the organizational forms of teaching activities based on the information.
- Analysis of teaching objectives—"Semi-finished product processing" strategy aims at cultivating students' comprehensive ability and stimulating students' learning motivation in the process. Therefore, before practice teaching, teachers should analyze and determine teaching targets based on the three-dimensional teaching objectives, analysis and determination of teaching objectives in order to provide guidance for implementing teaching activities.
- Analysis of teaching content—"Semi-finished product processing" strategy aims to guide students to build relationship between knowledge points and a knowledge network from point to line to surface. Therefore, teachers need to analyze and clearly define the relationship between knowledge points in order to design semi-finished materials. As "semi-finished product" aims to provide students with a clear framework, whose accuracy and effectiveness depends on defining the relationship between knowledge points.
- Design semi-finished materials—the function of "semi-finished materials" is equivalent to a learning scaffold, which helps students get a grip toward the framework of learning content. Teachers need to complete the design of semi-finished materials aiming at teaching objectives and contents before class to organize subsequent teaching activities [19].

RESEARCH METHODS DESIGN

Research Ideas

There is no consensus of knowledge construction process model, the "semi-finished product processing" strategy is a teaching strategy mainly aiming at cultivating the ability of comprehensive application and stimulating students' motivation. Therefore, which knowledge construction process model can be used to better adapt to the teaching process based on the "semi-finished product processing" strategy? How to ensure the effectiveness and scientificity of the teaching mode becomes the critical issue of this research.

First of all, apart from knowledge construction process models proposed by researchers, this research intend to find a knowledge construction process model, which is compatible with the "semi-finished product processing" strategy on the basis of existed research. According to its elements, It requires to reconstruct the teaching model oriented to the construction of the knowledge system of the "semi-finished product processing" strategy. Therefore, the primary task of this research is to define the types of mainstream knowledge construction process models.

Secondly, after rounds of iteration, the problems will bewe collected, analyzed, and further optimized to form a more scientific and effective teaching model.

Finally, as a quasi-experimental research, questionnaires will be collected to evaluate students' sense of self-efficacy at the beginning and end of teaching practice.Also the artifacts and students' mind map used to evaluate students' comprehensive application ability will be collected and analyzed. The learning effect data of students under this teaching mode which is oriented to the constructed of the knowledge system was analysed to identify it's role in promoting students' comprehensive application ability, knowledge construction ability and self-efficacy.

Research Process Design

Based on the above research ideas, the research process includes reading and analyzing literature, determining the type of knowledge construction process models, determining the teaching process which is based on the "semi-finished product processing" strategy, preliminarily constructing the teaching model oriented to the construction of the knowledge system, verifying the effect of this teaching model, and further modifying and perfecting this teaching model. The specific research process is shown in igure1.

