Path of Ideological and Political Education in the Sino-German Dual System Localization Learning Field Based on PLC Control Technology

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Abstract. Sino-German dual teaching model has been increasingly used in China, how to integrate this model into teaching, make it better integrated into the teaching of colleges and universities, in order to better promote the ideological and political work of colleges and universities, is currently an important issue of moral education in colleges and universities. Through the research of this paper, we explore the way of integrating ideological and political education with PLC control technology teaching to provide reference for the construction of "localized" courses under the dual teaching mode of China and Germany. On the basis of teaching with PLC control technology, the teaching effect, students' participation and students' satisfaction level of teaching with PLC control technology are compared, and the localized learning of ideological and political education under the Sino-German dual teaching mode is explored with the use of PLC control technology. It is experimentally verified that the method has achieved better results in practice and has greater superiority compared with the conventional 63 points. With the PLC control technology-based teaching method, the students' participation and satisfaction were 87.4% and 92.2% respectively, which were significantly higher than the conventional teaching method. Under the Chinese-German bilingual localized teaching environment, ideological and political education for college students based on PLC control technology can effectively improve the overall quality of college students and cultivate their innovative spirit, collaborative spirit and social responsibility.

Keywords: PLC Control Technology, Sino-German Dual System, Ideological and Political Education, Path Inquiry

1. Introduction

The application of PLC control technology has been extensively utilized in the realm of engineering and automation, yet its untapped potential and significance in the domain of value-based political education have yet to be thoroughly investigated. In the field of Chinese and German bilingual localization teaching, the exploration of curriculum ideological and political teaching based on PLC control technology is gradually attracting the attention of researchers. In the environment of economic

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globalization and educational reform, people are exploring how to integrate value-based political education into subject teaching, so as to improve the comprehensive quality and creativity of college students. Compared with the current development trend, this paper proposes that integrating programmable controller technology into the curriculum, so that students can move from theory to practice, would be a new way with great development potential. This paper takes the Sino-German dual education as the starting point, integrates PLC technology into the course teaching content, provides a way of ideological and political education, so as to improve the thinking ability of college students. This can cultivate their correct values, in order to provide new ideas and practical guidance for the localization of Sino-German bilingual teaching curriculum, and promote the continuous development and innovation in teaching methods.

Under the background of accelerated global integration and continuous educational reform, the exploration of curriculum political and ideological teaching approaches from the perspective of Sino-German dual localization teaching has attracted more and more scholars' attention. Among them, Ji J took the Sino-German dual teaching as an example to explore how to integrate value-based political education into the localization pedagogical process. Taking this as the starting point, he focuses on the growth needs of students, takes value-oriented, German educational experience as guidance, Chinese characteristics as guidance, interactive teaching, case analysis and other methods to enhance students' capacity for critical thinking and political literacy [1]. In the course design, Zhang B focuses on cultivating students' international vision and social responsibility, and integrates a large number of international issues and ideological and political education contents into the course. Through his analysis of the social status quo in Germany and China, he enables students to better understand China and to better understand China [2]. Liu X pays attention to cross-cultural communication and integration of educational values in Sino-German dual localization teaching, and advocates the use of multicultural teaching materials and pedagogical approach to cultivate students' ability of cross-cultural communication and respect for different cultures, and on this basis improve their moral cultivation and social responsibility [3]. With the background of Chinese and German dual localization teaching, these scholars explored the path of political and ideological teaching in the curriculum from both theoretical and practical levels, and had important practical significance for ideological and political education and cross-cultural understanding of college students. The research results can provide practical guidance for the bilingual teaching of Chinese and German, help students to understand the world situation, establish correct values, and play a crucial role in promoting the development of the world economy. However, the above scholars have not applied PLC control technology to the Ideological and political indoctrination of the curriculum in the study of political and ideological teaching.

Political and ideological teaching is an important part of fostering holistic development of students, and it holds great significance in building socialist core values and cultivating a citizen with good ideological and moral quality [4-5]. It is helpful to enrich the teaching resources of the school and enrich the teaching methods of the teachers by closely integrating the ideological and political concepts of the curriculum with PLC control technology. This can effectively enhance students' political accomplishment, improve students' practical ability, and guide young

students to form correct ideological and moral values [6-7]. In this paper, the Sino-German dual system of localized political and ideological teaching curriculum design aims to combine the cultural backgrounds and educational concepts of China and Germany to create a set of ideological and political courses that meet local needs, so as to equip students with international vision, cross-cultural communication ability and global citizenship awareness.

