Research on Practical Teaching Mode of Software Technology Major Based on Innovative Talents Training

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Abstract. In the traditional teaching of software technology major in higher vocational colleges, the classroom teaching is mainly based on basic theoretical knowledge, supplemented by a few practical knowledge, and does not pay attention to the cultivation of students' comprehensive practical ability, which makes students unable to solve practical problems encountered in programming with the knowledge they have learned. Based on this, this research combining with the characteristics of software technology specialty, through in-depth investigation, understand and study the various relevant factors in the practice, puts forward reasonable innovative talents cultivation practices, combined with software technology professional practice teaching reform practice, promote the software technology professional practice teaching content, methods, means and teams, management and the reform and innovation of practice teaching mode, and promote the software technology major in the teaching content, curriculum system, practice and other aspects of personnel training mode comprehensive reform. At the same time, taking the practice teaching implementation of Huffman algorithm as an example, the feasibility and effectiveness of the whole practice teaching model has been fully verified from explaining the principle of the algorithm, inspiring students to analyze the defects of the algorithm and guiding students to program to realize the improvement of the algorithm. The research shows that the practical teaching mode is conducive to the integration of vocational talent training and social needs, to promote the expansion and deepening of the theoretical research of creativity education, and to promote the employment of software technology students.

Keywords: higher vocational colleges · software technology · innovative talent training · practical teaching reform

1 Introduction

With the rapid development of information technology, computer software has become an indispensable and important part. At the same time, the application requirements of various industries for computer technology are constantly improving. Relevant software needs to involve more fields, have more and more distinctive functions, making the innovation of software technology particularly important. As the training base of innovative

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talents, higher vocational colleges are not only the breeding ground of innovative ideas, but also the important subject of the national innovation system. How to cultivate innovative and practical high-quality technical and skilled talents facing the front-line needs of enterprises has become the important mission of all higher vocational colleges [1].

At present, the teaching of software technology in higher vocational institutions is mainly composed of theoretical teaching and practical teaching, and most of the practical teaching is in classroom practical training, unit practical training or practical training of a professional link, and most of the contents of the practical training courses are simple or only related to a certain course. The students are not able to integrate with each other, and the professional training is not enough. Students' rich imagination and innovation cannot be combined with professional teaching, and some innovative ideas cannot be put into practice, which greatly limits students' ability to perceive, think and recreate new things. Similarly, due to the limited number of students that can be accepted by the internship base, many aspects of stage internship and on-the-job internship tend to be formal due to the lack of systematic facilities, coupled with the lack of teachers' guidance in the internship session. How to reform the practical teaching mode of software technology majors, make the practical teaching more effective, make students combine the learned professional knowledge with the actual work through practice, and further cultivate students' innovation and entrepreneurial consciousness in the practical link, so as to lay a good foundation for students' career development, which is an important issue to be solved in the reform of practical teaching of software technology majors.

2 Research Status of Integrating Innovative Education into Software Technology Major

The research of innovative education has a history of nearly one hundred years in the world, and some developed countries have accumulated many valuable experiences for us to learn and refer to. The idea of innovation was first proposed by Joseph Alois Schumpeter in "The Theory Of Economic Development" in 1912. In 1954, Alex Faickney Osborn and S. J. Parness founded the American Creative Education Foundation to promote innovative education and cultivate creativity. The research in this field in China started late. The convening of the first academic symposium on creativity in June 1983 marked that the study of innovation has been paid attention to in China. Since then, innovative education has attracted much attention in colleges and universities. However, there are not many documents about the integration of innovation education into software technology majors. Literature [2] discusses how to build an innovation and entrepreneurship platform and how to build teachers with innovation and entrepreneurship teaching ability. Literature [3] mainly studies the mode of relying on enterprise college and studio. Literature [4] discusses the integration of innovative education through the construction of a specialized training system for innovative and entrepreneurial talents. It can be seen that the focus of innovative education is mainly focused on the construction of relevant innovative and entrepreneurial platforms and studios and the cultivation of teachers' abilities, and the research on how to carry out innovative education through practice is not involved.