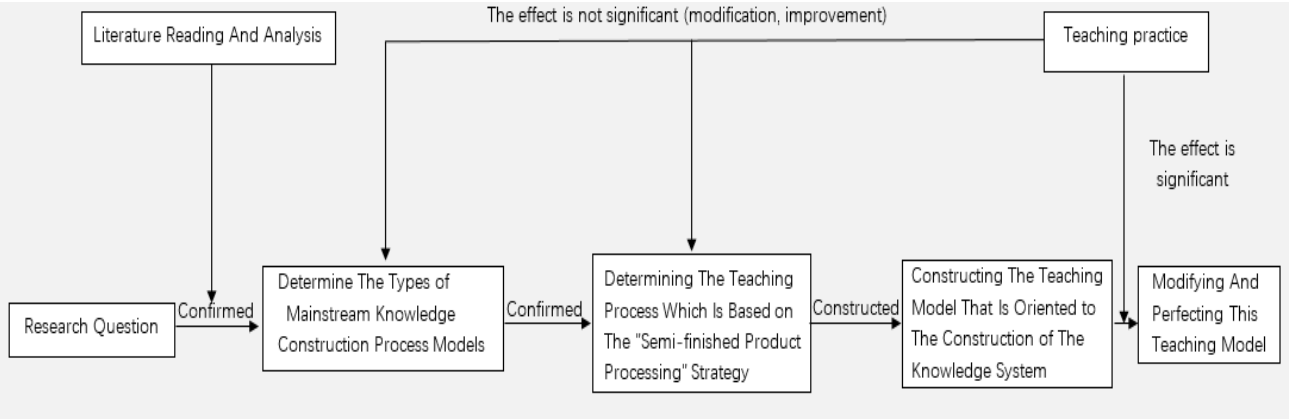


Figure 1. Diagram of research process

Design of Evaluation Tools

Selection and Characteristics of Evaluation Tools

This research focuses on the knowledge construction of learners and aims to solve the issue about the poor ability of comprehensive application in information technology, the weak ability of self-direction knowledge construction and the rapidity of decline in self-efficacy of middle school students in the western of China. Therefore, the evaluation of this study should also focus on those three dimensions. Based on this assumption, the evaluation tools of this study mainly include the evaluation table about the Photoshop works'quality, the quality of the mind map which reflects the level of the students' knowledge system structure and the information technology self-efficacy questionnaire

Evaluation Form of Photoshop Work Quality

Regarding the related literature of Photoshop work evaluation, the evaluation standard and a form of Photoshop works' quality was designed. The evaluation form was divided into five dimensions: topic fit, structural integrity, color expressiveness, technical expressiveness, and innovation. Each dimension was divided into four grades. The details are shown in Table1.

Table 1. Evaluation form of Photoshop works

Dimension	Investigation content	The proportion of Score
topic fit	Check whether the selected material is closely related to the theme and appropriate	20%
structural integrity	Check whether the overall layout is beautiful and generous, and whether the structure layout is reasonable	20%
color expressiveness	Investigate whether the choice and use of colors can highlight the theme of the work and give people a deep visual impression	20%
Technical expressiveness	To examine whether you can proficiently use the various tools and commands you have learned	20%
innovation	Investigate whether the originality is novel, or effectively convey the information of the work in a unique way	20%

The mind map oriented to the knowledge system structure and drawn independently by the students

A concept map or a mind map is an effective tool to reflect the logical relationship between the internal knowledge system and knowledge points of the course. From the perspective of thought, the mind map can reflect the thinking process of students and their understanding of the holistic knowledge system. Therefore, the students participating in this quasi-experimental study were required to independently draw a mind map of related modules during the review phase (or when they are content-complete the course). the logical relationship between the internal knowledge system, knowledge points, and the level of knowledge construction can be reflected by the quality of the mind map..

Self-Efficacy Questionnaire for Information Technology Curriculum (Elementary and Secondary)

Under the guidance of some theories related to self-efficacy, based on the questionnaire design in "General Self-Efficacy Scale (GSES)" and "The Development and Application of Learning Self-efficacy Scale" (Yufang Bian, 2003), the "Self-efficacy Questionnaire for Information Technology Curriculum

(Elementary and Secondary)" was designed to be used for pre-test and post-test for students after reviewed some items according to actual condition,.

Reliability and Validity

As the comprehensive work in Photoshop and the mind map independently drawn by students both reflect students' level in comprehensive application ability and knowledge system construction objectively, its reliability and validity are self-evident.

The questionnaire oriented to the self-efficacy of information technology courses wasmodified based on the "General Self-Efficacy Scale (GSES)" and "The Development and Application of the Learning Self-efficacy Scale". Since the "General Self-Efficacy Scale (GSES)" and "The Compilation and Application of the Learning Self-Efficacy Scale" are authoritative scales with good reliability and validity,Self-Efficacy Questionnaire for Information Technology Curriculum (Elementary and Secondary) has good reliability and validity guarantee.

To further ensure the quality of this survey, a pilot test was carried to evaluate the reliability and structural validity of the questionnaire. The results showed that the Cronbach coefficient of the questionnaire was 0.787, higher than the standard value of 0.7. And KMO(Kaiser-Meyer-Olkin) value was 0.787. Bartlett's sphericity test was the null hypothesis $p=0.0000<0.001$. In a word, the questionnaire has better internal consistency and structural validity.

