Research on Quality Monitoring System of Practical Training in Computer Specialty of Higher Education

Wenhao Jiang1, a, Runze Wan1, b, *, Xingyan Zhang1, c, Qinghui Hu2, d
1 Hubei University of Education, Wuhan 430205, China.
2 Guilin University of Aerospace Technology, Guilin 541004, China.
a huewww@126.com, b, * runzewan@126.com, c zhangxingyan@hust.edu.cn, dhuqinghui2004@126.com

Abstract. Aiming at the problems of imperfect evaluation mechanism and loose assessment in the process of professional training teaching, we present a quality monitoring system by measure each link of practical training and change the education mode in terms of different roles. Through the layout of monitoring points in all aspects of practice, evaluation objectives can be refined. At the same time, various types of data produced in professional training are analyzed and studied to explore and establish a quality monitoring system for practical training teaching. We look forward to open new ideas for solving the problems existing in practical training and optimizing the learning process, thus to improve the quality of personnel training based on school-enterprise integration.

Keywords: professional training, teaching process, quality control, evaluation mechanism.

1. Introduction

Talent is the key to supporting technological innovation in manufacturing industry. Technological innovation depends not only on high-end academic and scientific research talents, but also on the vast number of front-line technical application talents. This kind of talents should have strong theoretical foundation, practical skills and application ability of technology. They can turn theoretical design and development into technology application and directly create productivity. The integration of industry and education and the establishment of joint training mechanism between universities and enterprises are the key to cultivate applied talents to meet the needs of social and economic development, which can solve the contradiction between the structural supply of talents in Colleges and universities.

The integration of the new generation of information technology, such as artificial intelligence, big data and Internet plus, with traditional manufacturing industry has become an urgent demand of the government [1]. Industry talents play an important role in the current economic construction and social development. For the undergraduate computer specialty in colleges and universities, the training goal is to cultivate high-level, multi-level, compound senior software development and management talents with the ability to command the software industry. From this goal, we can see that the training objectives are too broad, the professional orientation is not clear, leading to too loose of the learning content, so that students can not have enough time to highlight their major and strengthen their skills.

2. Joint Training Mode of School-Enterprise Integration

At present, the professional environment, the trend of innovation, the knowledge ability and comprehensive quality required by social development are highly complex. Besides, the curriculum content of talent training in Colleges and universities lags behind the development and application of science and technology [2]. In addition, teachers generally lack experience in engineering practice. Talents training in Colleges and universities are separated from the development of industrial enterprises, which makes the demand of enterprises unable to be transformed into the driving force of talent training reform in time. At present, according to the characteristics of computer specialty, we adopt the long-term school-enterprise cooperation mode to facilitate the joint training teaching based on the mode of school-enterprise integration as follows: "3+1” talent training mode, joint course training in off-campus IT education enterprises, and appointment of teachers to study in enterprises
to improve teachers' practical teaching level. Although the participation of enterprises in joint training teaching has been greatly improved, there are still many problems:

1. Enterprises often do not arrange training contents in accordance with school enterprise cooperation agreement to complete the guiding task.
2. In the process of implementing school-enterprise cooperation, students' daily management and practice process are loose, the effect of practice is poor, and the satisfaction of practice is low.
3. For students who are assigned to practice in enterprises, it is difficult for enterprises to cooperate objectively and subjectively to complete the task of practice because of the limitations of their own business processes and their own interests.
4. The selection of cooperative enterprises should be careful and meticulous. We should have a thorough understanding of the scale, qualification level, credibility and internal management mode of the enterprises.
5. The dual tutorial mechanism should be improved. Enterprise-appointed instructors are skilled in engineering, but there are some shortcomings in teaching experience and methods compared with full-time teachers. There are differences in the acceptance of core skills for students with different foundations, which will affect the quality of training. It is necessary to cooperate with school practice instructors.

Generally speaking, these problems are mainly due to the imperfect evaluation mechanism, loose assessment and process management control [3]. In order to effectively solve the above problems, we present a quality monitoring system in practical teaching process by measure each link of practical training and change the education mode from "relying on experience" to "relying on data" in terms of different roles.

