Application of Artificial Intelligence Technology in Computer Aided Art Teaching

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Abstract. With the help of computer technology, artificial intelligence teaching can conveniently provide students with a virtual environment to experience the process firsthand, helping them to better understand the knowledge they have learned. Aiming at the defects of the existing artificial intelligence computer-assisted teaching system, based on modern education theory and using existing information technology, this paper studies the artificial intelligence computer-assisted teaching system model with personalized teaching and collaborative learning functions. According to the development mode and application requirements of the intelligent artificial intelligence computer-assisted teaching system, a teaching system model based on artificial intelligence technology is proposed. In the research learning process of logo design topics, the digital network learning platform based on artificial intelligence computer-assisted art teaching mode played an important role. The learner's design creativity is greatly supported by educators and participants. Through extensive interactive communication and mutual evaluation, learners are encouraged to further in-depth research. This achieves a very significant learning effect, and the learners' desire to study in the art major is greatly stimulated. The practice of the subject proved that the computer-assisted art teaching model based on artificial intelligence has a great learning advantage over the traditional art teaching model.

Keywords: art teaching; computer-aided education; artificial intelligence technology.
DOI: https://doi.org/10.14733/cadaps.2021.S4.118-129

1 INTRODUCTION

Intelligent teaching system is an important research field of artificial intelligence and educational technology, and it is also the inevitable development direction of digital education in human society in the 21st century [1]. Its research involves artificial intelligence, computer science, cognitive science, education, psychology and behavioral science. The ultimate goal of the research is to assume the main responsibility of human education by the computer system, that is, to help learners acquire knowledge and skills without the guidance of a human tutor [2]. Since the 1970s, many countries and regions such as the United States, the United Kingdom, Canada, and Japan have attached great importance to the research, development and application of intelligent teaching systems [3]. At present, the research of intelligent teaching system can be said to be still in the research stage. The research work is mainly carried out in a few universities and scientific research institutions, and the results are mostly "display-type" systems. The intelligent teaching system that really goes out of the laboratory and puts into teaching practice is not many.

When artificial intelligence appears in the inter-discipline, knowledge tends to be integrated, and technology begins to integrate, the latest artificial intelligence technology has begun to become a dazzling pearl, making the field of education science brighter [4]. So, how do we introduce this achievement and get it widely used? This has become an innovative work of very important significance. This work will enable modern distance education to enter a new era of intelligence and set off a wave of intelligent education technology [5]. The SCHOLAR system developed by Quan et al. is the first to apply intelligent technology to the teaching system [6]. The system uses the knowledge expression method of artificial intelligence, adopts the form of semantic network through the knowledge base, and finally forms a new teaching method with the help of facts, concepts and processes. The mechanism generates more questions and evaluates the students' answers. The intelligent system can diagnose some of the students' fallacies and guide them to think about themselves, and then further correct the mistakes based on the results of the thinking. The intelligent teaching system GUIDON developed by Lafrance is combined with the system MYCIN [7]. The new system adopts a rule-based knowledge representation method. The teaching process is an interactive learning environment and a student model (overlay model) is established. However, there is a lack of teaching strategies when using MYCIN's knowledge base in the GUIDON system. These strategies are used to explain and organize the teaching knowledge of the teaching process. The Auto tutor system developed by Sheikh and Fann is a complex system jointly developed by multiple disciplines [8]. Auto tutor system has obvious advantages, and its comprehensiveness is reflected in the user interface, teaching content and teaching process. The system mainly includes topic selection, course description, students' contribution in collaborative problem solving, teaching dialogue transfer, dialogue transfer generation rules, system evaluation, etc. At the same time, in the multimedia teaching, the synthesis of speech and the display of images are considered, and the image agent also simulates facial movements and other factors. Tian and Duan pointed out that in the process of implementing modern distance education, the intelligent decision support system IDSS has realized the planning, layout, structure, resource construction and mode selection of distance education, which provides great possibilities for making decisions [9]. Zaranis and Synodi believe that the distance teaching in the new century has realized the transition and transformation from the traditional CAI auxiliary system to the intelligent teaching system [10]. The traditional CAI auxiliary system is a multimedia reading material that integrates sound, text and pictures, while the intelligent teaching system can provide an all-round open interactive teaching environment. This intelligent system uses computers to simulate the teaching thinking process of experts and professors, and uses various advanced teaching methods such as AI technology and multimedia to form an intelligent system for students to learn independently and the system automatically provides learning resources according to requirements. The teaching effect is largely optimized. Bliss et al. have proposed a personal intelligent navigation system based on Java technology [11]. The system has the function of autonomous learning, can actively analyze the learning habits of users, and can help groups of

learners to conduct targeted learning guidance, allowing learners to quickly and accurately use the system to find learning resources that suit them.

