A New Micro-Studio Mode in Vocational Skills Teaching

https://doi.org/10.3991/ijet.v17i09.30933

Yu Yun
Logistics Division, Wuxi Institute of Technology, Wuxi, China
yuyun@wxit.edu.cn

Abstract—The methods currently applied in engineering vocational skills teaching are mostly boring for students and even disconnected from the development of enterprises. It is often difficult for students to truly master vocational skills under the traditional teaching mode. Firstly, the concept of agile development mode was introduced to put forward a new studio-based microteaching method according to the characteristics of engineering colleges and the requirements of vocational skills teaching. Under the support of informatization, the procedure of implementing new vocational skills teaching was designed as "project selecting—plan making—activity exploration—achievement exchange—activity evaluation". Then, the information entropy evaluation method was used to divide the new teaching strategy into four steps: determining the classification of groups, designing the chain mechanism of evaluation, judging the consistency of evaluation results, and identifying the chain relationship and the final ranking. The results show that this new teaching mode can improve students' motivation of learning vocational skills and promote their mastery of vocational skills. Therefore, it is beneficial to popularize this teaching reform idea in the cultivation of vocational skills among students in engineering colleges.

Keywords—micro, studio, vocational skills teaching, information entropy

1 Introduction

As a special action skill to manipulate a certain device in practical activities, the training of vocational operation skill is the key to achieve the goal of training high-quality skilled talents in higher vocational education [1]. Vocational skills teaching can enhance employment and entrepreneurship, alleviate the structural employment conflicts in society, and is an important support for promoting high-quality social development. The current vocational skills teaching is closely integrated with all walks of life, combining practice and theory, aiming to enhance the high-quality teaching ability of vocational skills and the efficiency of skilled personnel training. However, in the actual teaching of vocational skills, there are still many problems that cannot be ignored. It is found that most learners of vocational skills have a weak foundation, poor research habits and insufficient learning ability. If they are taught according to the traditional method of teaching functional skills, where theoretical knowledge is learnt first and then put into practice, the effect will not be satisfactory. With a long period of boring theory learning in the early stage, students will gradually lose interest in learning vocational skills, and some complex theories are difficult to understand, which will also greatly dampen learners' interest in learning and make them lose motivation to learn. Moreover, although the current vocational skills teaching combines theory and practice, it emphasises theory over practice, and many teaching contents are detached from the practical application of skills [2]. With the rapid development of the Internet, many vocational skills teaching contents cannot keep up with the changes in the industry and do not closely integrate teaching with the occupation, and students often fail to really improve and master the professional skills. Secondly, in the actual vocational skills teaching, teaching resources are not shared enough, and the teaching evaluation and skills learning evaluation cannot be synchronised in real time due to the restrictions of the teaching location and time, resulting in students not being able to conduct timely and comprehensive self-evaluation and reflection, and the learning effect is greatly reduced.

This paper therefore proposes a new vocational skill teaching model based on the microteaching studio. Firstly it uses the agile software development concept. The agile software development [3] is a model in software development project management, a standardised process for product iteration that distinguishes itself from traditional development models such as the traditional waterfall development, prototype model and spiral model. Agile software development avoids the disadvantages of reduced freedom and high costs that result from strict hierarchies in traditional models, and enables projects to be kept in a usable state. Traditional vocational skills teaching is similar to the traditional project development model, which focuses on planning and control, therefore, this research innovatively applies the agile software development to vocational skills teaching and examines the effectiveness of its application in teaching new vocational skills. Secondly, this research's teaching model innovatively creates a kind of skills studio, which aims to conduct vocational skills training, and through the development of teaching plans and related systems, experimentally integrates students with real work tasks, and collaborates with enterprises to solve technical problems and technological innovations. At the same time, the new model provides a dynamic and objective evaluation of the entire teaching strategy through information entropy techniques, quantifying the teaching process with objective data and providing a rational analysis of the vocational skills teaching strategy.