3. Quality Monitoring System for Practical Teaching Process

As an application-oriented undergraduate college, we attach great importance to the status of IT training in IT personnel training, and insert training teaching in its education system, and gradually increase its proportion. In the talent training program for computer science and technology major of our university in 2017, 188.5 credits are required for all compulsory courses, of which 19 credits are for comprehensive professional practice and about 2-4 weeks per semester are arranged for professional training, accounting for 10.1%. At present, by taking advantage of the school's geographical location, we have established a new mechanism for joint training of talents through in-depth cooperation with IT enterprises and entrepreneurship centers in Donghu Hi-tech Zone (such as Wuhan University Science Park, Wuhan Overseas Students Pioneering Park, Hongshan Pioneering Center, etc.). In particular, many attempts have been made in the teaching of joint training under the mode of collaborative education based on School-enterprise cooperation framework. For example, enterprise engineers participate in professional teaching and student training teaching, the introduction of enterprise management model, the construction of school-enterprise cooperation training curriculum system, and the coordinated implementation of centralized practice posts between schools and enterprises. The school-enterprise cooperative training teaching aims at the actual needs of the society and takes a large number of practical training projects as a means to improve students' ability and solve practical problems. As for the lack of practical training and innovation ability of students trained in the past "arranged and closed" education, the training mode of school-enterprise cooperation talents meets the needs of the society and is in line with the market. However, there are still some problems in the professional training links which play a decisive role in the quality of training high-skilled talents, mainly due to the imperfect evaluation mechanism, loose assessment and process management control. In order to solve the above problems effectively, we intend to measure the monitoring points of each link in the practical training from the perspective of the role of practical training. By classifying the influencing factors and data of practical training events, this paper explores the relationship between events and teaching quality by using data mining method, so as to realize the control of teaching quality.
In view of the professional training activities, the analysis of the quality of practical training teaching includes two parts: connotative data and denotative data. To clarify which data are related to teaching itself and have strong traditional concepts, which belong to a wide range of data, not directly related to teaching. Furthermore, setting the boundary between connotative and denotative data is the premise for the research of teaching data.

The setting of data monitoring points is shown in table 1-4. Monitoring points are defined as control points set up in teaching to monitor certain processes, phenomena or objects. The settings of monitoring points include: effective monitoring of the operation of the whole teaching process, whether the teaching process meets the teaching progress and requirements, students' response and satisfaction with the training courses, teachers' response and satisfaction with students, teaching progress, teaching process, human problems in the process of teaching implementation, and teaching implementation. There are a series of problems in the process, such as environmental problems, students' satisfaction in the process of teaching implementation. Furthermore, it should reflect whether the training implementation process is carried out in an orderly manner, whether the monitoring of practice links is in place, and whether the teachers' guidance in practice links is in place. Through the monitoring of monitoring points, we can find out the existing problems and take timely measures to adjust the corresponding teaching problems.