The artificial intelligence computer-assisted teaching strategy is directed to a certain teaching goal, a series of measures and behavior implementation processes that regulate and control teaching activities in a specific artificial intelligence computer-assisted teaching situation. This kind of adjustment and control is generally realized through the overall effect of factors such as the arrangement of teaching activities and the selection of teaching methods. The selection of factors such as activity procedures and methods is generally based on learner characteristics and learning content. It can be seen that there are two main steps in the formation of artificial intelligence computer-assisted teaching strategies: one is to identify and diagnose learner characteristics and learning content; the other is to design artificial intelligence computer-assisted teaching strategies on the basis of recognition and diagnosis. The artificial intelligence computer-assisted art teaching model has established a digital network learning platform and completed its release, which has played a positive role in promoting the development of art teaching. Based on the teaching theory of artificial intelligence computer-assisted art teaching mode, combined with the use of digital network learning platforms, this paper compares the 2016 and 2019 students' art learning data to analyze the difference between the new and old teaching modes on art teaching. It systematically expounds the benefits of artificial intelligence computer-assisted art teaching mode for art teaching, and proposes perfect and improvement measures for problems found.

2 DESIGN OF ARTIFICIAL INTELLIGENCE TEACHING SYSTEM MODEL

2.1 Function and Composition of Intelligent Teaching System Model

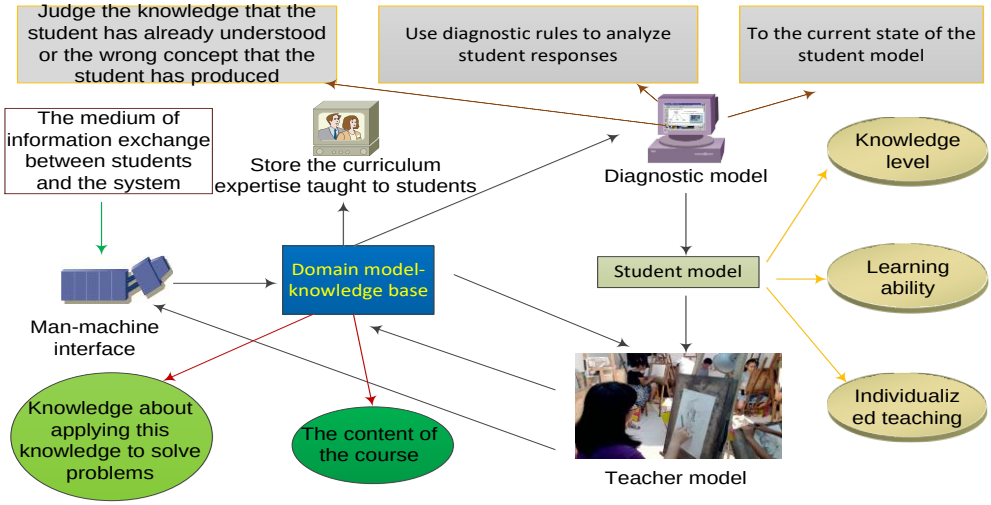

Figure 1: Block diagram of the intelligent teaching model.

The key of the intelligent teaching system is to be able to test the learning effects of learners and give corresponding learning suggestions, so as to realize the intelligence of the learning process. The main functions are as follows:

(1) According to different teaching content, you divide the knowledge points and establish a database of learning elements. Learning effect is an important indicator of learning quality. The learning process includes online learning, online exercises, online testing, and practical teaching,

collecting learning process information, and then making a reasonable evaluation of the learning effect.

(2) According to the learning situation, the learning effect evaluation is given, and then the learning guidance and learning suggestions are given according to the learning effect, so that the learning process has a stronger pertinence to achieve the purpose of improving the quality of learning.

