Research on the Teaching Practice of the Course "Foundation of Artificial Intelligence" in Universities Empowered by Digital Transformation

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Abstract: Digital transformation can empower teachers to teach and students to learn, playing an important role in the reform of curriculum and teaching in universities. This article analyzed the background of the teaching reform of computer public course in Chinese universities. In the situation where digital talents are urgently needed in society, "Foundation of Artificial Intelligence" was proposed as a computer public course in universities. We have designed the course content, pre class teaching, in class teaching, post class teaching, and student learning evaluation of "Foundation of Artificial Intelligence", and deeply integrated information technology with education and teaching, carried out digital transformation teaching practice. From the results of student academic exam and student satisfaction survey, it can be concluded that the digital transformation has enabled the teaching practice of the "Foundation of Artificial Intelligence" course in universities to be very successful.

1. Introduction

At present, the talent cultivation mode of higher education in China exhibits obvious popularization characteristics, with a single teaching content and method, and a significant lack of exploration of individual potential and discovery of personalized needs. This is mainly due to the imprecise and incomplete portrayal of students' growth and behavior [1]. The human-machine interaction, knowledge interconnection, and data sharing brought about by digital transformation have met the personalized and precise learning needs of students, injecting the necessary technological spirit into higher education to solve traditional education problems and transform education models [2]. The digital transformation of higher education teaching can promote the deep integration of digital technology, information technology and teaching, so that the talent cultivation plan, process, and curriculum teaching of higher education closely follow the needs of enterprises and the development of technology.

When formulating professional talent cultivation plans, higher education institutions should visit enterprises, governments, and research institutes, integrate the connotations of social needs and technological development into talent cultivation plans, and make clear application requirements for technologies such as digital animation, virtual reality, augmented reality, the Internet of Things, blockchain, metaverse, and human intelligence in the training process, and build a platform for implementing the talent cultivation process, enable the talent cultivation process to be dynamically displayed and interact in real-time with enterprises, governments, research institutes, and other units, continuously incorporating social needs and new scientific and technological achievements into the talent cultivation process, and exploring certain aspects to integrate teaching and research, enabling students to solve practical social problems and have innovative abilities [3].

The execution of talent cultivation plans should be implemented through courses. Digital transformation can empower all aspects of the curriculum implementation process, empower teachers and students, and improve teaching quality. This article took the common computer course "Foundation of Artificial Intelligence" in Foshan university as an example to explore the entire process of digital transformation empowering university teaching [4].

2. Research on Empowering Teaching Practice in Universities through Digital Transformation

2.1. Teaching Design of Digital Transformation Empowerment Course

2.1.1. Background of the Reform of Computer Public Courses in Chinese Universities

Since 2000, the teaching of computer public courses in most universities in China has been based on the course "Foundation of College Computer". The content of "Foundation of College Computer" varied among different universities, with some universities focusing on Word,

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Excel, PowerPoint, and others focusing on the Internet, Photoshop, and animation production [5]. The teaching of these contents has played a positive role in helping students master the basic operations of office software and the internet. However, with the development of computer technology and social progress, the teaching of the above public computer courses has been unable to meet the social needs, especially since 2020, with the emergence of the COVID-19, all sectors of society have highlighted the need for digital talents [6]. For the first computer course studied by college students, it should keep up with the times and undergo reforms. Since 2020, Foshan university has reformed the course of "Foundation of College Computer" to "Foundation of Artificial Intelligence". Below, we will explore how to use digital transformation to empower curriculum teaching, empower teachers, and empower students.

2.1.2. Course Content Design of foundation of Artificial Intelligence

In today's era, artificial intelligence technology has been applied to various fields of society, and had a profound impact on people's learning, life, and work. Cultivating the knowledge, technology, and ability of artificial intelligence among college students is a requirement of the times [7]. As the first course for college students to learn about artificial intelligence theory and technology, "Foundation of Artificial Intelligence" should not only meet the requirements of disciplinary development, but also consider students' foundation, which can stimulate students' interest and enhance their abilities. Based on the above principles, the course content of "Foundation of Artificial Intelligence" in Foshan University has been designed, mainly included Python programming, basic knowledge and applications of artificial intelligence, and experimental content.