THE PROCESS OF PRACTICE TEACHING

This study is designed to build a teaching model that can help students to construct knowledge construction, have a holistic knowledge system and improve their self-efficacy. On the one hand, it can help students to build relationships between the scatteredfragmentary knowledge points by means of this teaching model so that students can construct knowledge better. On the other hand, it can help teachers stimulate and improve students' sense of self-efficacy in the teaching process, so as to maintain their learning motivation and improve efficiency in the class.

Preparation before practice

Participants

A total of 107 students of two classes(experimental class and control class) in a senior high school in Wuzhong, Ningxia, participated this research. Before the study, three questions were designed in the pre-test questionnaire to test the students' knowledge of Photoshop, and the questionnaire of self-efficacy was designed to test the students' self-efficacy level, so as to ensure that there is no significant difference in their prior knowledge and self-efficacy level between the two classes. The result of the chi-square test of the three questions testing students' prior knowledge shows that the P values of progressive salience value are respectively 0.377, 0.821 and 0.515, which are all higher than the significance level of 0.05. There is no statistically significant difference in the prior knowledge of the students in the two classes. The result of the pre-test's independent sample T test which tests their self-efficacy level in the two classes shows that the bilateral Sig. Value is 0.598(>0.05), and there is also no statistically significant difference in their self-efficacy in the two classes

The variable control in the process of quasi-experiment

In order to detect the function of the teaching model in the process of practice, this study implements the "semi-finished product processing" strategy teaching model for the experimental class, and for the control class it implements the teaching model of "demonstration +instruction", and the variables are controlled as follows:

1 Independent variable: Two classes with no statistical difference in knowledge base and level of self-efficacy were selected as independent variables.

2 Dependent variable: Whether the students' comprehensive ability has significantly improved will be reflected in their compositive works that were designed and produced by themselves without teachers' guidance. In this study, the results of their works was taken as the test data of their comprehensive ability and their ability to construct knowledge was reflected in their mind maps, so their self-evaluation results of mind maps was taken as the test data of their ability to construct knowledge. Therefore, the dependent variables of the experiment were the results of compositive works, self-evaluation scores of mind mapping and students' level of self-efficacy.

3 The control of irrelevant variables: Information technology teachers of the same grade were invited to mark the anonymous students' compositive works based on the comprehensive evaluation standard of Photoshop works that was set after referring to the literature, so as to ensure the consistence of teaching content and experimental time of the two experimental classes. During the experimental test, the teacher did not give any special hints or tutoring to any experimental class.

The design of teaching content—"semi-finished production"

Three rounds oriented toward three important knowledge points were conducted in this study, which are successively "concept and use of layers", "quick masking technology" and "concept and application of masking". As space is limited, only take the quick masking as an example to introduce the design of "semi-finished product".

The selection and blank-leaving of "semi-finished production"

The "semi-finished" images to be processed should be closely related to students' real life and conform to their age features; the selection of semi-finished products should take resonating and stimulating their interest as the principle;

The blank-leaving area of "semi-finished products" should be closely related to the knowledge points taught in class and focus on the requirements of knowledge and skill goals;
The blank-leaving area should have proper density to make it easy for students to find it, but it should also have certain difficulty to ensure its challenge.

The blank-leaving of "semi-finished products" should be progressive, developmental various levels, with various levels, from the elementary to the profound, in accord with the theory of "Zone of Proximal Development" and not exceed students' zone of proximal development.

The"semi-finished product" of "quick masking"module

Requirements of the case: the teacher provides students with a multi-layer PSD image. Layer 1 is the giraffe and layer 2 is the golden grassland. Students need to produce "using golden grassland to fill the ground under the giraffe's feet", as shown in the Figure2.



Figure 2 Effect diagram

The design of semi-finished product: (1) deliberately put the layer of the semi-finished product in the wrong position in order to make students find out the effect of layer position on the image; (2) masking has been added to the layer, and local regions in the image have been processed perfectly, so as to reduce students' workload, have contrasts and provide some reference for students; (3) draw some wrong parts of the layer masking, and let the students find the missing parts by themselves and "correct them".