2. Application of PLC Control Technology in the Course of Study

Based on the ideology and governance structure of PLC practical training course, in the teaching mode combining classroom teaching and online cloud platform, teachers upload the project to the cloud platform, assist students in reflecting and exchanging ideas the ideological and political elements of the project, and foster students' comprehension and consciousness of ideology and politics in a imperceptible way [8]. In the teaching process, after the teacher explains the subject, the cloud platform would issue some test questions about ideological and political lessons, so that students can better understand the components of ideological and political lessons in the subject, and consciously give consideration to the material covered in ideological and political lessons [9-10]. PLC practice teaching prioritizes students as the primary focus, teachers as the auxiliary, each project needs students to complete independently. Finally, after completing all the courses, students are required to submit an internship summary related to ideology and politics [11].

As an advanced technology that has been widely used in the field of industrial automation, PLC control technology can also play a great role in the field of learning [12-13]. This paper would make a brief introduction to the application of programmable controller in ideological and political education in the field of teaching.

① Practical training and project work: In the course of learning, PLC control technology can be used to allow students to combine the theory and practice learned in the process of practical training and project work [14-15]. On this basis, PLC simulation and problem solving can be realized through PLC programming and operation, and students' hands-on ability and problem solving ability can be improved.

② Integration of interdisciplinary disciplines: PLC control technology and knowledge of other disciplines can be integrated into the ideological and political education in the learning field [16]. For example, it can combine the knowledge of physics, mathematics, computers and other disciplines to carry out the principle and application of PLC control technology. On this basis, it can further expand the scope and depth of students' knowledge, improve their comprehensive quality and interdisciplinary thinking.

③ The cultivation of creative thinking: by learning the control technology of programmable controllers, this may promote the development of students' creative thinking. On this basis, a new control theory with strong application value is put forward. On this basis, it puts forward its own views and puts forward its own methods to solve the problem.

④ Group cooperation and communication: In the course of learning

programmable controllers, students are often required to have good group cooperation and communication skills. Throughout the learning process, students should study in the form of a group, exchange ideas, and cooperate with each other. On this basis, it can further strengthen the students' collaborative ability, enhance their team spirit, and promote their communication.

In short, the adoption of PLC control technology in curriculum ideological and political education in the field of study can play a positive role in nurturing students' practical competence, broadening disciplinary integration, cultivating students' innovative thinking, and improving students' teamwork and communication ability [17-18]. The introduction of PLC control technology into learning can provide students with a more interactive, practical and comprehensive ability cultivation learning environment [19-20]. In the PLC control system, the following mathematical formulas are often used.

Proportional controller formula:

$$f(t) = S_p * w(t) \tag{1}$$

Integral controller formula:

$$f(t) = S_i * \int e(t)dt \tag{2}$$

Differential controller formula:

$$f(t) = S_v * (de(t)/dt) \tag{3}$$

Among them, $f(t)$ represents the output, S_p represents the scale coefficient, and $w(t)$ represents the input, which is usually an error signal. Ki represents the integral coefficient and $\int e(t)dt$ signifies the cumulative sum of the error signal. S_v represents the differential coefficient and de(t)/dt symbolizes the differential coefficient of the error signal.

The adoption of PLC control technology in the ideological and political education system can present students with a cutting-edge learning model and hands-on platform. Through the seamless integration of PLC control technology and political and ideological instruction, the practical application of knowledge and the cultivation of problem-solving ability can be realized. Students can explore social issues through practical operations and project tasks, and blend the foundational concepts of ideological and political education to cultivate a patriotic spirit, social responsibility and innovation. This way of learning not only improves the students' active learning ability, but also exercises their teamwork and communication skills. Through the application of PLC control technology, students can receive feedback and experience in real time, constantly adjust and improve the solution, strengthen the aptitude for problem-solving and facilitate deep learning. Through practical operations and project tasks using PLC control technology, students can also directly engage and apply the core concepts and principles of ideological and political education, thereby enhancing their understanding and practical abilities. In addition, the real-time feedback and adjustment mechanism of PLC control technology can also help teachers to timely understand the learning situation of students and implement tailored instruction adjustments. This innovative teaching mode can ignite students' enthusiasm for

learning and motivation, improve their participation and satisfaction in the field of ideological and political indoctrination, realize the organic integration of knowledge, technology and political and ideological awareness, and open up a broader territory for students' all-round development and growth. Figure 1 shows the application of PLC control technology to the framework of ideological and political education in this paper:

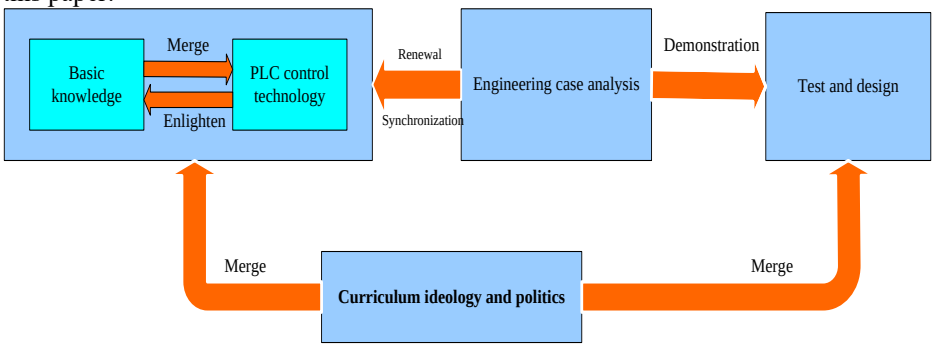

Fig.1 Application of PLC control technology in ideological and political education system

3. Evaluation of the Effect of Sino-German Dual System Localization Ideological and Political Education Courses Based on PLC Control Technology

3.1 Evaluation of Teaching Effect

Teaching effect is one of the key indicators to evaluate the quality of education and teaching. This paper probes into the teaching effect of these two different teaching methods. In order to show this comparison intuitively, Figure 2 below is the comparison chart of the teaching effect tested in this paper. This chart makes a horizontal comparison between conventional instructional approaches and the teaching methodologies based on PLC control technology.

According to the observation of the score of each test in Figure 2, it can be found that in each test, the learning methodology incorporating PLC control technology has obtained a higher score than the traditional teaching method. On this basis, the median score of the traditional teaching method is 63 points, while the average grade of the pedagogical technique employing PLC control technology is as high as 90 points. The findings reveal that the educational method based on PLC control technology has achieved better teaching effect in general.

Under the guidance of Sino-German dual localization teaching theory, Sino-German dual localization teaching domain aims to improve students' intercultural communication ability and subject knowledge. By comparing the similarities and differences between Chinese and German dual localization courses and other teaching models, this paper aims to further understand the characteristics and advantages of the two countries' dual localization courses. Through comparative analysis, it can compare the differences between local learning domains of China and

Germany and other local learning domains of the two countries from the perspective of multiple indicators, so as to better understand the educational effects and values of local learning domains of the two countries. The specific comparison results are shown in Table 1.

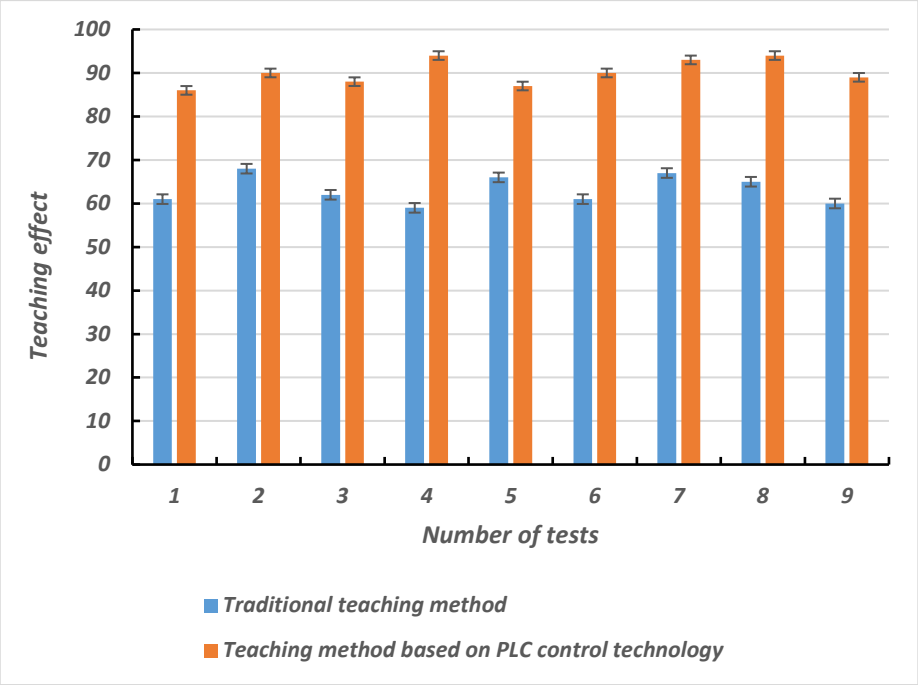

Fig.2 Comparison of teaching effects

Table 1. Comparison of Chinese and German dual system localization courses in learning fields