The Python programming content include:

- Overview of Python Language: introduction, installation, IDLE development environment, code specification.
- Foundation of Python syntax: constants, variables, data types, operators, expressions, reserved words and identifiers.
- The basic structure of a program: branch structure, loop structure, and exception handling of the program.
- Combined data types: list types, tuple types, dictionary types, set types and its operations.
- Functions: Basic usage, parameter passing, recursive calls, and modules.
- File operation: reading, writing, and directory management of files.

Basic knowledge and application of artificial intelligence include:

- Basic computer knowledge: the connotation of computers, computer system composition, information representation in computers, and computer development history.
- Introduction to artificial intelligence: the meaning, development history, and industrial structure of artificial intelligence.
- Supporting technologies for artificial intelligence: computing power, algorithms, big data, Internet of Things, cloud computing, 5G and so on.
- The application technologies of artificial intelligence: text recognition, image recognition, facial recognition, speech recognition, and natural language processing.
- Industry applications of artificial intelligence: intelligent manufacturing, intelligent logistics, intelligent security, intelligent healthcare, intelligent environmental protection, and intelligent education.

The experimental content has also been arranged. The course experiments include:

- Python installation: python compilation environment and library installation.
- Python basic data types and operations: constants, variables, data types, operators, and expressions.
- Python program structure: Sequential structure, selection structure, and loop structure.
- Composite data type: lists, tuples, dictionaries, collections, and their operations.
- The function: function definition, function parameter transfer, recursion, module.
- File operation: file read and write, file and directory management.
- Comprehensive experiment: student performance management system.
- Artificial intelligence application technologies: text recognition, image recognition, speech recognition, and natural language processing.

The course has 24 hours of theoretical lectures and 24 hours of experiments, totaling 48 hours.

2.1.3. Teaching Process Design for the Course of Foundation of Artificial Intelligence

In order to conduct teaching efficiently and with high quality, we adopt deep integration with information technology, carefully design teaching, and use digital transformation to empower teachers' teaching and students' learning [8]. The following explores teaching process design from five aspects: digital teaching platform functions, pre class teaching design, in class teaching design, post class teaching design, and student learning evaluation improvement.

- Functions of digital teaching platform. The deep integration of information technology in teaching must be carried out using a digital teaching cloud platform. The digital teaching cloud platform can provide various functions such as student situation research, uploading teaching materials, collective lesson preparation, classroom attendance, courseware display, problem interaction, student homework, video explanation, and score analysis, providing services for teachers to carry out digital teaching [9]. At present, Ketangpai, Super Star, and Yuketang are all digital teaching platforms, and teachers can choose based on the actual teaching situation. This teaching reform carried

out in conjunction with the Ketangpai cloud teaching platform.

- Pre class teaching design. A thorough understanding of students' learning foundation is a prerequisite for ensuring high-quality teaching [10]. Before each class, make full use of Ketangpai design survey questionnaires to understand students' foundation for the content to be learned. Based on the investigation, adjust and optimize the content of PPT courseware, design interactive questions, select or produce some animations and videos, and form teaching materials that stimulate students' interest in learning. Upload optimized teaching materials to Ketangpai cloud teaching platform, enabling students to preview classroom teaching content in advance.
- In class teaching design. Using the Ketangpai cloud teaching platform to display teaching courseware, using animated demonstrations to illustrate principle issues, timely proposing problems and interacting with students based on the development of teaching content and students' learning situation, study problem-solving solutions, conducting classroom tests, testing students' learning effectiveness, and encouraging students to actively participate in teaching. Utilizing heuristic and discussion methods to efficiently carry out classroom teaching.
- Post class teaching design. Students use the homework function of Ketangpai cloud teaching platform to analyze homework details, complete homework requirements, and save the completed homework on the Ketangpai. The teacher will review the homework completed by students, mark any problems found, and urge students to make timely revisions. For problems that students cannot solve on their own, teachers provide guidance through Tencent video. Through video explanations, they discussed problem-solving ideas and solutions with students, enabling them to solve their learning problems in a timely manner and laying a solid foundation for the next class.
- Student learning evaluation plan. A good learning evaluation plan can encourage students to actively learn and achieve good learning outcomes [11]. Design assessments for classroom interaction, classroom quizzes, experimental assignments, and final exams, which are 5%, 5%, 40%, and 50% of the total course grade, respectively. The experimental assignments include basic Python experiments, comprehensive Python experiments, and artificial intelligence application technology experiments.