2 State of the art

As a type of education that is parallel to and integrated with basic education and higher education, as well as a type of education that directly serves production life and industrial transformation, vocational skills education in the integration and application of advanced teaching methods and teaching concepts should also always be continuously improved to meet the needs of social development. The exploration of vocational skills teaching models for engineering in developed countries began early. Z Bi used a mechanical engineering course as a case study to integrate everyday examples to motivate students to complete their studies, and this approach was proved to be very beneficial for both students and teachers. Students were motivated and inspired to apply their engineering knowledge directly to everyday practical applications [4]. Verhaest et al [5] based their comparison on data from two international datasets (ESJS and PIAAC) and focusing on upper secondary and post-secondary non-tertiary qualifications, the team found similar contrasting effects in terms of education and skill mismatch and suggested that vocational skills teaching should be taught in conjunction with vocational qualifications. This pattern was not only found for overall mismatches, but also for mismatches in terms of several more detailed types of skills. Oviawe et al [6] suggested that technical vocational education and training (TVET) refers to a deliberate intervention to bring about learning which would make people more relevant and productive in designated areas of economic and technological activities. This research team discussed concept of workplace training in TVET, concept of workplace-school collaboration, need for workplace-school collaboration in TVET, best practices to workplace-school collaboration: bridging the gap to meet the manpower needs of the 21st century workplace. Juarez-Ramirez et al [7] presented their experience in teaching skills using a real-world project-based learning approach in collaboration with industry, considering three main skill recommendations: the software engineering knowledge set, the 21st century skills philosophy, and a set of attributes for global engineers. Idris et al [8] found through their investigation that most important objectives of vocational skill acquisition programmes were to enable youth to acquire vocational skills that would provide gainful employment as well as raise their standards of living. Also the trainees perceived the relevance of skill acquisition programmes as centers for imparting marketable skills that focus more on practical aspect than theory. It was recommended that training courses should be relevant to the need of the sectors and target group. At the same time, teaching assessment was one of the important tools to improve the quality of course teaching; however, the traditional written test was still the main assessment tool in most higher education courses, which could not meet the development of higher education. In order to improve the quality of higher education, the use of machine learning technology was proposed to design an assessment system for higher education, which could play a further role in promoting and optimising the reform of teaching skills.

In recent years, vocational skills education in developing countries has also been reforming and innovating vocational skills teaching models in order to improve the skills level of vocational talents. OuYang Chunping proposed a TBL teaching model for the in-depth vocational skills training of software engineering talents [9], which allowed students to gain an in-depth understanding of various software career roles in the process of professional team-based software talent training, helping them to accurately position themselves for competent career positions and effectively enhance their employment competitiveness. Li [10] applied vocational skills competition to vocational skills teaching and explored the teaching model of promoting teaching, learning, reform and construction through competitions. The research constructed a training model similar to the world vocational skills competition, which was used to study the development of students' professional ability, and took auto body repair technology as an example, finding that this new teaching model could well promote students' learning motivation. Kang [11] suggested that vocational education should not only focus on students' learning and mastery of the basics, but also on the cultivation of students' hands-on professional skills in the teaching process. The research took the course of "Accounting Informatization Application Practice" as an example, and took the cultivation of accounting informatization ability as the main line, occupational standards as the reference, based on the work process, and typical work tasks as the carrier, and constructed a perfect four-dimensional integrated curriculum system of "course, post, certificate and competition" and a comprehensive assessment mechanism of skills. Through practical teaching, this new teaching reform could strengthen the students' business quality, realize the standardization of students' skills training, rationalize the teaching syllabus, and truly promote the comprehensive integration of practice and theory.

For the formation of vocational skills, one research divided the growth of vocational skilled talents into four stages and steps that progress in sequence: "the novice stage, the excellent novice stage, the competent stage and the skilled stage”. In the skilled stage, occupational skilled talents tend to react immediately in a conscious manner when handling work, are very skilled in their work and can be flexible and versatile in adopting various effective ways of handling different work situations. This shows that there is an inherent pattern to the formation of vocational skilled talents. Based on previous research, this research suggested that the microteaching model can be used as a vocational skills teaching model.

