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Application of electrician skill course based on EPIP

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Abstracts. EPIP is a new engineering education mode, and it is different from the traditional engineering education modes, which is based on vocational education engineering practice. EPIP stands for engineering, practice, innovation, and project. EPIP method proved effective in vocational education engineering practice. After analyzing the steps of EPIP, an application example of EPIP is presented to show what is EPIP, how it works, how to solve the problem of the traditional engineering education and how to transform a traditional electrician skill course to EPIP electrician skill course. EPIP electrician skill course has been tested in the experimental class. The experiment shows that EPIP has improved the innovation capability of students in the electrician skill. EPIP has a certain application value in vocational education. Finally, the paper discusses how to promote EPIP and to improve vocational education.

Keywords: EPIP, electrician skill, engineering, practice, innovation, project vocational education

Introduction

Today, we are in information high-speed development, technology update quickly society. New technologies and new processes shorten the cycle of product commercialization. With the continuous updating of technology today, how to cultivate engineering and technical talents adapting to today's society is becoming a hot topic. Because the traditional teaching mode is not suitable for today's engineering education, engineering education reform is imperative. In recent years, many teaching modes of engineering education have been proposed, one of which is EPIP teaching mode (Jingquan, Xiaohua, & Yanxia, 2017).

EPIP was born in 2012. Alliance EPIP international education was born in 2017. The league was led by 14 core promoters. The promoters popularize scientific and technical achievements that schools offer better education and enterprises gain application talents and skill talents. Alliance EPIP International Education aims to promote the development of higher education, vocational education and general education.

Application-oriented and skill-oriented talents are very important forces in modern manufacturing industry, and play a role in the process of production and manufacturing technology realization and reconstruction (Wang, Cheng, & Wang, 2017; Wang & Wang, 2016; Zhu, 2011). The interaction between education and industry is an important force to support the economic and social transformation and development. Industry needs application-oriented and skill-oriented talents to meet the production. Education needs to change the talent training plan and talent training goal. Vocational education engineering practice is the key, difficult and characteristic of the talent training plan and talent training goal. There are many problems in vocational education nowadays Wang & Xu, 2014; Guimarães & Mattos, 2015). For example, engineering practice teaching mode is different from engineering practice, lack of engineering training for practical industry, students take part in the internship has no effect and almost reduced to cheap labor, lack of cultivation means in the ability of technological innovation. EPIP mode is based on vocational education engineering practice, which is adapted to the needs of industry application-oriented and skill-oriented talents.

Electrician Skill Course Based on EPIP

What's EPIP

EPIP is abbreviation for the first letters of engineering, practice, innovation, and project. It

is a new vocational engineering education mode which is creative and innovational where several related courses are integrated. EPIP follows basic path of engineering technology innovation. According to the analysis of EPIP engineering education mode and CDIO education mode, we can concluded that EPIP engineering education mode have innovation, while CDIO education mode lack of innovation (Baryshev, et al, 2017; Ikonen, Piironen, Saurén, and Lankinen, 2009; Törngren, Grimheden, Gustafsson, & Birk, 2017). First, learn about previous engineering projects, which can help us solve our current problem. Second, carry out engineering project practice. In the process of practice, we find problems through observation and training. Finally, solve the problem of engineering practice by application-oriented and skill-oriented course. This is EPIP. EPIP engineering education mode is a new education mode to develop application-oriented and skill-oriented talents, which is taking the actual project as the guide, taking the practical application as the steering, taking the cultivation of innovation ability as the goal, taking the project practice as the target.

For example, we want to build a positive and negative rotation control of three phase asynchronous motor system. According to EPIP engineering education mode, students achieve the system through 4 steps. EPIP 4 steps as shown in the following Fig. 1.

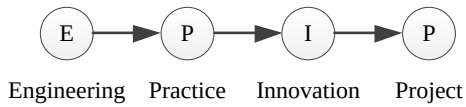


Figure 1. EPIP steps

Step I, students survey the positive and negative rotation control of three phase asynchronous motor system, including the structure, technology and process. Step II, students abstract the core technology of the system and make clear the distinction between the system and the model. Step III, students achieve the system by EPIP engineering education mode, including design the schematic diagram, achieve circuit connection, debug on running, and fault diagnosis. Step IV, students find problems and shortcomings, according to the previous situation, and then, renew and improve the system. After 4 steps above, students achieve the engineering, practice, innovation, and project of engineering technology.

Electrician Skill Course

Electrician skill course will divide into more than one project. To be able to gain most, all projects need to be completed by groups with regards to student groups. There are various groups in the class and from 3 to 4 students for each class to reach one job. Each group conceives one project in two class period or more time. All the projects must be done in the prescribed time. The teacher chose which groups do the best when the course ends. The course follow electrician skill course based on EPIP engineering education mode. According to EPIP engineering education mode, students achieve the system through 4 steps in the positive and negative rotation control of three phase asynchronous motor system course.

