Research on University Computer Education from the Perspective of Aesthetics

Min Wu, Jia Jia, Haiping Huang(✉), Zhixun Liu, and Fu Xiao

School of Computer Science, Nanjing University of Posts and Telecommunications, Nanjing 210003, China
hhp@njupt.edu.cn

Abstract. University computer is the core course of science and engineering colleges. It is necessary to strengthen the penetration of aesthetic elements in computer education. In this paper, we analyze the current situation of aesthetic education in universities and propose several strategies of integrating aesthetic education elements into computer teaching from specific teaching links such as classroom, experiment and practice.

Keywords: Aesthetic Education · Computer Education · High-Level Language Programming

1 Introduction

Aesthetics is a discipline that studies the aesthetic relationship between people and reality. It focuses on cultivating people's correct aesthetic concepts, noble sentiments, the ability to feel, appreciate and create beauty. It is a cross-combination of aesthetics and pedagogy. As a result, it occupies an extremely important position in the process of cultivating people's all-round development.

1.1 The Current Situation of University Computer Aesthetic Education

In 1993, as the "Outline of China's Educational Reform and Development" proposed: "Aesthetic education plays an important role in cultivating students' healthy aesthetic concepts, aesthetic ability, noble sentiments and comprehensive development" [1].

Aesthetic education, as a form of education that imparts aesthetic concepts and aesthetic experience, has a significant impact on the growth of everyone and the harmonious development of society [2]. In recent years, the Chinese government has issued corresponding documents to ensure the implementation of aesthetic education. Therefore, certain progress has been made in related theoretical research and practical exploration. However, many universities, especially those of science and engineering, still have a weak awareness of aesthetic education.

Take university computer education as an example. This subject has strong professionalism for universities. The teaching of this subject focuses on cultivating students'

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professional and practical skills, so that students can use computers to discover, analyze and solve problems. However, whether it is in terms of teaching content, teaching process, or teaching quality evaluation, most universities at this stage teach in accordance with the examination syllabus, focusing on the transfer of knowledge and skills. Usually they ignore the role of aesthetics in teaching, paying little attention to design and communicate beauty during their teaching process. Moreover, many teachers of universities generally have a narrow concept of aesthetic education or insufficient understanding. They believe that aesthetic education is only art education, which is about music or fine arts. Some teachers even regard aesthetic education as philosophy, emphasizing theory and critical thinking, which have nothing to do with computer education. These understandings have neglected the intuitive and sensitive side of computer education itself. Actually, the education process combines the teaching of knowledge and the cultivation of students' healthy computer aesthetic awareness. Therefore, the implementation of aesthetic education has not been effective in many universities. This delays the practice of quality education and is not conducive to the cultivation of comprehensive high-quality scientific and technological talents.

1.2 The Perfect Function of Aesthetic Education in Computer Teaching

Aesthetics is a kind of instant "experience" for individuals to perceive their own life existence and the nature of the world. It is a cognitive model and a method of thinking which cultivates students' ability to recognize, appreciate and create beauty [3]. It itself is a dynamic and open system composed of countless aesthetic activities. The science and technology courses contain a large number of aesthetic phenomena in their contents. As a matter of fact, science and aesthetics are inseparable, their common foundation is human creativity. Furthermore, scientific research activities are processes of not only "seeking truth", but also "aesthetics". Therefore, digging out the aesthetic elements in science and technology from an aesthetic point of view will allow students to experience more, which can improve their subjective perceptions and cognitive abilities of computer technology [4].

Computers are the source of innovation and the specific medium of human activities. Take computer technology as an example, the teaching of this subject should strengthen the computer aesthetic education in classroom and practical teaching. Educators can try to create a teaching atmosphere based on computer aesthetics from various dimensions so that their teaching process is not merely a cold technical training, but also includes cultivation of their aesthetic awareness.

In conclusion, it is necessary to explore the aesthetic concepts of teaching content and methods in computer education. On the basis of these researches above, this paper proposes several strategies of integrating aesthetic education elements into computer teaching in colleges and universities from specific teaching links such as classroom, experiment and practice.