Table 1. The perspective of instructors in the training process

| category                          | Item No. | Observation point                                      | Data type |
|-----------------------------------|----------|-------------------------------------------------------|-----------|
| Student level                     | 01       | Adapt to teaching methods                             | Logic     |
|                                   | 02       | Adapt to teaching content                             | Logic     |
|                                   | 03       | Adapting to teaching environment                      | Logic     |
|                                   | 04       | Adapting to teachers' progress                        | Logic     |
|                                   | 05       | Teaching attitude                                     | Grade     |
|                                   | 06       | Interest degree                                       | Grade     |
|                                   | 07       | Long term attractiveness of course                    | Score     |
| Outline progress                  | 08       | Does the learning schedule meet the standards?        | Logic     |
|                                   | 09       | Problem oriented curriculum syllabus                  | Logic     |
| Work assessment                   | 10       | Composition of evaluation system                      | Grade     |
|                                   | 11       | Performance appraisal relationship                     | Grade     |
|                                   | 12       | Does it reflect effectiveness?                        | Logic     |
|                                   | 13       | Formative assessment method                            | Grade     |
|                                   | 14       | Validation of practice results                         | Grade     |
|                                   | 15       | Validity of evaluation                                | Score     |
| Self evaluation                   | 16       | Courseware framework                                  | Logic     |
|                                   | 17       | Curriculum knowledge decomposition system              | Logic     |
|                                   | 18       | Problem oriented transformation system                 | Logic     |
|                                   | 19       | Other resources integration                            | Logic     |
|                                   | 20       | Ways to enhance students' attention                    | Grade     |
|                                   | 21       | Are cognitive assessment methods effective and novel?  | Logic     |
|                                   | 22       | Reconstructing and reorganizing specialized courseware framework | Grade     |
| Cooperative guidance teachers     | 23       | Complex knowledge decomposition ability                | Score     |
|                                   | 24       | Understanding of knowledge                            | Score     |
|                                   | 25       | Collaboration with speakers                            | Score     |
|                                   | 26       | Ability of Fragment knowledge combination              | Score     |
|                                   | 27       | Conversion ability of problem types                   | Score     |
|                                   | 28       | Transformation from logical thinking to image thinking | Score     |
|                                   | 29       | Expressive force                                      | Score     |
|                                   | 30       | Organizational counseling reconstitution ability       | Score     |
Table 2. The perspective of students in the training process

| category              | Item No. | Observation point                          | Data type |
|-----------------------|----------|--------------------------------------------|-----------|
| The tutors            | 31       | Qualifications                             | Grade     |
|                       | 32       | The orderliness of the knowledge points    | Grade     |
|                       | 33       | Teaching skills                            | Grade     |
|                       | 34       | Associative expressive power               | Grade     |
|                       | 35       | Subject background                         | Logic     |
|                       | 36       | Professional degree                        | Logic     |
|                       | 37       | Educational background                     | Grade     |
| Homework / assessment | 38       | Assessment and evaluation                  | Grade     |
|                       | 39       | facility value                             | Grade     |
|                       | 40       | Type diversity                             | Logic     |
|                       | 41       | Professional fit                           | Logic     |
| Practice conditions   | 42       | Enterprise environment                     | Grade     |
|                       | 43       | Enterprise atmosphere                      | Grade     |
|                       | 44       | Equipment conditions                       | Grade     |
|                       | 45       | Management level                           | Grade     |
|                       | 46       | Support degree                             | Grade     |
|                       | 47       | Disciplinary requirements                  | Logic     |
| Learning support      | 48       | Effectiveness                              | Logic     |
|                       | 49       | Pertinence                                 | Logic     |
|                       | 50       | meet professor                             | Logic     |
|                       | 51       | Frequency and intensity of counselling     | Score     |
|                       | 52       | Degree of discussion                       | Grade     |

Table 3. The perspective of teaching administrator in the training process

| category               | Item No. | Observation point                                      | Data type |
|------------------------|----------|--------------------------------------------------------|-----------|
| Teaching behavior      | 57       | Unity of practice and outline                          | Grade     |
|                       | 58       | Unity of emphasis and difficulty in Teaching           | Grade     |
|                       | 59       | Unity of teaching and tutoring                         | Grade     |
|                       | 60       | Teaching answer conditions and real time response      | Grade     |
|                       | 61       | Practical activity guidance                            | Score     |
|                       | 62       | The unity of lesson plan and syllabus                  | Grade     |
|                       | 63       | Degree of homework approval                            | Grade     |
|                       | 64       | Qualifications and professional background of Teachers | Grade     |
|                       | 65       | Teaching deviation                                     | Grade     |
|                       | 66       | Teaching process evaluation                            | Score     |
|                       | 67       | Unity of contents and courseware knowledge points      | Grade     |
|                       | 68       | Overall training intensity                             | Grade     |
| Student learning behavior | 69     | Student mastery level                                  | Score     |
|                       | 70       | Business upgrading capability                          | Score     |
|                       | 71       | Problem solving ability                                | Score     |
|                       | 72       | Can you get timely guidance?                          | Logic     |
|                       | 73       | Achievement distribution                               | Grade     |
|                       | 74       | Quality Control                                        | Logic     |
| Training development   | 75       | Contradiction between engineering and Engineering      | Logic     |
|                       | 76       | Contradiction between quality and quantity             | Logic     |
|                       | 77       | Contradiction between occupation and learning direction| Logic     |
|                       | 78       | Student base differences                               | Grade     |
### Table 4. The perspective of teaching resources