(3) You collect students' response information in time, analyze and process them, and judge students' performance; choose different teaching content for different students, filter out the knowledge that students do not have the learning conditions; help students analyze the reasons for errors, judge and mark the knowledge points that students need to learn most; provide targeted individual tutoring and appropriate tuition materials.

(4) It allows students to communicate with computer tutors in natural language.

The intelligent teaching model mainly includes knowledge base, student model, teacher model and intelligent interface. The basic structure diagram is shown in Figure 1.

2.2 Design of the Knowledge Base

The knowledge base is composed of static knowledge and dynamic knowledge. Static knowledge refers to professional knowledge, assessment knowledge, teaching goals, teaching process and teaching strategies. Professional knowledge is the knowledge that describes the teaching content and the relationship between them, and is the core content of the knowledge base. In order to accurately and reasonably describe the professional knowledge, it is necessary to decompose the teaching content. On this basis, the relevant knowledge of each part and the relationship between each other is given, and artificial intelligence methods are used to convert this knowledge into knowledge that can be understood and transmitted by computers, this process is called knowledge representation.

Dynamic knowledge is temporary knowledge generated during the operation of the system, which is the precondition for the further operation of the system, including the intermediate data obtained in the inference process, the intermediate result of the problem, and the record of the problem-solving process.

A good knowledge representation method can not only organize domain knowledge reasonably and effectively, but also provide information query for the system, but also help students establish clear conceptual relationships, establish knowledge structures, and improve problem-solving capabilities.

Knowledge Point (K P) is the basic unit to convey teaching information in the course of teaching activities, including theories, principles, concepts, definitions, examples and conclusions. Among them, the most basic teaching unit with indivisible content is called atomic knowledge point. A knowledge point composed of two or more knowledge points is called a compound knowledge point. The knowledge points that make up a composite knowledge point can be atomic knowledge points or composite knowledge points. In order to describe the teaching content accurately and reasonably, it needs to be decomposed. First, the whole teaching content is decomposed into several unit knowledge points, each unit is independent and interrelated, and then each unit knowledge point is decomposed into several sections of knowledge, and the section knowledge points can be divided into one-on-one teaching. The smallest unit of content is an atomic knowledge point. Attention should be paid to maintaining the integrity and consistency of the content of the knowledge points during decomposition, thus forming a tree-shaped hierarchical structure.

Through the analysis of knowledge points, in ICAI's domain knowledge base, there is a partial and overall relationship between knowledge points, which is called organizational relationship; the relationship between knowledge points is except for the organizational relationship obtained by dividing knowledge points. In addition, there is a successive relationship between the content they

express. This relationship is called a dependency relationship, and the dependency relationship is also called a support relationship.

Organizational relationship and dependence relationship are two aspects of knowledge point relationship. Organizational relationship is obtained through the division of knowledge. It is an artificial relationship. Dependency relationship is the internal relationship between the content expressed by knowledge points. They are different from each other. The angle reflects the relationship between knowledge points. In addition to the pure organizational relationship and dependence relationship between knowledge points, they may also be expressed as a composite relationship: brother relationship and parallel relationship. The system model of the intelligent collaborative interactive learning environment is shown in Figure 2.