2 The Strategy of Integrating Aesthetic Education into University Computer Education Ease

To integrate aesthetic education into computer education, it is necessary to update the aesthetic education concepts of the most teachers in universities. It is significant for them to understand the indispensability of aesthetic education based on the requirements of the times. Teachers ought to establish their own aesthetic awareness in computer education. When setting teaching content and teaching links, they had better re-examine and re-explore the aesthetic characteristics of the curriculum. This is because only when educators broaden their horizon and change their original narrow opinions, could it be possible for them to guide students to discover and understand the scientific aesthetic logic in computer technology.

Due to the characteristics of computer science, computer courses generally include classroom learning, experimental processes and more practical links. Thus, the integration of aesthetic education into university computer teaching can be explored from three aspects, namely, classroom teaching, experimental guidance as well as practice promotion.

2.1 Beauty in Classroom Teaching

The French mathematician Henri Poincare once said: " The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful" [5].

Take computer science as an example, the subject is highly specialized and complex. The teaching content should not only cover comprehensive computer technical knowledge, but also be able to meet the students' demands of beauty. When teaching "true" knowledge, teachers ought to pay attention to digging out various aesthetic elements in the content. The aesthetic point of view of actual teaching content can be optimized from the following aspects.

Vividness. Aesthetic activities directly appeal to perceptual objects, which are inseparable from thinking in images. Computer teaching should develop students' observation, imagination and image thinking ability through more vivid teaching content and methods.

Computer courses require higher rational and logical thinking skills. But if teachers focus more on knowledge transferring, the process will be filled with the boring explanations of concepts, techniques, and operating procedures. As a result, student will gradually lose interest. To avoid such embarrassment, teachers need to develop more vivid teaching ability.

Vivid teaching is mainly embodied in two aspects: teaching content and its methods. The former means that teaching content should be integrated with the development of the times, social hot issues, major national projects and future development technologies.

For example, when teaching the evolution of computer programming languages, namely from primitive binary machine language to assembly language, from various popular high-level languages to 4GL languages, teachers can show students several typical cases written in specific different languages. This intuitive and perceptual comparison process will guide students to personally understand the aesthetic principle of

the computer language. Also they will be inspired by the continuous pursuit of scientists in their struggle for better simplicity, efficiency, practicality and beauty.

In addition, vivid teaching is also reflected in teaching methods. Teachers should use advanced teaching methods to resolve teaching difficulties and devote themselves to creating a lively and relaxed teaching atmosphere. In psychology there is an important terminology called recency effect. It is a cognitive bias in which those items, ideas, or arguments that came last are remembered more clearly than those that came first. The more recently heard, the clearer something may exist in a juror's memory [6]. According to this effect, teachers should pay more attention to the current teaching links so as to maximize the teaching effect. From the aesthetic point of view, the teaching process is a kind of labor, which is a performance of intelligence and physical strength. In this way, teachers and students will inevitably form a relationship between aesthetic subject and aesthetic object. Teachers should devote to the pursuit of beauty during the specific process. They can demonstrate better teaching images, more pleasing expressions when trying to create more relaxed atmosphere.

Many software-related courses contain various algorithms, and some of them are abstract and difficult to understand. In this case, teachers can consider a visual teaching method, presenting some important algorithms or programming cases with vivid graphics and music programs. For example, teachers can design some works with exquisite interface and good logic for comparison and display. This way of comparison allows students to feel the beauty of computer design more vividly. It can not only deepen students' understanding of professional knowledge, but also stimulate students' enthusiasm and desire for practice.