| category                        | Item No. | Observation point                  | Data type |
|---------------------------------|----------|------------------------------------|-----------|
| **Training course**             |          |                                    |           |
|                                 | 82       | Modularization                     | Logic     |
|                                 | 83       | Quality of lectures                | Grade     |
|                                 | 84       | Empathic degree                    | Score     |
|                                 | 85       | Interactivity                      | Score     |
| **Curriculum resources**        |          |                                    |           |
|                                 | 86       | Courseware evaluation              | Grade     |
|                                 | 87       | Teacher's evaluation               | Score     |
|                                 | 88       | problem mining                     | Grade     |
|                                 | 89       | Technical specifications            | Logic     |
|                                 | 90       | Resource database construction      | Grade     |
| **Learner**                     |          |                                    |           |
|                                 | 92       | Matching between resources and learners | Grade |
|                                 | 93       | Attention to resources             | Score     |
|                                 | 94       | Fragmentation of knowledge          | Logic     |
|                                 | 95       | Job evaluation                      | Score     |
| **Evaluation of learning**      |          |                                    |           |
|                                 | 96       | Self-test of students              | Score     |
|                                 | 97       | Formative assessment               | Score     |
|                                 | 98       | Discussion on Interaction Evaluation | Score   |
|                                 | 99       | Test evaluation                     | Score     |

Training teaching can show the characteristics that traditional classroom teaching does not have. Effective monitoring of teaching quality has become a very important link to ensure the quality of teaching. By setting up the data monitoring points, we can detect, analyze and process in time. Usually, the occurrence of teaching events has certain precursor, relevance and predictability. In order to deal with the current events, we must understand and mine the relevant phenomena and information, infer the causes of the events, the factors involved and other information from these data, so as to provide effective basis for decision-making. In addition, by making use of data mining and waveform analysis of historical data, the law of events can be discovered. Furthermore, it can help to realize the prediction of teaching quality, which is of great significance to improve the effect of practical teaching.

### 4. Conclusion

Professional training activities based on the mode of school-enterprise integration can effectively combine theory with practice, improve students' ability and realize seamless connection between talent training and social needs. However, this mode often shows imperfect process evaluation mechanism, loose assessment and process management control. To solve these problems, this paper intends to start from different roles in the practical training, measure the monitoring points of each link in the practical training, and change the educational mode from "relying on experience" to "relying on data". By laying out the monitoring points in each link of the internship, refining the evaluation objectives, analyzing and researching the huge amount and various types of data generated in the professional training, we explore the establishment of a quality monitoring system of the training teaching process, which integrates data collection, analysis, evaluation and feedback. Through the setting of data monitoring points, it can effectively improve the management and control of the joint training teaching process under the mode of school-enterprise integration, and enhance the degree of industry enterprises' participation.

### Acknowledgements

This research was supported in part by the Hubei Provincial Educational Science Program (Grant No. 2018GB073) and the Guangxi Nature Science Fund (Grant No. 2016GXNSFAA380226).
References

[1]. Ye, Yan; Lv, Qingsong; Wu, Maocheng; “Reform and practice for photoelectric specialty experimental teaching based on virtual simulation experiment platform,” In: Proc. of 14th Conference on Education and Training in Optics and Photonics (ETOP), Hangzhou, PEOPLES R CHINA, MAY 29-31, 2017.

[2]. Zhang, Zhanguo. “Constructing the Practical Teaching System of Innovation and Entrepreneurship Education for Engineering College Students,” In: Proc. of 9th IEEE International Conference on Computer Science and Education (ICCSE), Univ British Columbia, Vancouver, CANADA, AUG 22-24, 2014, pp: 877-882.

[3]. Evgeniou, Evgenios; Loizou, Peter. “The Theoretical Base of E-Learning and Its Role in Surgical Education,” Journal of Surgical Education, 2012, 69(5): 665-669.