The process of teaching practice

The implementation of single-round practice

According to the existing literature, case teaching method is used in most of studies on the Photoshop teaching. Therefore, in this study, case teaching method is used to organize teaching activities in the control class, while in the experimental class, apart from using case teaching method, works based on "semi-finished products" are also blended to provide support for learners' learning activities.

This study refers to the model of knowledge construction process that was put forward by Stahl, Beers, Li Haifeng and Wang Wei and blends the knowledge construction process to the teaching process based on "semi-finished products processing" strategy to build the teaching model of "semi-finished products processing" oriented towards the knowledge system. The model consists of three stages： before class, during class and after class, and three levels: personal knowledge acquisition, knowledge acquisition construction, and knowledge integration.

In this study, three rounds were conducted, namely " the concept and use of Layer ", "quick masking skill" and "the concept and application of masking". The implementation process of each round of teaching practice is shown in Figure3.

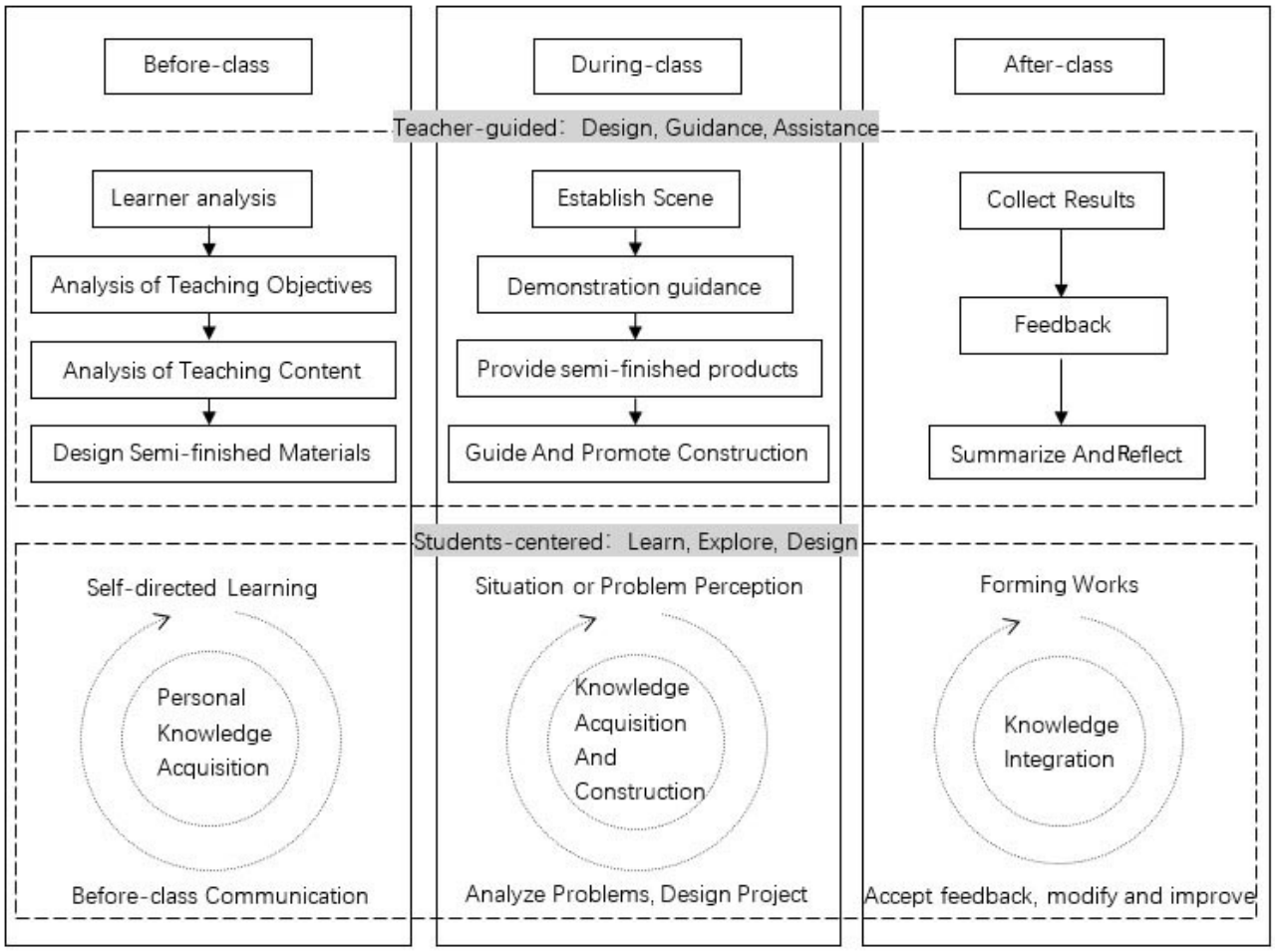


Figure 3 The first version of the teaching model of the "semi-finished product processing" strategy oriented to the construction of the knowledge system

The supplementary explanations of the practice process

At the end of each module, collected data and targeted interviews should be conducted in order to test the effect of this teaching model. Therefore, students' works, self-assessment results of mind map and post-test questionnaires of self-efficacy also need to be collected as the first-hand data. On this basis, experts are invited to observe the process of teaching practice, and some representative testees are selected to conduct targeted interviews, so as to enrich and improve the conclusion of this study to ensure the scientificity and objectivity of this study.

The acquisition of research data

Starting in September 2019, data of corresponding teaching module was collected during the teaching practice mainly including three types of data sets: first, before the beginning of teaching practice, send and collect the pre-test questionnaire to two regular classes of 107 students in an ordinary senior high school in Wuzhong, Ningxia and input these data into SPSS to make analysis; second, students needed to draw mind maps by themselves and conduct self-assessment at the end of each round of teaching, and then collect self-assessment results and input them into SPSS for data analysis; third, score the compositive Photoshop works submitted by students according to the Photoshop Compositive Works Evaluation Form and input the results into SPSS for data analysis.