Microteaching training is currently defined as a reduced, controlled teaching environment. By providing a skills training environment based on modern educational technology, this training environment not only realizes "people, environment, things, processes, and even time and space" in a realistic, panoramic, and adjustable way (i.e., the ideal change in the virtual state of zooming in, zooming out, speeding up, slowing down, etc.), but also simplifies the complex classroom teaching activities and provides students with a lot of real feedback. Currently, the Luoding Polytechnic [11] in China has built 18 microteaching classrooms adapted to the needs of the microskill teaching, all of which have a complete system consisting of indoor hemispherical cameras, lenses, shields, heads, decoders, computers and televisions. Over the past five years, it has been found that microteaching classrooms and the microskill teaching are playing an increasing role in improving students' overall teaching skills and helping them to become skilled professionals. However, throughout previous studies, this microskill teaching is currently only used in the vocational skills development process for teacher trainees. This research innovatively combines this teaching model with vocational skills teaching and examines its application in the vocational skills development process for engineering majors. At the same time, the teaching process is a process of information transfer, both from the teacher to the students and from the students to the teacher, and is composed of teaching and learning interactively as a teaching system. The traditional way of evaluating the classroom teaching process is through experienced teachers making a listening record sheet and scoring or grading the classroom. Most of these evaluations are done by recording some highlights or shortcomings of the teaching process through language, which is more or less unobjective. Therefore, we should strengthen quantitative research and use objective data to make some objective and rational analysis of the classroom. This study applies the information entropy method, treating the teaching process as a special kind of information transmission and processing process, and also a probability system, to make an objective and scientific evaluation of the effectiveness of the new teaching strategy.

3 Application of microstudio in vocational skills teaching

3.1 Application of the microteaching method

Microteaching, also known as "micro-teaching", "microview-teaching" and "mini-teaching", is a method of developing students' and teachers' skills through the use of modern information technology. Figure 1 shows the use of information technology in microteaching. Unlike traditional teaching models, courses of microteaching are shorter and more focused, and teachers use multimedia equipment to explain the knowledge and dynamics of the course to enhance the interest of the classroom. It can help students to understand the knowledge points and stimulate their interest in learning. Teachers can use information technology to explain the course in the multimedia classroom at any time, and students can watch the course through the equipment at any time to learn and consolidate their knowledge. At the same time, microteaching breaks the traditional teaching place and time constraints, teachers can have enough time to evaluate students' learning, students can also evaluate each other, and the perfect evaluation system also makes the evaluation more objective and reasonable.

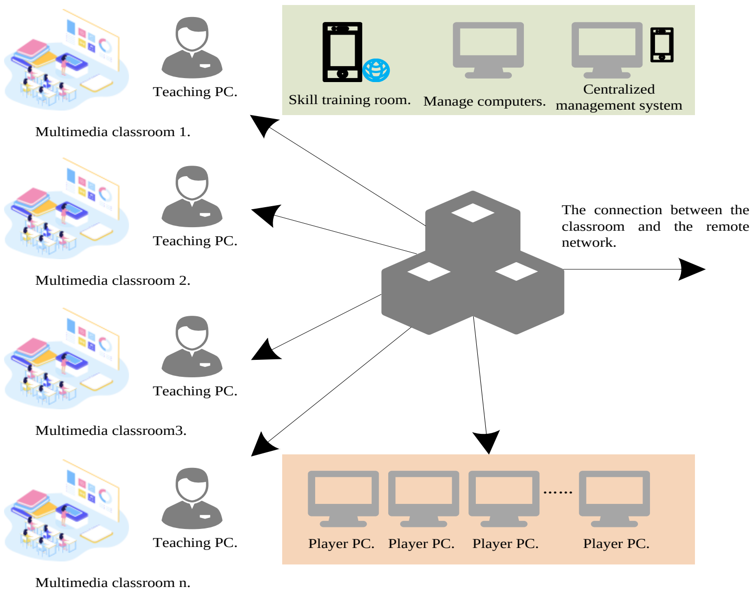

Fig. 1. Application of information technology in microteaching

Based on the traditional microteaching method, this paper proposed a new studio-based microteaching method for vocational skills teaching, as shown in Figure 2. With the support of the information technology environment, the implementation process of the studio-based microteaching method in vocational skills teaching is roughly as follows: "select a project - develop a plan - explore activities - exchange results - evaluate activities".