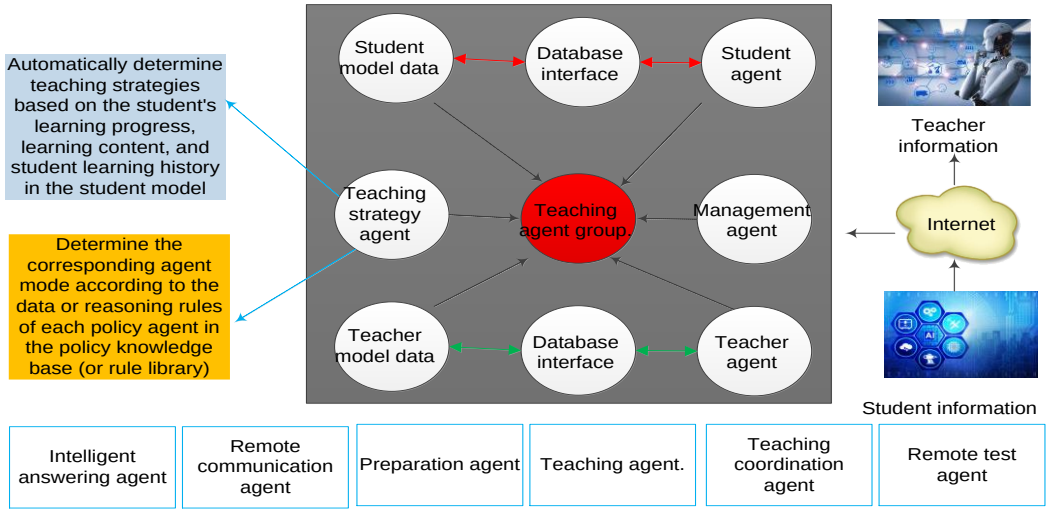

Figure 2: System model of intelligent collaborative interactive learning environment.

2.3 Reasoning Mechanism

The function of the inference engine is to find the relevant information in the knowledge base reasonably and quickly according to the knowledge representation method of the knowledge base to select the reasoning scheme. Therefore, the corresponding representation method must be selected according to certain knowledge structure characteristics and then the choice is also realized. The structure and reasoning mechanism have reached a high degree of unity. In order to realize the intelligent reasoning of the system, this model uses a production system to represent knowledge and information.

The problem-solving process of the production system is the search process of the solution space, that is, the reasoning process. The reasoning mechanism of the production system can be forward reasoning, backward reasoning and bidirectional reasoning. The former is data-driven reasoning and the latter is goal-driven reasoning. Forward reasoning is also called fact (or data) driven reasoning and forward link reasoning; backward reasoning is also called reverse reasoning, goal driven reasoning, and reverse link reasoning.

(1) Forward reasoning (data-driven). Each production has a set of conditions on the left and a set of actions on the right. Whenever the current state of the data base meets all the conditions on the left part of a certain production, the corresponding production is activated and the actions on the right part are executed. To realize forward reasoning, first they provide a batch of facts (data) to the comprehensive data. The system uses these facts to match the premise of the rule, triggers

the successfully matched rule, and adds its conclusion to the general database as a new fact. They use all the facts in the updated master database to match another rule in the rule database, and use the conclusion to modify the contents of the master database again until there are no new matching rules.

(2) Backward reasoning (goal driven). Backward reasoning is reverse and imprecise reasoning. The basic principle is to set the target state as S, then first check whether the current state of the data base is already S. If it is, no work is needed and the problem has been solved. Otherwise, you check whether there is such a rule R, and the state S2 can be converted to S,. If yes, you check whether the current state of the data base is SZ. If so, you just execute R, to reach the state S, and the problem can be solved. If the status of the current data base is not Sz, then you further check whether there is such a rule, and the status can be converted to Sz, if there is, check whether the status of the current data base is S3.

(3) Two-way reasoning. Two-way reasoning is also called forward and backward mixed reasoning. It combines the strengths of forward reasoning and backward reasoning and overcomes the shortcomings of both. The reasoning strategy of two-way reasoning is to reason from the goal to the fact and from the fact to the goal at the same time, and at a certain step in the reasoning process, realize the match between the fact and the goal.

The reasoning engine is the module used to complete the reasoning function in the system, and it can also be called the reasoning engine. The inference engine generally includes three parts: scheduler, executor and consistency coordinator. The scheduler controls the entire reasoning process so that the reasoning can proceed according to a certain process; the executor executes the actions selected by the scheduler, and is responsible for reading the knowledge in the knowledge base and the information in the global blackboard; the consistency of intermediate results is mainly used in reverse reasoning. The inference engine adopts different control strategies according to different knowledge representations. What this model achieves is knowledge representation based on production rule sets. The reasoning engine based on this knowledge representation adopts the method of "recognizing an action" to execute rules in a loop.

2.4 Student Model

Based on behaviorist learning theory, the corresponding learning model is to cover the student model. If the correct rate of the question is lower than a certain percentage (such as 60%) when learning a certain knowledge point, you let the students repeat the knowledge point. Since there is no analysis of the mistakes made by the students, there is no way to give targeted learning guidance. The consequences of students simply repeating learning are often mistakes made again! Since they don’ t know the reason for the mistakes, naturally they can’ t find a solution. The consequence of this continuous cycle is often that students lose interest in learning and lose confidence in themselves.

The intelligent computer-assisted teaching system mainly provides various support services for online learning. Its function strength plays a key role in students' learning. Its composition structure is shown in Figure 3.