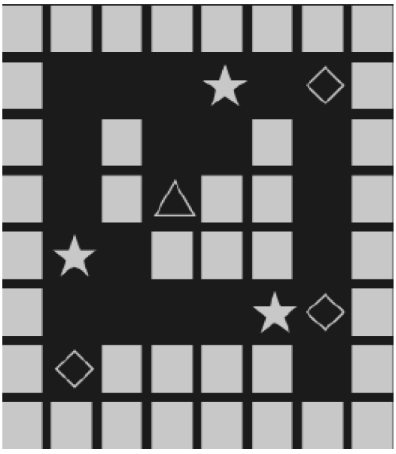

Fig. 1. The command line version of Sokoban

Taking the "Advanced Language Programming" as an example, when implementing C language applications, teachers can install easyX which is a plug-in of the common compilation environment called Visual Studio. For example, when explaining the graphic interface design by a two-dimensional array, teachers can introduce an interesting game

Fig. 2. Graphical version of Sokoban

called Sokoban and teach student how to implement this application. In advance teachers can design two versions for this game, namely the command line version (Fig. 1) and the graphical version (Fig. 2). Through these visual methods, students themselves will gain more curiosity and fun, which will inspire them to imitate and create more.

Pleasure. Dewey once said that most people only contact things through five senses. They like interesting things and show little interest in books [5]. The education of computer is more difficult, abstract, and boring. This puts forward higher requirements for teachers' aesthetic education. They will need more effective teaching methods to create a pleasant and interesting teaching atmosphere.

For example, in the computer software-related courses, teachers can consider using computer games as contents to cultivate students' interest. Taking the high-level language programming courses as an example, teachers can guide students to gradually develop games. By this mean students' interests, their programming skills will be developed. From this perspective, teachers are required to collect and design some effective scenarios and puzzle games such as gomoku, playing airplanes, finding differences, linking, minesweeping, etc. Being familiar with these games, students will feel excited and will be more willingly to discuss various details of design and programming with the teacher. This process will not only enliven the classroom atmosphere, help students quickly reach the best state of learning, but also will help to cultivate their innovative thinking. Figure 3 is a Gobang game designed by students, with complete functions and beautiful interface.

Fig. 3. Mine-sweeping game designed by students

Emotionality. Lenin said that without emotion, and there has never been a person who pursues truth and ideals [5]. Rational computer education should also focus on inspiring students' inner emotional experience, rather than mechanically cold technical training because emotional memories last longer than other memories. Thus, courses with emotional feeling will cultivate more on students' strong interests and their persistent study habits.

In actual teaching, university computer education can be deeply explored and integrated with aesthetic elements through various ways, such as collective lesson preparation, teaching seminars, experience exchanges, on-site teaching observations and other activities.

Take the "Advanced Language Programming" course as an example. In computer education, the development of computers must be taught, that is, the process from electron tubes, transistors, integrated circuits to large-scale integrated circuits. Teachers can vividly talk about the beauty of science, the perseverance of scientific and technological workers and the attitude of lifelong learning through video or audio materials. Teachers can count down those unforgettable typical historical moments, let students feel the indomitable beauty of scientific and technological workers, and inspire their determination and responsibility to serve the country.

2.2 Beauty in Experimental Teaching

Former Soviet educator Suhomlinsky said that cultivating the feeling of beauty is only one aspect of aesthetic qualities, and another important aspect is the creation of beauty. Marxist aesthetics also believes that the correct aesthetics comes from labor practice [5]. The related courses of computer education have one common principle, which says "Only by hands, you can learn the truth." Therefore, for most courses of computer education, experimental courses are also important parts of computer teaching.

The aesthetic perspective in practical teaching can be optimized from the following three aspects.

The Principle of Activity. The principle of activity means that the individual must participate in the activity. In terms of computer education, the experiments are generally divided into two types, verification and design experiments. During the processes of experiments, teachers should not only guide students to actively digest knowledge, improve their ability to analyze and solve problems independently, but also need to inspire students to pay more attention to the beautiful design of software products such as composition, layout, color and shape, and develop practical applications.