In the session of selecting project, the teacher uses multimedia information tools to design the vocational skills knowledge point learning, using PPT, PowerPoint, etc. to design a course with illustrations and text, including audio and video, to introduce the course scenario and stimulate students' interest and motivation in learning. The designed micro-course should be around 10-15 minutes in length, highlighting key points and being lively and interesting. Students view the content to be learnt through their computers, mobile phones and other devices, understand the requirements and objectives of learning, and form learning groups to discuss together.

In the session of developing a plan, the teacher should guide students to develop a reasonable vocational skills learning plan based on their learning situation and the level of difficulty of the knowledge points, and share relevant materials that students can watch and find at any time through computers, tablets and other devices. Groups of students should also develop a common learning plan and discuss it together to improve learning efficiency.

In the session of exploring activity, the teacher improves the resources for students to explore according to the vocational skills knowledge learned in the course, supervises and guides students to explore and analyze the lack of understanding, right and wrong, as well as the strengths and weaknesses in students' thinking during the discussion, and makes up for students' deficient points in time, so that students can master the vocational skills knowledge learned more deeply. Students can also use the rush tools and microlearning resources to explore the activities and record the process according to the learning plan developed.

In the session of exchanging results, the teacher organises the presentation and exchange of students' work. Students upload their results through the multimedia, the teacher and other students exchange their results, find out the strengths and weaknesses of the displayed work and the teacher gives advice on how to improve it. Through the presentation of others' results, students themselves can get new inspiration and discover their own shortcomings to further optimise their own work.

In the session of evaluating activity, the teacher instructs other students to evaluate the student on the learning process and learning outcomes. Study groups, study partners evaluate each other, and while evaluating others, they can also reflect on their own shortcomings. Students themselves comment on and summarize their own learning process and results. Activity discussion allows students to become more objectively aware of their own shortcomings, and teachers can further optimize their teaching design through activity discussion.

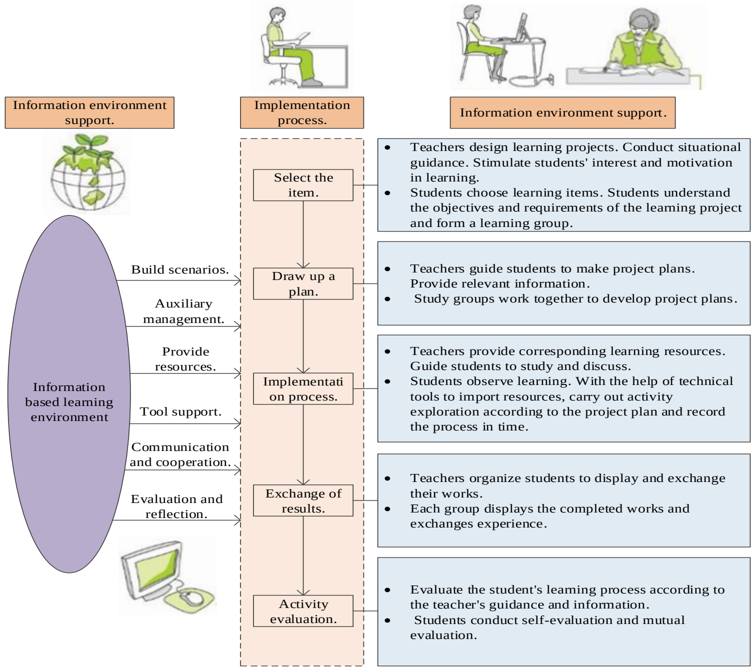

Fig. 2. Microteaching in an information-based environment

3.2 Evaluation of teaching strategies in microstudio based on information entropy

There are four main steps in the evaluation of teaching strategies based on information entropy: determining the classification of clusters, designing the chain mechanism of the evaluation process, adjusting the consistency of the evaluation results, and determining the chain relationship and the final ranking.