DATA ANALYSIS AND DISCUSSION

Analysis of Learning Effect Based on Practical Data

Influence on Students' Comprehensive Design and Application Ability

To test knowledge system construction-oriented "semi-finished products processing" strategy whether can promote the comprehensive application ability of students, at the end of the teaching practice, collect a piece of Photoshop work that students choose and design independently, invite the information technology teacher of the experimental school to score the student's Photoshop work according to the scoring standard of the work evaluation tool, and classified statistic the results. The results confirmed that the number of works submitted by the students in the experimental class and the performance of the works was better than those in the control class. See Table2 for details.

Table 2. Statistical results of works

Group Statistics				
	Class	**N**	**Mean**	**Standard deviation**
The score of works	the control class	35	22.71429	4.190826
	the experimental class	40	28.50000	4.624350

The scores of each work submitted by the experimental class and the control class were extracted, and an independent-samples T-test was performed to prove statistically that there was a significant difference between the experimental class and the control class in the scores dimension. The data analysis results in Table3 were obtained.

Table 3. The results of independent-samples T-test of final works of experimental class and control class

Independent-samples Test					
	Levene-test of The Variance Equation		**T-test of The Mean Equation**		
	F	Sig.	Sig. (Bilateral)	95% Confidence Interval of Difference	
				Upper Limit	Lower Limit
The score of works	.000	.989(Homogeneity)	.000**	-7.828173	-3.743255

The results in Table3 show that the probability of the Photoshop works scores dimension independent-samples T-test is 0.000, which is far less than 0.05. And the probability of the homogeneity test of variance is greater than 0.05, which indicates that the students' ability to creat Photoshop works has a striking difference in the experimental class and the control class after teaching practice, and the test result is credible.

The Effect of This Model in Enhancing Students' Knowledge Construction Ability

To evaluate the "semi-finished product processing" strategy oriented to the construction of knowledge system whether is helpful to enhance the knowledge construction ability of students, after each round of teaching practice, collect the self-evaluation results of the mind map independently drawn by the experimental class students, and make descriptive statistics on the obtained data. The results confirmed that the knowledge construction ability of experimental class students is gradually enhancing. See Table4 for details.