3 Problems Existing in the Integration of Practical Teaching and Innovative Education of Software Technology Major

3.1 Separation of Innovative Education and Professional Talent Training

Most of the higher vocational colleges to carry out innovation and entrepreneurship education and basically only offer 1 to 2 courses. The teaching goal is just to make students understand the basic knowledge and theory of innovation and entrepreneurship, and by writing "business plan" to make the students understand and master the innovative entrepreneurial knowledge and basic skills, strengthen the application of analysis and solving actual problems. Besides, the course is positioned as a public basic course, and there is no subsequent knowledge to integrate with the major, so innovative education has little relevance to the training of professional talents [5].

3.2 Imperfect Curriculum System of Innovation and Entrepreneurship is Separated from Practical Ability

The separation between the innovation and entrepreneur-ship courses offered by the school and the practical ability is mainly reflected in three aspects. First, it is difficult for the teachers to ensure that they have some experience in innovation and entrepreneurship. Although they have rich teaching experience, they lack the understanding of the industry development trends, lack of updated knowledge, and cannot simulate the real enterprise environment; Second, students' innovation and entrepreneurship awareness is constrained by traditional concepts, and they believe that innovation and entrepreneurship are risky, not as stable as work; Third, the construction of innovation and entrepreneurship curriculum system failed to combine the characteristics of higher vocational colleges and the actual situation of students. The designed teaching content was not deep enough and did not conform to the reality, which made the innovation curriculum not really integrated into the teaching process of various majors, lacked professional pertinence, could not stimulate students' enthusiasm for learning, and the content and practical operability were limited, As a result, students' innovative consciousness does not match their professional practical ability.

3.3 Insufficient Investment in Innovation and Entrepreneurship Resources

The lack of investment in innovation and entrepreneur-ship resources in higher vocational colleges includes infrastructure resources, teacher resources, teaching materials resources, and lack of financial security and corresponding management systems. First of all, teacher strength is the key factor to determine the effectiveness of innovation and entrepreneurship education. Without a high-quality team of innovation and entrepreneurship education teachers, it is bound to be difficult to effectively complete the educational goals and tasks. At present, most higher vocational colleges rely on teachers of related majors to carry out innovation and entrepreneurship education. There are problems such as insufficient attention and investment in the introduction and training of professional teachers. Secondly, innovation and entrepreneurship education is not only a theoretical course, but also a practical one. It can only be effectively carried out with relatively

complete basic education facilities as support and guarantee. At present, the practice of innovation and entrepreneurship education in most higher vocational colleges is mainly carried out by relying on the internal training base and off campus practice base. From the perspective of educational achievements, it is far from meeting the requirements of innovation and entrepreneurship education practice. The lack of infrastructure resources has become an important constraint to improve the effectiveness of innovation and entrepreneurship education. In terms of textbooks, there is no systematic and scientific innovation and entrepreneurship textbook resources with higher vocational characteristics, which makes the selection of textbooks more random and difficult to meet the teaching requirements. The innovation and entrepreneurship education in higher vocational colleges has insufficient teaching material resources. The selection of innovation and entrepreneurship teaching materials is relatively random, and there is no systematic and scientific innovation and entrepre-neurship teaching material resources with higher vocational characteristics. In addition, the investment in innovation and entrepreneurship is not enough. On the one hand, adequate financial support encourages students' innovation spirit, on the other hand, it also relieves some entrepreneurial pressure. Finally, in terms of guaranteeing the implementation of innovation and entrepreneurship education, there is a lack of more perfect incentive management system and guarantee system.

4 The Reformational Thought of Practical Teaching Mode Based on the "Innovation" Mode

Cultivating students' innovative spirit and practical ability is the focus of implementing quality education, and practice is the source of innovation. Closely combining practical teaching and practical ability training with innovative ability is the key to solving the above problems.

4.1 Make Top-Level Planning and Improve the Guarantee Mechanism

According to the characteristics of software technology major and the theory of knowledge innovation, firstly, the project-driven teaching method is used to strengthen students' technical foundation. Secondly, it simulates the enterprise environment to carry out the project training, which is completed under the guidance of the enterprise tutor with rich practical experience, focusing on cultivating students' ability to analyze and solve problems and innovative thinking, and improving students' development ability. Finally, students' innovation ability is cultivated through professional skills competition, off-campus training base, and industry-university-research studio. In addition, the guarantee mechanism is also related to the quality of innovation and entrepreneurship education. Generally speaking, it is necessary to establish a leading group for innovation and entrepreneurship education, cooperate with multiple departments to formulate implementation plans, and be responsible for overall planning, system construction and funding support. The general idea is shown in Fig. 1.