2.2. Implementation of the Teaching Process for the Course of Foundation of Artificial Intelligence

In the first semester of the 2022-2023 academic year, the course "Foundation of Artificial Intelligence" was taught at Foshan University. A total of 67 classes attended the course, with a total of 2010 students. I taught a total of 11 classes, including Light Source and Lighting class 1-3, Physics Normal class 1-2, Physics class 1-2, Food Quality and Safety class 1-2, and Food Science and Engineering class 1-2. There was a total of 322 students in these classes.

During the teaching process, other teachers carried out teaching in a teacher led mode. I deeply integrated information technology with education and teaching, carried out blended teaching, and empowered teachers and students through digital transformation. Following the aforementioned teaching design approach, various teaching links were carried out. At key teaching nodes such as course content introduction, program algorithm demonstration, artificial intelligence technology explanation, and after-school homework problem-solving, computer animation, virtual reality, ChatGPT, internet teaching platform, Tencent video conferencing and other information technologies were fully integrated into the teaching process, and ideological and political content such as patriotism to be integrated into the teaching content, timely solving students' problems, stimulating their interest in learning, enhancing their deep thinking process, and achieving good learning outcomes.

2.3. Student learning effectiveness

After a semester of teaching, students' Python programming skills, basic knowledge of artificial intelligence, and application abilities of artificial intelligence have greatly improved. Here, taking the final exam scores of the entire school's students in the course "Foundation of Artificial Intelligence" as an example, compared the learning effectiveness of students under the digital transformation empowerment teaching and teacher led teaching mode.

The final exam of the course "Foundation of Artificial Intelligence" was conducted using a computer network exam system. Each group of test papers was randomly selected from the question database, and the computer can automatically evaluate the test papers. This exam was fair, just, and scientific. Four exams were conducted, and the results of each exam are shown in Table 1 to 4.

Table 1 Situation of the first exam

The exam classes	Number of students	Average score	Number of students with scores greater than or equal to 90	Excellence rate
All classes participating in this test	490	77.65	104	21.22%
My teaching classes: Light Source and Lighting Class 1-3	80	87.96	39	48.75%

Table 2 Situation of the second exam

The exam classes	Number of students	Average score	Number of students with scores greater than or equal to 90	Excellence rate
All classes participating in this test	655	83.45	235	35.88%
My teaching classes: Light Source and Lighting Class 1-3	172	86.73	86	50.00%

Table 3 Situation of the third exam

The exam classes	Number of students	Average score	Number of students with scores greater than or equal to 90	Excellence rate
All classes participating in this test	750	75.99	140	18.67%
My teaching classes: Light Source and Lighting Class 1-3	69	86.28	30	43.48%

Table 4 Situation of the fourth exam

The exam classes	Number of students	Average score	Number of students with scores greater than or equal to 90	Excellence rate
All classes participating in this test	114	74.84	104	19.30%
My teaching classes: Light Source and Lighting Class 1-3	1	97	1	100%

From Table 1, it can be seen that the total number of students participating in the first exam was 490, and there were 80 students in my teaching class. The average score of the entire exam was 77.65, and the average score of the students in my teaching class was 87.96, which was 10.31 points higher than the average score of the entire exam. The excellent rate of the students in the entire exam was 21.22%, and the excellent rate of the students in my teaching class was 48.75%, the excellent rate was 27.53% higher than the overall student excellent rate.