Table 4. Descriptive statistical results of mind map self-evaluation scores in experiment class after three-round teaching

Description of Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Standard deviation**
The First Round	52	2.900	6.300	4.67115	.741048
The Second Round	52	2.800	6.600	4.76154	.737285
The Third Round	54	3.600	6.400	5.05556	.607397

The results in Table4 show that the average of the self-evaluation scores of experimental class students' mind maps collected after the first round of teaching practice is 4.671, and that of the second round is 4.761. The third round is 5.055.And the average value of the self-evaluation scores of the experimental class students' mind maps is gradually increasing, which shows that the "semi-finished product processing" strategy can effectively improve the students' knowledge construction ability.

The Effect of This Model in Enhancing Students' Self-efficacy

To test whether the "semi-finished product processing" strategy teaching model can strikingly enhance the self-efficacy level of students in the statistical sense, the author extracted the pre- and post-tests score of the self-efficacy of each student in the experimental class and the control class (the mean value of all questions' option after assigning). A pared-sample T-test was performed on these data, and the data analysis results in Table5 were obtained.

Table 5. T-test of paired-samples of test scores before and after self-efficacy in experimental class and control class

Class	**Mean**	**Standard Deviation**	**df**	**Sig. (Bilateral)**
Experimental class	-.267308	.905045	51	.038*
Control class	-.158586	.932487	54	.213

The results in Table 5 show that the probability value of the self-efficacy level paired-samples T-test of the experimental class is 0.038(<0.05), which shows that there is a striking difference in the self-efficacy level of the students in the experimental class before and after teaching practice. The probability value of the self-efficacy level paired-samples T-test of the control class is 0.213(>0.05), which shows that there is no striking difference in the self-efficacy level of the students in the control class before and after teaching practice.

Considering that the improvement of students' self-efficacy may be produced natural growth during the study period, it does not necessarily mean that the enhancement of students' self-efficacy was cased by the "semi-finished product processing" strategy . Therefore, the post-test data of the self-efficacy of the experimental class and the control class were further tested using the "independent-samples T-test" method. The data analysis results in Table6 were obtained.

Table 6. T-test of paired samples of self-efficacy scores in experimental and control classes

Independent-samples Test					
Dimension	**Levene-test of The Variance Equation**		**T-test of The Mean Equation**		
	F	Sig.	Sig. (Bilateral)	95% Confidence Interval of Difference	
				Lower Limit	Upper Limit
The Self-efficacy Sense	.003	.956（Homogeneity）	.045*	-.71083176	-.16229434

The results in Table6 show that the probability value of the self-efficacy sense level independent-samples T-test is 0.045(<0.05). The probability of the homogeneity test of variance is greater than 0.05, which indicates that the self-efficacy level of students in the experimental class and the control class is indeed striking difference after teaching practice, and the test result is credible.

Discussion and Reflection

To ensure the scientificity, effectiveness, and rigor of the "semi-finished product processing" strategy teaching model, experts were invited to observe and remark on the teaching practice process and this teaching model. And several representative students of the experimental class were selected for an interview. Integrating expert's advice and interview information, the problems and shortcomings of the "semi-finished product processing" strategy teaching modelwas analyzed and further optimized to make it perfect [20].

The problems and shortcomings of the has achieved remarkable results in improving students' knowledge construction ability and developing comprehensive works

The data analysis results in Table 2 and Table 3 indicate that the teaching model has a significant effect on promoting students' ability to design and produce the comprehensive works that students complete independently. There maily exists two factors contributing to this.

First of all, the teaching method based on the strategy of "semi-finished products processing" aims to help students establish connections between knowledge points and learn knowledge from point to line to surface. Actually, Photoshop learning is generally the learning of software. The characteristics of software knowledge are complex and systematic, which aims to master the use of software tools by students systematically. But, the traditional teaching model of "teacher presentation + lecture + student acceptance" makes students always learn isolated skills or knowledge points. It is difficult to establish an overall knowledge structure.