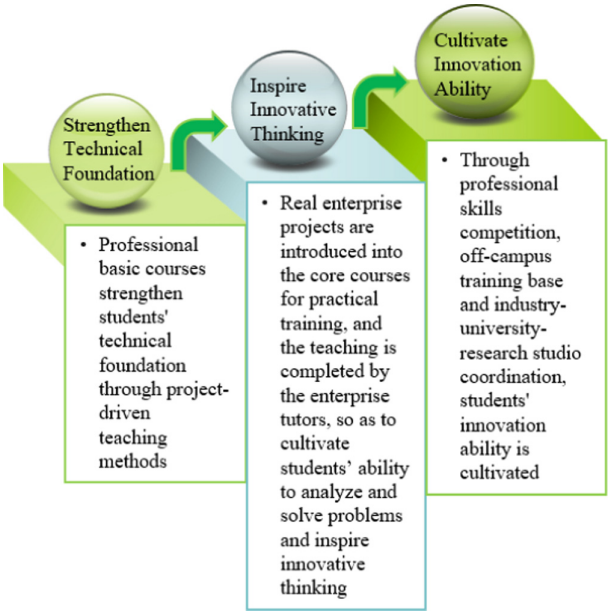

Fig. 1. The overall train of thought

4.2 Applying Constructivism Theory to Design Innovative Practical Teaching Mode

Teaching mode is one of the key factors to implement talent training mode. The traditional teaching mode is centered on teaching, and students are often passive in the process of practice. Their enthusiasm, initiative and innovation are not given full play, leading to the disconnection between theory and practice. The constructivist learning theory has changed the traditional teaching theory. It believes that knowledge is not obtained passively through senses or communication, but through the active construction of the cognitive subject. Its core is student-centered, emphasizing students' active exploration and discovery of knowledge, as well as the active construction of the meaning of the learned knowledge [6].

Constructivism theory is conducive to the cultivation of students' overall quality, so the practical teaching model can be designed according to the four elements of constructivism theory, namely, situation, cooperation, conversation and meaning construction [7]. First of all, learning is in a particular social cultural background and specific learning environment, under the condition of design practice project combining the actual situation of the real life to arouse students' interest, to overcome the learning content abstract, so that the students can mobilize their cognitive structure of knowledge and experience, play its association and imagination, promote the students' knowledge in effective migration [8]; Second, practice project emphasizes, practical and application oriented project itself characteristics and inherent law need according to the project and team to implement the process, in general the individuals can accomplish, so in the process of implementation, it is only through constant discussion, dialogue between team

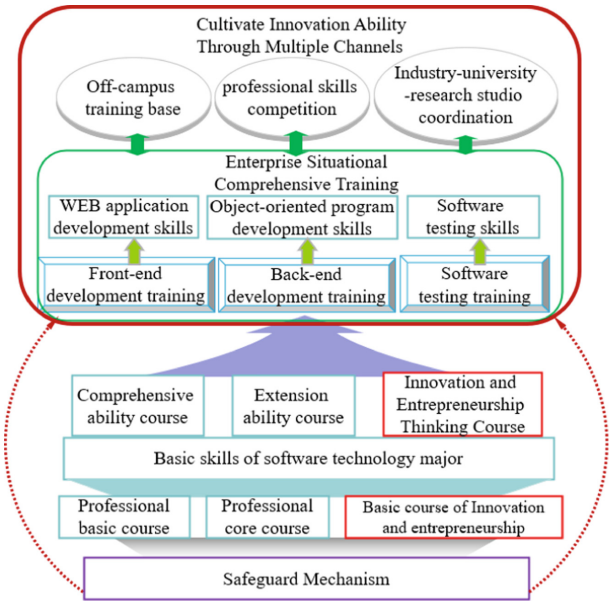

Fig. 2. Innovative practical teaching mode

members, negotiate to get deeper understanding of knowledge, At the same time, full discussion and negotiation can stimulate students' innovative thinking and promote the team to complete the practical learning task efficiently. The final meaning construction is the ultimate goal of the practice teaching process. Helping students construct meaning in the process of learning is to help students achieve a deep understanding of the nature and law of things reflected in the current learning content and the internal relations between the things and other things. The real meaning construction is not only that students understand the theoretical knowledge and complete the practice process, but also that students can describe, identify and explain the practice with their own language on the basis of their own practice, and can also use it flexibly to solve the problems in actual production and life. The specific practical teaching mode is shown in Fig. 2.