From Table 2, it can be seen that the total number of students participating in the second exam was 655, and there were 172 students in my teaching class. The average score of the entire exam was 83.45 points, and the average score of the students in my teaching class was 86.73 points, which was 3.28 points higher than the average score of the entire exam. The excellent rate of the students in the entire exam was 35.88%. and the excellent rate of the students in my teaching class was 50.00%, the excellent rate was 14.12% higher than the overall student excellent rate.

From Table 3, it can be seen that the total number of students participating in the third exam was 750. and there were 69 students in my teaching class, and the average score of the entire exam was 75.99 points and the average score of the students in my class was 86.28 points, 10.29 points higher than the average score of the entire exam. The excellent rate of the students in the entire exam was 18.67%, and the excellent rate of the students in my teaching class was 43.48%, the excellent rate was 14.81% higher than the overall student excellent rate.

From Table 4, it can be seen that the total number of students participating in the fourth exam was 114, and there was one student in my teaching class. The average score of the entire exam was 74.84, and the average score of the students in my teaching class was 97, which was 22.16 points higher than the average score of the entire exam. The excellent rate of the students in the entire exam was 19.30%, and the excellent rate of the students in my teaching class was 100%, the excellent rate is 80.7% higher than the overall student excellent rate.

From the above analysis, it can be seen that except for the fourth exam where one student from the class taught by me participated in the exam and the exam results were not very descriptive, the average score and excellent rate of the students in the class taught by me in the first to third exams were significantly better than the average score and excellent rate of the students in the entire school who participated in the exam. This indicated that the integration of information technology and education was deeply integrated, and digital transformation empowered teachers to teach and students to learn. Therefore, the digital transformation teaching reform achieved great success in student academic exams.

3. Students' Satisfaction Survey of the Digital Transformation Teaching Reform

Student satisfaction survey is a subjective evaluation of teaching by students and an important reflection of their inner self satisfaction and value realization [12]. A survey was conducted on internet platforms targeting teaching students to assess their satisfaction with the hybrid teaching reform that empowers teachers and students in this digital transformation [13]. Survey indicators include teaching objectives, teaching content, learning resource, online learning, classroom teaching, students' autonomous learning, collaborative learning ability, basic knowledge acquisition, programming capabilities, artificial intelligence application capability, academic achievement and comprehensive quality. The detailed connotations of teaching objectives, teaching content, learning resources, online learning, and classroom teaching indicators were explained as follows:

- Teaching objectives: knowledge transfer, ability development, and value leading 3D teaching objectives.
- Teaching content: designing teaching content around teaching objectives, clarifying students' autonomous learning content, integrating theory with practice, challenging content, highlighting practical and innovative ability cultivation.

- Learning resource: learning objectives, learning content, learning evaluation plan, courseware, videos, animations, question database, and portfolio.
- Online learning: homework, quizzes, forums, learning reflection, timely guidance, evaluation, and feedback from teachers.
- Classroom teaching: key points, difficulties, teaching ideas, application of information technology, reflection of students' subjectivity, inspiration and discussion.

Conducted a survey on each indicator mentioned above from four aspects: very satisfaction, satisfaction, general satisfaction, and dissatisfaction. 322 students participated in the survey, and the statistical results were shown in Table 5.