In order to overcome the shortcomings of the covering student model, the teacher analyzes and summarizes the mistakes made by the students, contrasts the correct problem-solving method, and obtains the corresponding defects of different types of errors. As long as the students learn more about the corresponding weak links, the learning will be more targeted, and the learning effect will naturally be better. The student model of the intelligent teaching system based on this teaching activity is the deviation model.

In order to determine the cognitive ability of students, we must first solve the problem of how to represent cognitive ability. According to the famous American educational psychologist Bloom’ s "education goal classification" theory, educational goals should include three areas of content, namely cognitive ability, motor skills, and emotion. Among them, the goal of cognitive ability can

be divided into six levels according to the complexity of the intellectual activity: memorization, understanding, application, analysis, synthesis, and evaluation. The above-mentioned six levels of cognitive ability are divided according to the degree of intellectual activity from simple to complex and from concrete to abstract. That is, memorization and understanding belong to the simpler low-level cognitive ability. Obviously, we should pay special attention to the cultivation of students' advanced cognitive ability.

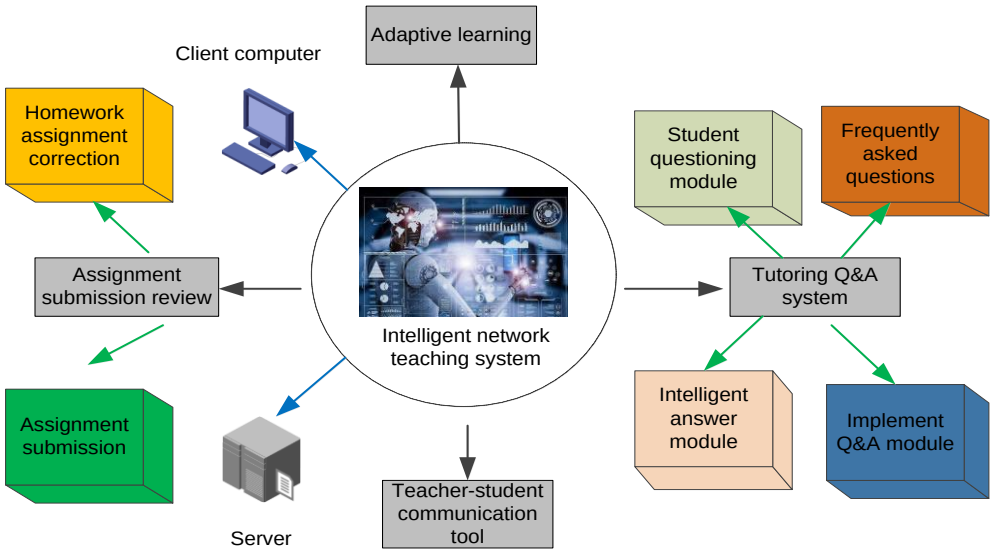

Figure 3: Intelligent computer-assisted teaching system.

3 APPLICATION RESEARCH OF ARTIFICIAL INTELLIGENCE COMPUTER-ASSISTED ART TEACHING MODE

3.1 Analysis of the Advantages of art Project Creation under the Artificial Intelligence Computer-assisted Teaching Mode

The artificial intelligence computer-assisted art teaching model is applied to the school's art design 2019 student group, and its contrast is the 2016 student group (graduated) under the influence of the traditional art teaching model. The reasons for choosing the 2019 level are as follows:

This major has the characteristics of a combination of art and computer courses, which is in line with the content teaching category of "multiple teaching"; the 2019 grade belongs to the senior student group, with the ability of computer application and the level of art creation, suitable for digital network learning platform. The advantages of art creation under the artificial intelligence computer-assisted art teaching mode are embodied in two aspects: design time and design effect.

Compared with the traditional art teaching mode, the artificial intelligence computer-assisted art teaching mode has two creative advantages in terms of data retrieval and digital technology application support in the creation of art projects. By comparing the study design time of the art project creation of the 2016 and 2019 students, we can clearly see the obvious difference, as shown in Figure 4.

The artificial intelligence computer-assisted art teaching model has solved the problem of subject production in art creation, better use of digital graphics rendering software technology, increased the time of creation and design, and significantly accelerated the pace of creation.