4.3 Expand the Innovation and Entrepreneurship Teaching Team and Effectively Implement Practical Teaching

Besides hiring companies with innovative entrepreneurial experience tutor, also need to develop the existing faculty [9], which let teachers participate in the enterprise technology innovation or related subject research, which can improve teachers' practical ability, and can solve the practical problems in enterprises inject new vitality, inspire teachers' innovation potential, thus creating innovative entrepreneurial faculty team.

In the process of implementing practical teaching, teachers should use a variety of "student-centered" teaching methods and means according to the practice situation, give full play to the students' dominant position in the practice process, and maximize the participation of students in the form of group cooperation to stimulate students' interest

in learning. At the same time, in the practice of the students, teachers must be good at guiding students will have learned the knowledge and skills of active applications to the new practice task, inspire the students' innovative thinking, and around the teaching goal to take the diversity of teaching methods, by completing the classroom teaching innovation to build efficient classroom education, to implement practical teaching [10].

The following takes the practical teaching implementation of Huffman algorithm as an example, firstly explains the compression principle of Huffman algorithm with an example, and then guides students to discuss the shortcomings of the algorithm and assigns tasks for students to put forward the ideas for improvement. The specific operations are as follows:

1) **Principle of Huffman algorithm**

Huffman is a coding algorithm based on character statistical frequency and binary tree data structure [11, 12]. Its coding goal is to assign shorter codes to characters with high occurrence frequency, and assign longer codes to characters with low occurrence frequency.

The following takes the word "innovation" as an example to discuss the compression principle of Huffman algorithm, which only contains 6 small English characters a, i, n, o, t and v. The statistical results of all characters are shown in Table 1.

Construct a Huffman binary tree [13] according to Table 1. as shown in Fig. 3.

Table 1. The frequency statistics of each character in the example word

Character	**a**	**i**	**n**	**o**	**t**	**v**
Statistical frequency (number of occurrences)	1	2	3	2	1	1
Frequency (normalized)	10%	20%	30%	20%	10%	10%

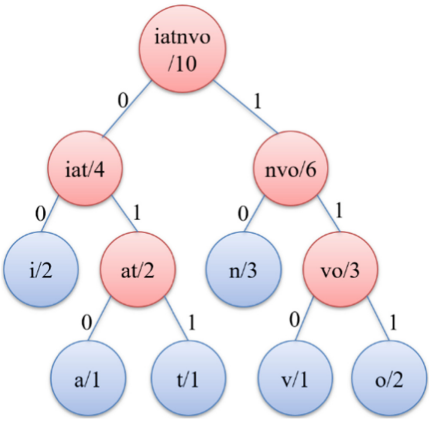

Fig. 3 Huffman binary tree

Table 2 Huffman encoding table of each character in the example word

Character		**a**	**i**	**n**	**o**	**t**	**v**
Encoding Information	Huffman encoding	010	00	10	111	011	110
	encoding length(bit)	3	2	2	3	3	3

According to the Huffman binary tree in Fig. 3, the detailed encoding information of each character can be obtained as shown in Table 2. which lists the Huffman encoding of all six characters contained in the word, and also lists the Huffman encoding of each character. Coding length (CL) of the Huffman code.

The data volume of the compressed data source encoded by the Huffman algorithm is equal to the corresponding Weighted Path Length of Huffman Tree(WPL), The following is the calculation of the weighted path length of the Huffman tree using as in (1) and (2),Which is assumed to contain n leaf nodes with coding length CLi(i = 1,2,3,…n).

$$\mathbf{WPL} = \sum_{i=1}^{n} \boldsymbol{CL_i} * \boldsymbol{f_i} = \boldsymbol{CL}_1 * \boldsymbol{f}_1 + \boldsymbol{CL}_2 * \boldsymbol{f}_2 + \ldots + \boldsymbol{CL_n} * \boldsymbol{f_n} \tag{1}$$

$$\mathbf{WPL} = \mathbf{1 * 3 + 2 * 2 + 3 * 2 + 2 * 3 + 1 * 3 + 1 * 3 = 25} \tag{2}$$

In the example, the word contains 6 kinds of characters. If the fixed-length encoding method is used for encoding, the shortest encoding length of each character is 3 bits, and there are 10 characters in the example, the total amount of encoded data is 3*10 = 30(bit). Correspondingly, if the Huffman algorithm is used to encode the above example word, the theory is that only 25 bits of data can be used to represent all the information in the string. Therefore, after using the Huffman algorithm to process the data, the purpose of compressing the data can be achieved without information loss.