Comparative content	Chinese proposal	German proposal
Course content	With Chinese culture as the core, we focus on cultivating students' awareness of national conditions and traditional values	With multi-culture as the core, it focuses on cultivating students' cross-cultural understanding and respect
Discipline structure	Emphasis on natural science and technology courses, emphasizing the cultivation of practical operation ability	Comprehensive subject setting, focus on academic research and critical thinking ability training
Teaching method	Give priority to theoretical teaching	Practice-based teaching

From the comparison in Table 1, China's plan is centered on Chinese culture and focuses on cultivating students' national consciousness and traditional values. The German programme emphasizes the importance of multiculturalism and mutual understanding and respect among different cultures. In terms of subject setting, China proposes to focus on science and engineering, and focus on cultivating students' practical skills. The German proposal focuses on an integrated curriculum with an

emphasis on academic research and critical thinking. From the perspective of teaching methods, the Chinese program is mainly theoretical, while the German program is mainly practical.

On the whole, China's program focuses more on cultivating national culture and practical skills, while Germany's focuses more on cultivating students' cross-cultural and scientific research skills. This difference reflects the difference in emphasis and educational the notion of "politics and ideology in the curriculum" education between China and Germany.

3.2 Comparative Assessment of Student Engagement

Within the sphere of ideological and political enlightenment, the traditional teaching method and the teaching method based on PLC control technology are two different teaching methods. Traditional teaching methods are mainly teacher-centered, and take heed of the imparting of information and the passive acceptance of students. The pedagogical technique grounded in PLC control technology proposed in this paper places greater emphasis on the active participation of students and the cultivation of practical ability. In order to compare the differences in student engagement between these two teaching methods, this paper conducted a comparative assessment of them, as shown in Figure 3.

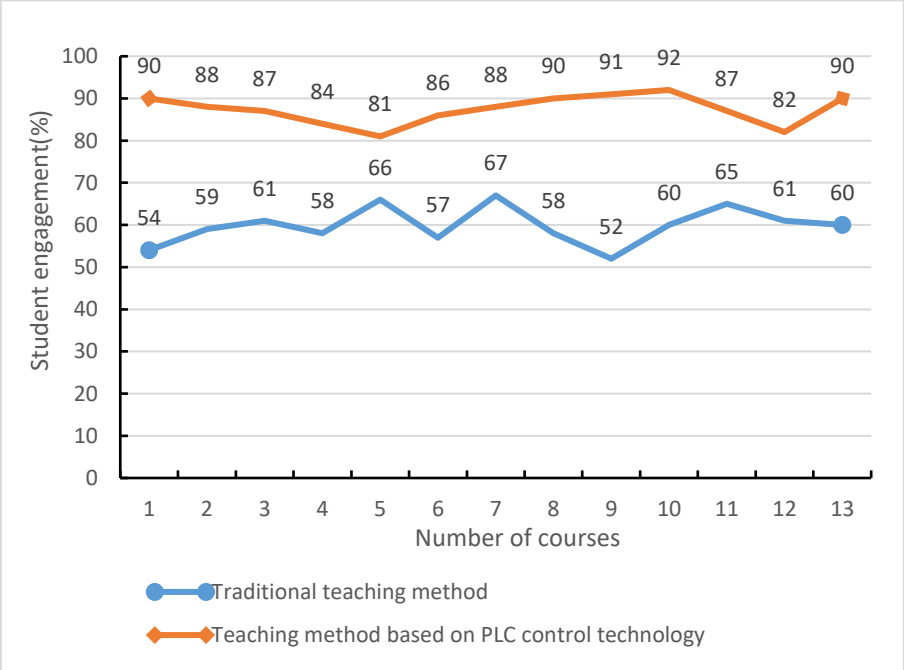

Fig.3 Comparison of student participation

According to the data analysis in Figure 3, the data indicates that in the 13 classroom tests of traditional educational methodologies, the fluctuation range of student participation is relatively large, the lowest is 52%, the highest is 67%, and the

average participation is 59.8%. In the 13 classroom tests, the fluctuation range of student participation remained between 81% and 92%, and the average participation was 87.4%. The instructional approach relying on PLC control technology exhibits elevated levels of student involvement, with the overall average notably surpassing that of the conventional educational methodology.