The Principle of Differentiation. The principle of differentiation requires teachers to design different angles for specific experimental content from a technical and aesthetic point of view. Different experiments have different focuses. Some focus on whether the design of the data structure and algorithms are the most concise, whether the time and space complexity are the lowest. Others focus on the visual aesthetics of their works, such as whether the layout is beautiful, the user interface is exquisite, or the operation process is humanized. This kind of conscious analysis and guidance will enable students to truly understand that a piece of perfect work is not only about its complete function, but also about its various aesthetic expressions. Under this influence, students will consciously use their aesthetic knowledge in their actual experimental performance. Thus they are easy to form their own unique design style and improving the quality of their works comprehensively.

	Sub-evaluation												
	Process evaluation (40%)						Functional evaluation (40%)			Aesthetic evaluation (20%)			
	Design	Coding	Debug	Test	Reply	Report	Sub-function 1	Sub-function 2	Sub-function 3	Visual performance		Logical performance	
										Interface layout	coding style	data	algorithm
Excellent													
Good													
Middle													
Qualified													
Unqualified													

Fig. 4. A specific evaluation form

The Principle of Creativity. The principle of creativity refers to cultivating students' performance ability, especially their imagination. In actual computer experimental courses, immersive education methods such as "teacher guidance, teacher-student interaction, and group discussion" can be adopted. In each link, by selecting excellent students' works, teachers will teach students how to appreciate its beauty form the perspective of their functional and aesthetic characteristics. This method will form a good atmosphere for the interaction between them and at the same time students will be

inspired to create more beautiful works. Of course, after their experiments, a scientific evaluation system must be provided. Teacher assessment and collective evaluation can be used. Generally speaking, the evaluation system should be different because of the specific experimental content. It usually includes process evaluation, functional evaluation, and aesthetic evaluation. Only from all comprehensive aspects, students' ability can be evaluated more objectively and more accurately. Figure 4 shows the specific evaluation form of an experimental course.

2.3 Beauty in University Practice

Education is also influenced by the cultural of university. The computer education can not only to rely on classroom teaching and experimental teaching, but also pay more attention to cultivating students' practical aesthetic quality. When universities provide more practical activities, they should focus more on the aesthetic elements among them. In this way students will gradually regard it as a necessary way of social life, which helps to develop their intuitional practice of the professional knowledge.

Generally speaking, universities can share, display and propagate the aesthetic value of computer works through scientific and technological competitions, debates, club activities, lecture reports, online magazines, etc. At the same time, in this era of "Internet + ", big data, and AI intelligence, universities can integrate schools and social resources to achieve aesthetic education. For example, they can strengthen the interaction with related companies and establish the corresponding aesthetic education practice base.

3 Conclusion

It is very necessary to introduce aesthetic strategies in university computer teaching. Teachers can develop more methods through various teaching links such as classroom, experiment and practice. This kind of education not only makes computer teaching more vivid, but also enables students to gain correct and healthy aesthetic ability while mastering professional computer knowledge. Practice has proved that this strategies can improve the quality of computer education more comprehensively.

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References

1. Document: No. 3 Document, China Education Reform and Development Program. The Central Committee of the Communist Party of China. The State Council (1993)
2. Document: No. 2 issued by the Ministry of Education: Opinions of the Ministry of Education on Effectively Strengthening the Work of Aesthetic Education in Colleges and Universities in the New Era. Ministry of Education (2019)
3. Li, M.: The concept and practice of aesthetic education in undergraduate education in European and American universities and its enlightenment to higher education in China. Journal of Aesthetic Education **11**(4), 11–19 (2020). (in Chinese)
4. Li, Y., Pang, L., Wang, X.: Status quo and thinking of aesthetic education in universities of science and technology. J. Hebei Univ. Technol. (Social Science Edition) **11**(02), 74–78 (2019). (in Chinese)
5. Niu, H.: Introduction to Aesthetics, 1st edn. Renmin University of China Society, Beijing (2003). (in Chinese)
6. Zhong, Y., Yang, Z.: Research on the priming effect of impression formation in social cognition: frequency cause, proximity effect. Psychol. Sci. (5), 428–480 (1998). (in Chinese)