Secondly, the teaching mode has largely solved the problems of difficulty in completing a works quickly and inefficiency caused by force majeure , school curriculum time and weak foundation. Students no longer make works from scratch, but obtain a frame of works through semi-finished materials. Continued improvement on the frame will greatly shorten the time to complete the task and increase the efficiency.

The descriptive analysis results presented in Table 4 show that the "semi-finished product processing" strategy can help improve students' knowledge construction ability.

The data analysis conclusions presented in Table 5 and Table 6 confirm that the teaching mode has a significant effect on improving students' self-efficacy.

Firstly, Photoshop's learning assignments or design activities are in most cases a complete and comprehensive task. The traditional transfer-receptive teaching would take up half of a lesson, leaving only half of the time for students to complete the learning task. And in most cases, students always have to make from scratch. In such a short period of time, students with weak foundations are generally difficult to complete such a comprehensive task, and each time they study, they will have a personal frustration. If this situation continues, the students' sense of self-efficacy and interest in learning are gradually consumed. The implementation of this strategy plays an important role in maintaining students' interest in learning and enhancing students' sense of efficacy.

Secondly, the comprehensive tasks with relatively high difficulty also make this part of the students with weak foundation feel afraid of difficulties, and exacerbates the loss of learning self-efficacy. With the help of the "semi-finished product" learning framework, through the teaching activities which is organized around the "semi-finished product processing" strategy, the role of teacher guide is played, so that students can be more active in classroom. And in the process of finding problems and solviing problems, it helps students to connect the multiple isolated skills learned through "semi-finished products". on the basis of the above, students form memories by independently combing the knowledge context and construct their own knowledge network. In addition, the "semi-finished product processing" strategy encourages students to study cooperatively and solve problems through collaboration, because the cooperation and communication also can promote the construction of students' knowledge.

Optimization of the "semi-finished product processing" strategy teaching model

Based on the effect of practical teaching and the problems reflected in the practical teaching, the author optimized and supplemented the teaching mode of the first edition, deleted and added several parts, and formed the final version of the teaching model. The specific structure of the teaching mode is shown in Figure4.