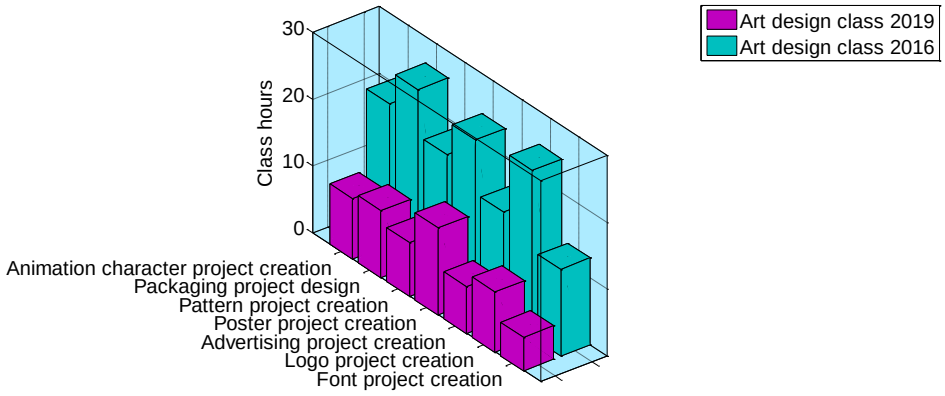

Figure 4: Comparison of the creation time of art projects.

The artificial intelligence computer-assisted art teaching model also has absolute advantages in teaching conditions for the effect of art creation and design. Although the current digital online learning platform cannot completely replace the classroom education form, it has strong favorable creative conditions in terms of a diversified knowledge system, the status of the learner's creative subject and the guidance of educators and virtual participants, which is helpful to promote the creation of fine art topics. The improvement of design effect plays a key role. Taking the logo project creation in the comparison between the 2016 and 2019 students as an example, the impact of the two teaching modes on the effect of art creation and design is analyzed. Under the traditional art teaching mode, the 2016 student group logo subject creation uses freehand drawing, and the use of computer technology is not high. It only uses the storage function of the logo subject design work, and does not participate in the production. The design effect of the logo subject works created by traditional freehand drawing is mediocre, lacking visual impact and appeal, the graphics are single in color, and the level of change is small. This is a practical problem faced by traditional art teaching.

At the same time, the logo topic modeling uses internationally popular 3DMAX, Photoshop and other digital software technologies to create a lifelike logo background ball shape, as shown in Figure 5.

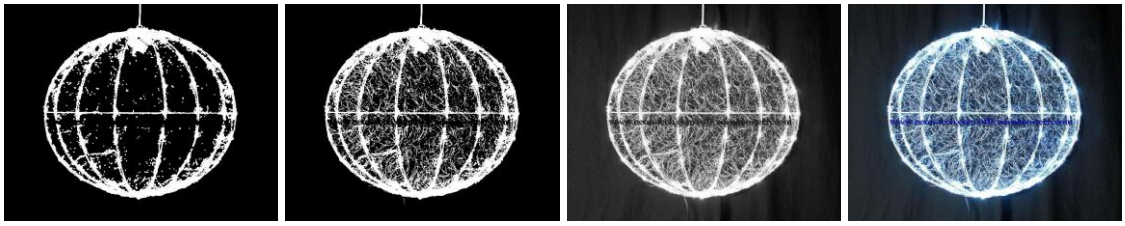

Figure 5: The logo background ball created using digital technology

3.2 Analysis of the Learning Advantages of Art Topics under the Artificial Intelligence Computer-assisted Teaching Mode

Artificial intelligence computer-assisted art teaching research study art project projects are basically derived from practice. According to the actual needs of society, educators recommend the direction and category of art project projects. Satisfying the cultivation of the creative ability and application ability of the learners' art design practice has high practical significance. The research

study of artificial intelligence computer-assisted art teaching stimulated the study mode of learners' teamwork, and triggered active discussion of the subjects. Through the emergence and supplement of viewpoints, learners can think deeply about the research value and significance of the subject project, thereby enhancing the learner's interest in the subject project, which enables the learner to transform the research and solution of the subject project into a motivation for research and learning. The creation of traditional art topics is quite different. Art topic projects are mainly derived from simulation assumptions and do not carry out research according to the actual needs of society, resulting in unclear topic selection goals and unspecific design goals. The creation of learners is only carried out based on personal perspectives, and educators have limited individual guidance in the face of the learner group, and most of them are guided by point-to-face guidance, which cannot form a research atmosphere for research team interaction and sharing of ideas.