Step I, it usually last for five days to ten days. Students survey the technology that how many enterprise using, how many products are sold at the market. Students learn the structure, technology and process in the products. Students in the group choose the actual project according to the theme of the project. Students learn the actual project by school enterprise cooperation One of students in the group summary the experience, the methods and the knowledge they have got, and hand in two reports to teacher. The two reports is project research report, core technology analysis report, respectively.

Step II, it usually last for two weeks to three weeks. Students abstract the core technology and learn the model of the laboratory. The first week, students learn how to use the model. And the rest of the practice time, students achieve the positive and negative rotation control of three phase asynchronous motor system in the classroom.

Step III, it usually last for two weeks to three weeks. Students achieve the system by EPIP engineering education mode, including design the schematic diagram, achieve circuit connection, debug on running, and fault diagnosis. In this period, the project is implemented and complete, but it may not perfect, and students put forward the improvement plan, this is the core of EPIP.

Step IV, it usually last for two weeks to three weeks. According to the previous situation, students find problems and shortcomings, and

then, renew and improve the system until it is perfect. The perfect project is showing in class.

Finally, teachers decide which project is the best to choose to be implemented at last.

EPIP in Trial

Numerical control maintenance major has been running for ten years in Tianjin electronic information advanced technical school. EPIP engineering education mode is adopted in all courses. Electrician skill course is one of the EPIP courses. In 2016, an experiment on EPIP engineering education mode is be done in Tianjin electronic information advanced technical school. 60 students are randomly divided into 2 classes. Class one adopts the EPIP engineering education mode and another class adopts traditional mode as a comparison. The whole experiment lasted one semester. It is EPIP engineering education mode course achieved in series of projects by student groups. After a semester project based training, students in class one are feeling good for well qualified and accumulated professional techniques.

How to change traditional courses in to EPIP

The aim of traditional education mode only imparts knowledge to students. How to change traditional courses in to EPIP is a problem. Here is an example in Tianjin Electronic Information Advanced Technical School of positive and negative rotation control of three phase asynchronous motor system course. The procedure is showed in Fig. 2.

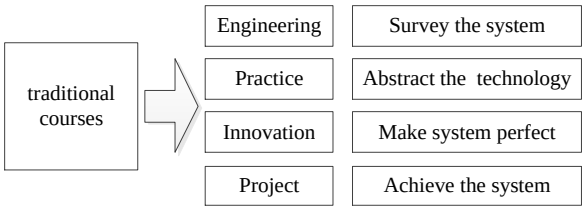
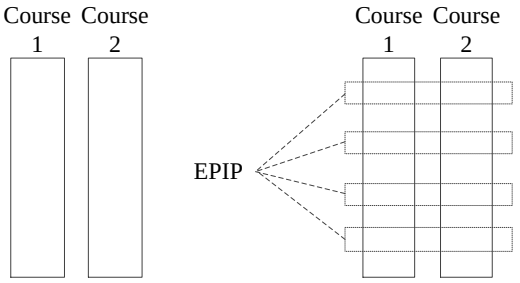


Figure 2. Change traditional courses to EPIP

In traditional engineering education mode, teachers still teach a lot, and students listen what the teachers say. This mode unification and suppleness education mode have to change. This is a very important reform that turn traditional engineering education mode into EPIP engineering education mode. Traditional engineering education mode can be changed to EPIP engineering education mode through 4 steps. First, teachers tell students how to survey the technology that how many enterprise using, how many products are sold at the market. Second, teachers tell students how to abstract the core technology and learn the model of the laboratory. Third, teachers tell students how to achieve the system including design the schematic diagram, achieve circuit connection, debug on running, and fault diagnosis. Last, teachers tell students how to find problems and shortcomings, and then, renew and improve the system until it is perfect. Students can achieve the 4 steps mentioned above independently after a period of EPIP engineering education mode study. Teachers can be at secondary position to the EPIP engineering education mode when students master the 4 steps knowledge.

EPIP is a new engineering education mode, and it is different from the traditional engineering education modes, which is based on vocational education engineering practice. As Fig. 3 shows, this is the difference between traditional engineering education mode and EPIP engineering education mode in the courses. Fig. 3(a) shows traditional engineering education mode. General courses are parallel without interaction in traditional engineering education mode, while EPIP engineering education mode changes this situation. Fig. 3(b) shows EPIP engineering education mode. EPIP engineering education mode makes several courses interactive and integrated.



(a) Traditional (b) EPIP

Figure 3. EPIP different from traditional mode

During positive and negative rotation control of three phase asynchronous motor system course based on EPIP engineering education mode, the schedule is given in Table 1.

Table 1. EPIP schedule

Process	Tasks	Time	Assessment scale
Engineering	Survey the system	5-10 days	20%
Practice	Abstract the core technology	2-3 weeks	20%
Innovation	Make the system perfect	2-3 weeks	30%
Project	Achieve the system	2-3 weeks	30%

Students attend the final examination traditional engineering education mode, and the final examination scours is only their learning ability, but not learning consciousness, practical ability, and innovation ability. In EPIP engineering education mode, students should attend 4 examinations which are engineering, practice, innovation, and project. EPIP engineering education mode is a comprehensive ability for students.