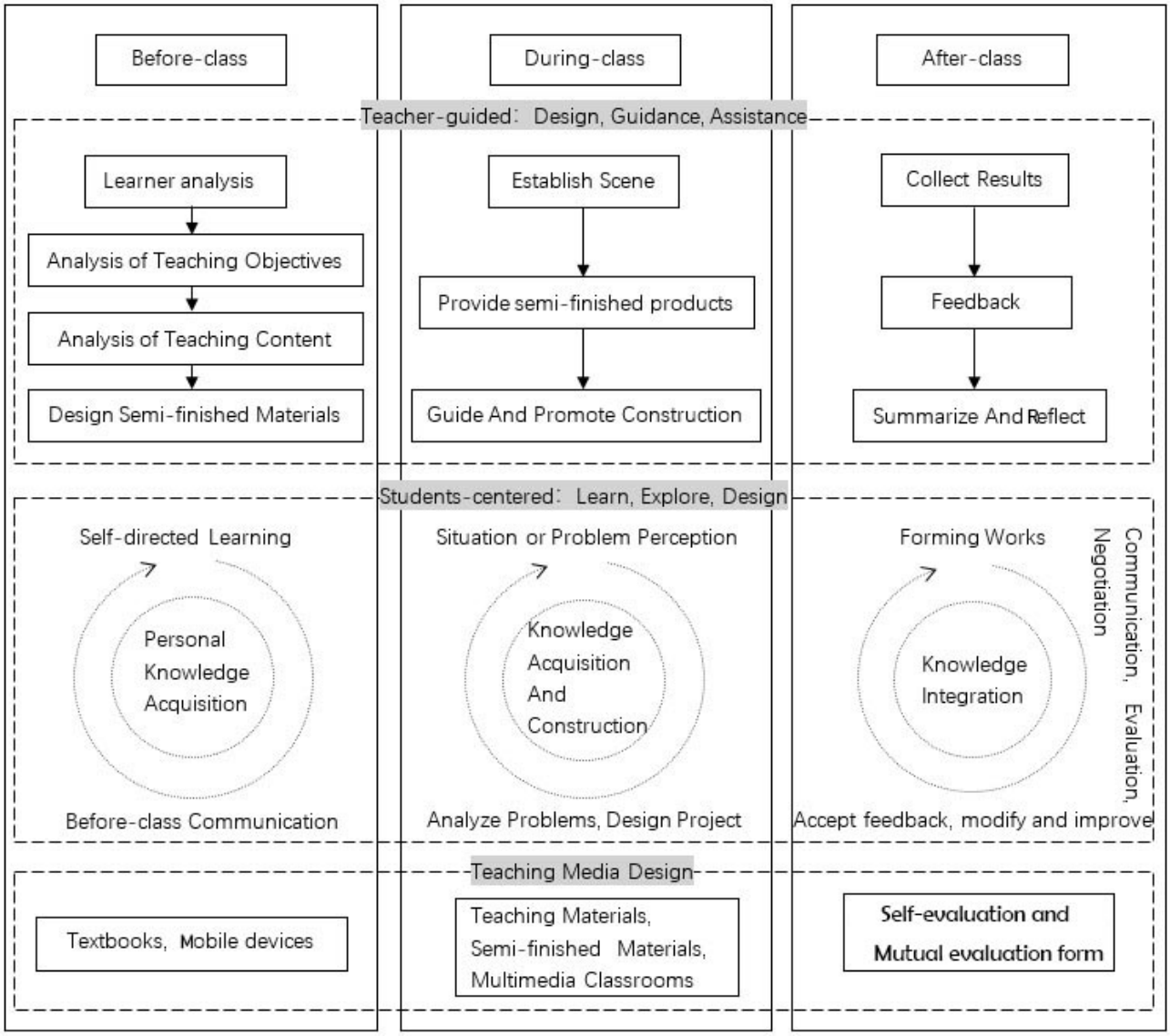


Figure 4. The optimized version of the teaching mode

Problems and deficiencies reflected in practice

The use of semi-finished products should be restricted and gradually reduced, to avoid lowering the difficulty of learning tasks and decreasing the opportunities for students to explore independently

According to expert comments and interview information, it is found that providing semi-finished products to students after giving demonstration and guidance to students can help student gain knowledge and skills efficiently. But it also affects the degree of the students constructing knowledge. Because it is easy for students to agree and apply with the teacher's demonstration. And when students face simplified tasks, their thinking changes quickly, which is not conducive to students' in-depth thinking. But if it is carried out in the form of inquiry, and teachers gradually reduce the provision of semi-finished products during teaching, it can be found that the second approach is a double blessing for students. First, this method can prompt students to produce many different views and opinions. Second, these different views can prompt students to generate a

process of knowledge construction by communication-negotiation-reconstruction after a collision, which is more conducive to students' deep knowledge construction.

Students should be encouraged to question and put forward divergent views when using the strategy of semi-finished products to organize teaching practice, When supporting the design of Photoshop works with semi-finished products, students spend most of the time filling in the teacher's blanks and solving problems according to the teacher's thinking, resulting in fewer interactions between students and fewer collisions between different views. In order to protect students' creativity and active inquiry consciousness, teachers should encourage students to question, put forward different points of view, and realize the collision of views.

SUMMARY AND LIMITATIONS

This research proposed a teaching model that conforms to the constructivist teaching concept and reflects the strategic advantages of "semi-finished product processing" from the perspective of knowledge system construction. It has certain educational value for teaching based on a "semi-finished product processing" strategy and cultivating students' comprehensive application ability. Although the participation of experts has ensured the scientificity and rigor of this teaching model to a certain extent, due to the short period of time and certain limitations, the universality and scientificity of this teaching model still need to be further tested. Hope in the follow-up teaching practice, it can be continuously improved and optimized to make this teaching mode more abundant and authoritative.

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