Determining the classification of the evaluated subjects and experts. 1) The set of evaluated subjects $X = \{x_1, x_2, L, x_n\}$. The classification of the evaluated subjects is based on the needs of the evaluated subjects and the individual differences of the evaluated subjects; 2) The set of experts $E = \{e_1, e_2, L, e_m\}$. If the expert pool is well-documented, it is one or morex_i assigned to each expert based on the expert's skills and preferences. If it is not well-documented, the selection of the evaluated subject is made by the experts themselves. The E is classified into multiple categories and its selection $C_{e_k} \in \{X_1, X_2, \cdots, X_i\}$, where $e_k \in E$. The group classifications are all determined by a chain mechanism to determine whether the division is satisfied.

Chain mechanism design of evaluation process. There are roughly three kinds of chain relationships: 1) the grouping of evaluated objects is divided, and the expert grouping exists in a chain relationship; 2) the grouping of evaluated objects exists in a chain relationship, and the expert grouping is divided; 3) both exist in a chain relationship, which constitutes a two-way chain structure.

Consistency judgment of evaluation results. If $C_{G_i} = X_i$, then $P\left(x_j^k\right)$ is the evaluation result of the expert $e_k \in G_i$ and $P\left(x_j^k\right)$ satisfies $order\left(s, P\left(x_j^k\right)\right) \longrightarrow f\left(s, a_j^k\right)$, where $order$is the descending ranking function, $f(\bullet)$is the conversion function that converts the percentage system to an integer ranking, and a_j^k is a ranking vector of size $s \times 1$. $A_k = \left\{a_1^k, a_2^k, \cdots, a_j^k\right\}$ is the ranking vector of expert $e_k \in G_i$ and b_j is the zero-one vector of size $s \times 1$. If $a_j^k = a_j^n$, then $b_j = 1$, and vice versa is zero. B_k is a vector of size $s(w-1) \times 1$, and $count(\bullet)$ is a function that calculates the number of elements of value 1 in B_k. When $cons(e_k) = (count(B_k), 0, 0, \cdots, 0)$, then $cons(e_k)$ is said to be the consistency vector of expert $e_k \in G_i$. $H(e_k)$ is the information entropy value of expert $e_k \in G_i$. $H(e_k) = E\left(I\left(cons(\cdot)\right)\right) = \sum_{i=1}^{n} p\left(cons(i)\right) I\left(cons(i)\right) = -\sum_{i=1}^{n} p\left(cons(i)\right) \log_b^{\left(p\left(cons(i)\right)\right)}$, where $I\left(cons(e)\right)$ denotes the amount of information about the evaluated object and $p\left(cons(i)\right)$ denotes the probability of occurrence of $cons(i)$.

Determine the chain relationship and the final ranking. Let $H(G_k) = min\{H(e_k)\}$, then $P(G_i) = P\left(x_j^k\right)$, then expert $e_k \in G_i$ is the intra-cluster relationship expert. $H(e_k^s)$ and $H(e_k^t)$ are the information entropy of expert $e_k \in G_i$ under subgroups G_s and G_t, then his combined information entropy is $H\left(e_k^{total}\right) = H(e_k^s) + H(e_k^t)$. If $H(G_k^{st}) = min\, H\left(e_k^{total}\right)$, then expert $e_k \in G_i$ is an expert in chain relations. If the evaluated object is divided into *m* subgroups and the number of chain experts $r = m - 1$, there is a chain relationship between *m* subgroups. According to the above, the relationship of the evaluated objects can be determined, and then the ranking is determined.

In order to quantitatively analyze and evaluate the process of vocational skills teaching strategies, the organizers analyzed the teaching based on information entropy and organized 10 experts to evaluate and score 40 vocational skills microlearning courses. The evaluees (40 courses) were divided into 4 categories (G1, G2, G3, G4) according to the research direction, and were also assigned to 10 experts ($e_1, e_2, \cdots, e_{10}$), and the scoring results are shown in Table 1.