Considering and Discussion

EPIP in engineering education

EPIP plays an important role in engineering education. Positive and negative rotation control of three phase asynchronous motor system controls the whole process of numerical control machine system, while EPIP engineering education mode controls modern industry manufacture, from design the schematic diagram, achieve circuit connection, debug on running, fault diagnosis, until to the end of the life of the numerical control machine products. The goal of EPIP engineering education mode is to train students' abilities in the whole process. They are not only engineering skills, but also learning methods, teamwork and communication skills and management capabilities.

What’re the keys

As you can see from above, innovation is the key of EPIP engineering education mode. Engineering let students know what they have to learn. Practice, like traditional engineering education mode, let students achieve what they have to learn. Project let students know how to make the products perfect. Although engineering, practice, innovation, and project are separate, the purpose is innovation.

Experimental result of learning consciousness

During positive and negative rotation control of three phase asynchronous motor system course based on EPIP engineering education mode in Class One and Class Two, the learning consciousness schedule is given in Table 2, Table 3. There are 30 students in each class.

Table 2. Learning consciousness schedule (before EPIP)

Class	Interest in learning	Interest in communication	Interest in writing
Class One	13	16	2
Class Two	14	16	2

Table 3. Learning consciousness schedule (after EPIP)

Class	Interest in learning	Interest in communication	Interest in writing
Class One	26	25	21
Class Two	14	16	2

From table 2, there is no significant difference in learning consciousness between Class One and Class Two before EPIP engineering education mode. From table 3, there is obvious improvement in learning consciousness between Class One and Class Two after EPIP engineering education mode. The improvement continues to increase as the experiment continues. We draw a conclusion that EPIP engineering education mode improves learning consciousness.

Experimental result of learning ability

During positive and negative rotation control of three phase asynchronous motor system course based on EPIP engineering education mode in Class One and Class Two, the learning ability schedule is given in Table 4, Table 5. The full score is 100 points.

Table 4. Learning ability schedule (before EPIP)

Class	Average score	Variance	T test
Class One	89.26	170.36	T = 0.0412
Class Two	87.74	137.12	P = 0.89>0.05

Table 5. Learning ability schedule (after EPIP)

Class	Average score	Variance	T test
Class One	89.54	90.34	T = 2.963
Class Two	88.93	107.92	P = 0.0021<0.01

From table 4, P = 0.89>0.05, there is no significant difference in learning ability between Class One and Class Two before EPIP engineering education mode. From table 5, P = 0.0021<0.01, there is obvious improvement in learning ability between Class One and Class Two after EPIP engineering education mode. The improvement continues to increase as the experiment continues. We draw a conclusion that EPIP engineering education mode improves learning ability.

Experimental result of practical ability

During positive and negative rotation control of three phase asynchronous motor system course based on EPIP engineering education mode in Class One and Class Two, the practical ability schedule is given in Table 6, Table 7. The full score is 100 points.

Table 6. Practical ability schedule (before EPIP)

Class	Average score	Variance	T test
Class One	90.35	73.45	T = 0.0506
Class Two	90.61	71.96	P = 0.61>0.05

Table 7. Practical ability schedule (after EPIP)

Class	Average score	Var.	T test
Class One	93.94	82.16	T = 3.015
Class Two	91.68	84.35	P = 0.0084<0.01

From table 6, P = 0.61>0.05, there is no significant difference in practical ability between Class One and Class Two before EPIP engineering education mode. From table 7, P = 0.0084<0.01, there is obvious improvement in practical ability between Class One and Class Two after EPIP engineering education mode. The improvement continues to increase as the experiment continues. We draw a conclusion that EPIP engineering education mode improves practical ability.

Experimental result of innovation ability

During positive and negative rotation control of three phase asynchronous motor system course based on EPIP engineering education mode in Class One and Class Two, the innovation ability schedule is given in Table 8, Table 9.

Table 8. Innovation ability schedule (before EPIP)

Class	Numbers of propose questions	Numbers of solve questions
Class One	4	2
Class Two	4	2

Table 9. Innovation ability schedule (after EPIP)

Class	Numbers of propose questions	Numbers of solve questions
Class One	8	7
Class Two	4	2

From table 8, there is no significant difference in innovation ability between Class One and Class Two before EPIP engineering education mode. From table 9, there is obvious improvement in innovation ability between Class One and Class Two after EPIP engineering education mode. The improvement continues to increase as the experiment continues. We draw a conclusion that EPIP engineering education mode improves innovation ability.

Conclusion

Students make a significant improvement in learning consciousness and learning ability. Passive and single way of learning in the classroom has been changed by EPIP engineering education mode. Students actively participate in the classroom teaching. Students can further explore the problem, put forward the problem, solve the problem, and realize the fun of active learning. EPIP method proved effective in vocational education engineering practice. In future work, we plan to popularize EPIP engineering education mode to more majors and more area.

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