The artificial intelligence computer-assisted art teaching model has changed the traditional art teaching lack of team discussion and has a great advantage of interest in art topics. The digital network learning platform constructed by the new model provides learners with a space for expressing personal opinions and communicating with each other, allowing learners to express their personal opinions in real time and show their unique artistic personality. For the research study of fine arts, it is very important to cultivate learners' interest in fine arts research and learning. Interest generates motivation for learning. In the process of their learning, different opinions on the topic will inevitably appear, resulting in a situation of controversy. The level of creation can be improved by rebutting arguments, and the correct understanding of art study can be obtained by revising the viewpoint. The artificial intelligence computer-assisted art teaching model has a great advantage in learning effect than the traditional art learning model. The application purpose of the new model of digital network learning platform is clear, and the application purpose of the traditional model is vague; the new model has the characteristics of review, expansion, practicality and interdisciplinary, and the subjects involved in the traditional model are limited to the scope of art design. The new model of digital network learning platform has the characteristics of rich subject professional curriculum data, high value of practical research materials and strong applicable design feasibility. The traditional model cannot be compared in these aspects.

After the project is set up, learners will carry out research-based learning practice, systematically investigate the relevant materials uploaded by educators, and be familiar with the corporate culture and design route of the project logo. The learning team formed by learners discusses together, puts forward personalized creative ideas, and uses research learning theory to carry out in-depth design of the logo, as shown in Figure 6. According to the actual situation of the process, the learner continuously publishes the staged research results of personalized creative ideas, and uploads the design results to the digital network learning platform to provide convenience for the next step of in-depth design and learner team discussions.

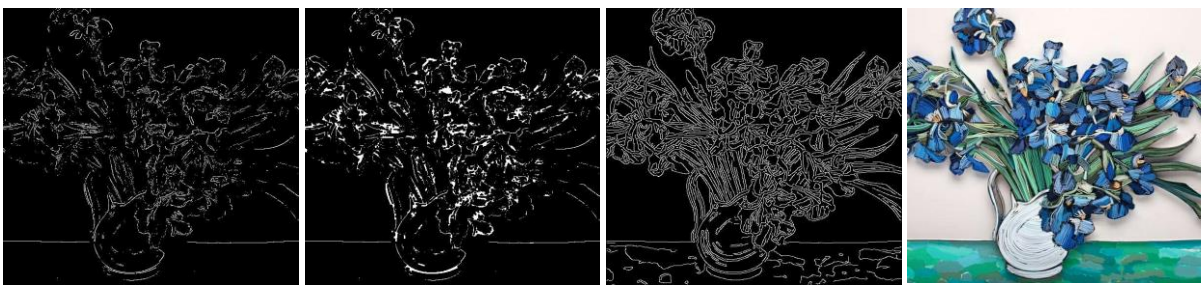

Figure 6: Creative ideas for in-depth design.

3.3 Practical Application Analysis of Artificial Intelligence Computer-aided Art Teaching Mode

In order to further verify the practical application of the artificial intelligence computer-assisted art teaching platform learning model, a targeted practical survey of the digital network learning platform was carried out, and application feedback was obtained through questionnaires. The survey involves several aspects, namely: the combination of artificial intelligence computer-assisted art teaching platform software and materials; the trend of artificial intelligence computer-assisted art teaching platform to promote learners to form a collaborative research form; artificial intelligence computer-assisted art teaching mode.

Figure 7 shows the survey summary of 60 students in the field of art professional practice study, artificial intelligence computer-assisted art teaching platform software and material data combination.