The instructional approach utilized in the classroom incorporating PLC control technology is relatively high in the degree of students' participation, which can arouse students' interest more than the traditional lecture-based teaching method and improve the degree of students' participation.

3.3 Comparative Evaluation of Student Satisfaction

Student satisfaction is one of the important indicators to measure the usefulness of teaching methods. The traditional teaching method and the teaching method based on PLC control technology are two different teaching methods, which have different effects on students' satisfaction. In order to compare the differences in student satisfaction between these two teaching methods, this paper conducted a questionnaire survey on 10 students, and the results are shown in Figure 4.

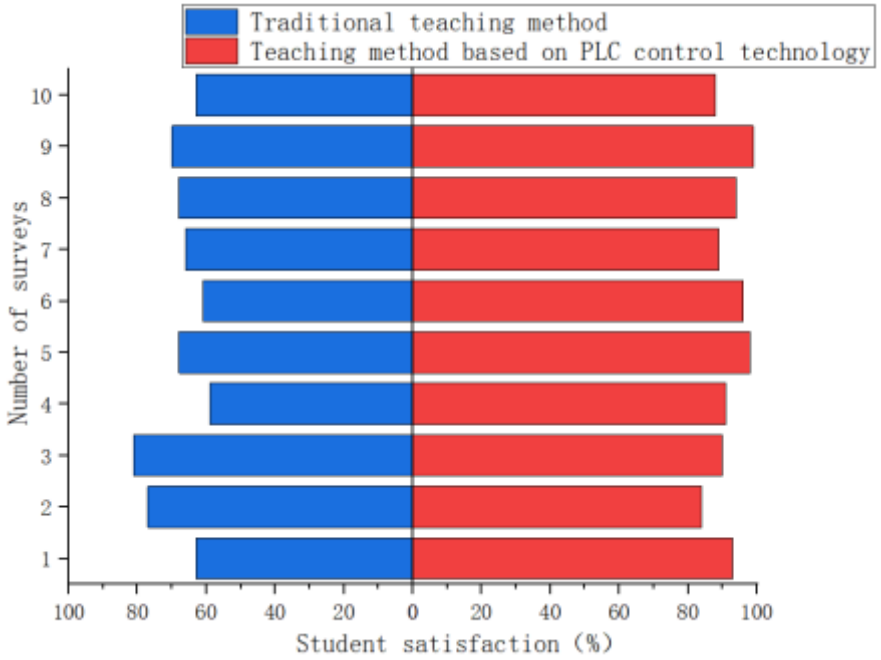

Fig.4 Comparison of student satisfaction

Based on the data depicted in Figure 4, student contentment demonstrated variability, ranging from a minimum of 59% to a maximum of 81% across the 10 surveys, with an average engagement rate of 67.6%. It is observable that in the conventional teaching technique, students' satisfaction level of the course is relatively

low, and it is easy to produce "tired of learning" emotion. In the pedagogical method centered around PLC control technology, the fluctuation range of student satisfaction is relatively small, basically fluctuating between 84% and 99%, and the average satisfaction is 92.2%.

To recapitulate, the pedagogical method in the classroom centered around PLC control technology is relatively high in the degree of students' participation, which can arouse students' interest more than the traditional teacher-led instruction method and improve the degree of students' participation.

4. Conclusions

Examining the localization approach of Sino-German dual ideological and political instruction holds immense practical importance in nurturing individuals with an entrepreneurial mindset, a strong sense of accountability, and a global perspective, while enhancing the adaptability of the Sino-German dual teaching model in China. However, in practice, there are still a series of problems and difficulties, which need the participation of government, schools, teachers, students and other parties. On this basis, this paper further explores the localization way of "Sino-German dual system" political and ideological instruction, aiming to enhance and optimize the teaching methodology. On this basis, this paper takes the Sino-German dual localization learning domain as the initial standpoint to delve into the way of integrating ideology and politics with PLC control technology teaching, which can offer fresh perspectives teaching concepts and methods for cultivating talents with innovative spirit, responsibility and internationalization. The research on the path of ideological and political curriculum education in the field of localized learning based on PLC control technology proposed in this paper is believed to be a catalyst to promote further research in this field.

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