2) **Inspire students' innovative thinking**

On the basis of students' understanding of the above examples, students are divided into groups. Each group is required to present the compression rate, advantages and disadvantages of Huffman algorithm when the string repeatability increases in the form of a written report. Through case analysis, the students found that the advantage of Huffman algorithm is that the running time is linear to the length of the input string, and the demand for storage space is a constant and does not depend on the length of the input string. The disadvantage is that when Huffman coding algorithm is used to process data, it needs to scan the compressed source file twice, so there are some restrictions on delay and compression efficiency. Finally, let the students study the ideas for improvement based on the shortcomings found.

3) **Improved implementation of Huffman algorithm**

Based on the above shortcomings of Huffman algorithm, students are guided to improve the efficiency of constructing Huffman binary tree by heap sort method [14], so as to improve the speed of data compression and decompressing of the algorithm to a certain extent, expand students' innovative thinking and strengthen their actual programming ability while solving problems. The key code of the algorithm is as follows:

```
#include "stdafx.h"
#include <cstdio>
#include <vector>
#include <algorithm>
template< class Type >
struct TreeNode
{
 TreeNode *leftChild, *rightChild;
 int value;
 const Type *data;
 struct nodeCompare
 {
  bool operator () (const TreeNode* a, const TreeNode* b)
    {
      return a->value > b->value;
    }
 };
};
template< class Type >
TreeNode< Type >* createHuffmanTree(const Type data[], int count)
{
typedef TreeNode< Type > TreeNode;
 ::std::vector< TreeNode* > heap(count, NULL);
 heap.clear();
 for (int i = 0; i < count; i++)
 {
      TreeNode *n = new TreeNode;
      n->leftChild = NULL;
      n->rightChild = NULL;
      n->data = &data[i];
      n->value = data[i];
      heap.push_back(n);
 }
 ::std::make_heap(heap.begin(),heap.end(), TreeNode::nodeCompare());
 while (heap.size() > 1)
 {
      TreeNode *n1, *n2, *t;
      ::std::pop_heap(heap.begin(), heap.end(),TreeNode::nodeCompare());
      n1 = heap.back();
      heap.pop_back();
      ::std::pop_heap(heap.begin(), heap.end(),TreeNode::nodeCompare());
      n2 = heap.back();
      t = new TreeNode;
      t->leftChild = n1;
      t->rightChild = n2;
      t->value = n1->value + n2->value;
      heap.back() = t;
      ::std::push_heap(heap.begin(), heap.end(),TreeNode::nodeCompare());
 }
 return heap.front();
}
template< class Type >
void destoryTree(TreeNode< Type >* root)
{
 if (root->leftChild) destoryTree(root->leftChild);
 if (root->rightChild) destoryTree(root->rightChild);
 delete root;
}
```

5 Conclusions

Under the guidance of the basic concept of "based on the school situation, find the right position, systematic planning, and highlight the characteristics", the software technology major of the School of Architectural Information in Guangdong Construction Polytechnic, According to the goal of innovation and entrepreneurship training, the software technology specialty has systematically planned the curriculum system of innovation and entrepreneurship, fully integrated it with the professional curriculum system, and pays attention to the effective implementation of the practical teaching model, which is oriented by innovation and entrepreneurship, the practical teaching implementation of Huffman algorithm is taken as an example for verification. The verification results show that the innovative practical teaching mode of software technology major proposed in this paper can generally improve students' innovation and entrepreneurship, actual development ability and comprehensive quality, and the employment competitiveness of graduates can be significantly enhanced after the implementation of the entire curriculum system. Of course, there are still some deficiencies in the current research, the next step is to build an innovation resource platform, explore the mechanism of cross department and cross major training of innovative and entrepreneurial talents, and promote the transformation of talent training to integration.

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