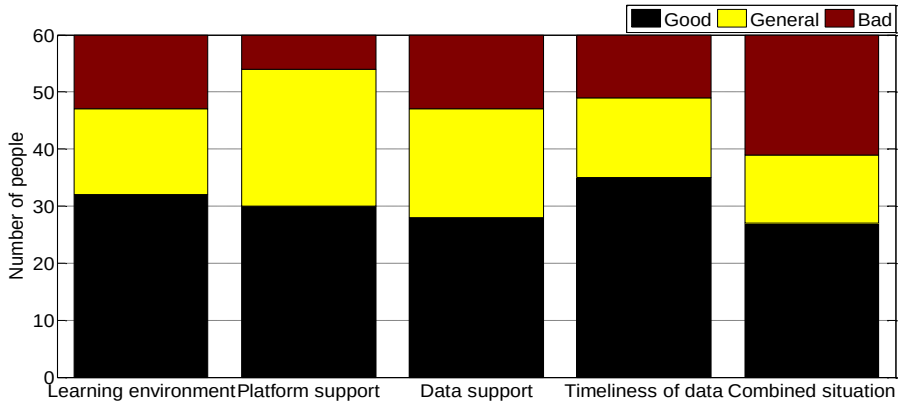

Figure 7: The combination of digital network learning platform software and materials.

Figure 8 shows the survey summary of the trend of artificial intelligence computer-assisted art teaching platform to promote learners to form a collaborative research form. Figure 9 shows the survey summary of the results of the artificial intelligence computer-assisted art teaching mode on research learning.

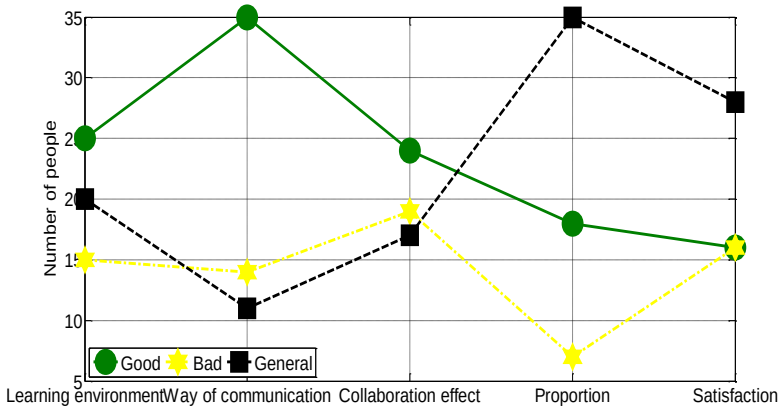

Figure 8: The trend of learners forming a collaborative research form.

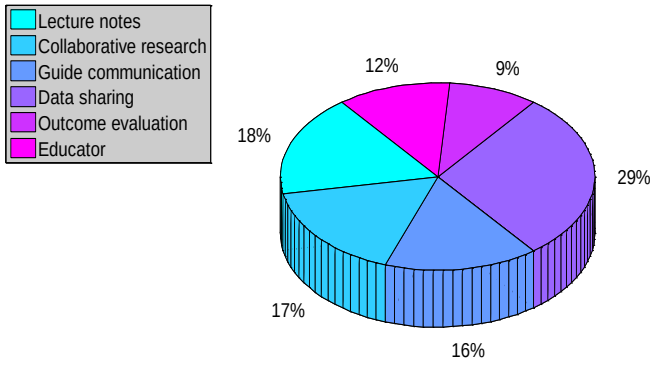

Figure 9: The results of the artificial intelligence computer-assisted art teaching model affecting research learning.

4 CONCLUSION

Making education more intelligent has always been the ideal and goal of the education industry and the field of education technology. After the emergence of artificial intelligence computer-assisted teaching, new educational theories are ready to come out, but with the support of existing technology, the realization of educational theories is extremely difficult, resulting in unsatisfactory teaching effects. Network education is a process of human-computer-person interaction. In this process, how to improve the intelligence of the network and computer is a major issue in the field of education technology. The emergence of artificial intelligence technology provides a good opportunity for achieving this goal. After studying the defects of the existing teaching system, this paper introduces artificial intelligence technology and computer technology into the traditional teaching system. Under the artificial intelligence computer-assisted art teaching mode, the creation of the logo of the 2019 student group uses a large number of computer graphics production techniques, giving full play to the advantages of the digital network learning platform's network interactive communication, and greatly improving the student group's creative level and production ability. Educators provide learners with relevant materials for design learning, share them through digital network learning platforms, and complete the creation of art logo topic projects. The learner team regularly uploads the research results of the topic design, which promotes the maturity of the learner's individual design ideas, and the logo design plan is continuously improved and refined. These phased results will be recorded by learners in a very concise and abstract form, and at the same time they will form solutions to many topic designs. At this stage, educators give a lot of guidance and evaluation to guide learners to form a more mature design form.

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