Table 5: Statistical results of students' satisfaction survey

	Very Satisfaction		Satisfaction		General Satisfaction		Dissatisfaction	
	Number of Students	percentage	Number of Students	percentage	Number of Students	percentage	Number of Students	percentage
Teaching objectives	210	65.22%	112	34.78%	0	0.00%	0	0.00%
Teaching content	215	66.77%	107	33.23%	0	0.00%	0	0.00%
Learning resource	205	63.66%	108	33.54%	9	2.80%	0	0.00%
Online learning	203	63.04%	112	34.78%	7	2.17%	0	0.00%
Classroom teaching	212	65.84%	100	31.06%	10	3.11%	0	0.00%
Students' autonomous learning	207	64.29%	99	30.75%	16	4.97%	0	0.00%
Collaborative learning ability	202	62.73%	97	30.12%	23	7.14%	0	0.00%
Basic knowledge acquisition	211	65.53%	101	31.37%	10	3.11%	0	0.00%
Programming capability	199	61.80%	98	30.43%	25	7.76%	0	0.00%
Artificial intelligence application capability	200	62.11%	99	30.75%	23	7.14%	0	0.00%
Academic achievement	220	68.32%	95	29.50%	7	2.17%	0	0.00%
Comprehensive quality	216	67.08%	98	30.43%	8	2.48%	0	0.00%

The overall satisfaction percentage was equal to the sum of the very satisfaction percentage and the satisfaction percentage.

From Table 5, it can be seen that for the teaching objectives, students were very satisfied with 65.22%, satisfaction was 34.78%, and overall satisfaction was 100%. For the teaching content, students were very satisfied with 66.77%, satisfaction was 33.23%, and overall satisfaction was 100%. For the learning resources, students were very satisfied with 63.66%, satisfaction was 33.54%, general satisfaction was 2.8%, and overall satisfaction was 97.2%. For the online learning, students were very satisfied with 63.04%, satisfaction was 34.78%, general satisfaction was 2.17%, and overall satisfaction was 97.83%. For the classroom teaching, students were very satisfied with 65.84%, satisfaction was 31.06%, general satisfaction was 3.11%, and overall satisfaction was 96.89%. For the students' autonomous learning, students were very satisfied with 64.29%, satisfaction was 30.75%, general satisfaction was 4.97%, and overall satisfaction was 95.03%. For the students' collaborative learning ability, students were very satisfied with 62.73%, satisfaction was 30.12%, general satisfaction was 7.14%, and overall satisfaction was 92.86%. For the students' basic knowledge acquisition, students were very satisfied with 65.53%, satisfaction was 31.37%, general satisfaction was 3.11%, and overall satisfaction was 96.89%. For the students' programming capability, students were very satisfied with 61.80%, satisfaction was 30.43%, general satisfaction was 7.76%, and overall satisfaction was 92.24%. For the students' artificial intelligence application capability, students were very satisfied with 62.11%, satisfaction was 30.75%, general satisfaction was 7.14%, and overall satisfaction was 92.86%. For the students' academic achievement, students were very satisfied with 63.32%, satisfaction was 29.502%, general satisfaction was 2.17%, and overall satisfaction was 97.83%. For the students' comprehensive quality, students were very satisfied with 67.08%, satisfaction was 30.43%, general satisfaction was 2.48%, and overall satisfaction was 97.52%.

From the above analysis, it can be seen that the digital transformation empowered teaching reform, and more than 90% of students were generally satisfied, with very good results. However, in terms of students' collaborative learning, programming capability, and artificial intelligence application ability, the general satisfaction rate was above 7%, further optimization and improvement will be needed in the next teaching process.

4. Conclusion

Digital transformation can empower teachers to teach and empower students to learn, improve teaching efficiency and quality. However, at present, the specific application of digital transformation in practical teaching work is not yet widespread, and only a small number of teachers are reforming, most teachers still use a teaching mode that focuses on themselves lecture in the classroom. The digital transformation of higher education should be implemented in the thinking and actions of teachers. Digital transformation is not only a transformation of society and education, but also a transformation of people. Digital transformation should reflect the subjective value of teachers as active individuals and enhance their digital literacy [14]. As inheritors, imparters, and producers of

knowledge, university teachers have strong initiative and exploratory abilities. They should independently reflect on the digital trend of higher education, consciously improve their digital literacy, and guide students' development through this.

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