Table 1. Expert rating

S.N.	e_1	e_2	e_3	e_4	**S.N.**	e_2	e_6	e_8		
1	75	59	83.75	84	21	74	63.75	74.5		
2	51.5	65	80	59	22	82.25	83	86.75		
3	73.75	70	94.75	72.5	23	85.75	85.25	96.5		
4	50	59	57.5	57.5	24	75.75	51.5	57.5		
5	58.75	59	52.5	66.5	25	87	54.25	58.75		
6	58.75	73.75	59	68.75	26	90.75	82.5	88.25		
7	91	82.5	53.75	87.5	27	59.75	57	57.75		
8	76.25	78.75	80	73.75	28	51.75	54.75	57.5		
9	80	53.75	80	76.25	S.N.	e_1	e_9	e_4	e_{10}	e_7
10	75	76.25	59	81.5	29	74.25	56.5	56.25	58.75	55
11	57.5	82.6	59	67.5	30	63.25	54.25	73.75	56.25	71.25

S.N.	e_4	e_5	e_6	e_7	31	66	75	76.25	88.75	68.75
12	73.75	83.75	80	75	32	86.25	76	58	58.75	40
13	78.75	56.5	58.75	75	33	64.25	85.25	77	98	87.5
14	71.25	61.25	58.25	85	34	66	75.75	57.5	58.75	82.5
15	57.5	82.5	81.25	72.5	35	67.5	75.5	74.75	58.75	82.5
16	85	85.5	74.75	81.25	36	66.25	56.25	59	73.75	56.25
17	57.5	64.5	76.75	65	37	61.25	67	56.75	58.7	53.75
18	55	55	55	60	38	95.75	86	89.25	99	93.25
19	82.5	63.25	77	81.25	39	86.25	71.75	85.75	99	94.25
20	73.75	55.75	58.75	62.5	40	75.75	48.75	58	57.5	48.75

Determine the intra-group ranking. Firstly, according to the definition and formula in 3.2.1, the entropy of expert information in the four evaluated classification groups can be calculated:

$$G1{:}H(e_1) = 0.46, H(e_2) = 0.63, H(e_3) = 0.83, H(e_4) = 0.52, H(\overline{e_1}) = 0.69 \quad (1)$$

$$G2{:}\ H(e_4) = 0.80, H(e_5) = 0.61, H(e_6) = 0.66, H(e_7) = 0.57, H(\overline{e_2}) = 0.57$$

$$G3{:}\ H(e_2) = 1.74, H(e_6) = 0.99, H(e_8) = 0.61, H(\overline{e_3}) = 0.65$$

$$G4{:}\ H(e_1) = 1.00,\ H(e_4) = 0.52,\ H(e_9) = 0.45,\ H(e_7) = 0.68,\ H(e_{10}) = 0.63,\ H(\overline{e_4}) = 0.45$$

This leads to the four subgroups of intragroup relationship experts as e_1, e_7, e_8, e_9.

Determine the chain relationship. According to the classification of clusters, it is known that: e_2 is a chain relationship expert of G1 and G3; e_4 is a chain relationship expert of G1 and G2; e_6 is a chain relationship expert of G2 and G3. And because $H(e_1^{total})$=1.46 , $H(e_4^{total})$=1.04 , $H(G_k^{14}) = min\{H(e_1^{total}),.H(e_4^{total})\} = H(e_4^{total})$, the chain relation expert of G1 and G4 is e_4. The number of chain relationship experts (5) is greater than the classification of the evaluated object (4), so it is necessary to calculate the comprehensive information entropy of the five chain relationship experts:

$$H(G_2^{13}) = H(e_2^{total}) = 2.37 \quad (2)$$

$$H(G_4^{14}) = H(e_4^{total}) = 1.32$$

$$H(G_6^{23}) = H(e_6^{total}) = 1.65$$

$$H(G_7^{24}) = H(e_7^{total}) = 1.25$$

So the set of total relationship chains is $\{H(G_4^{14}), H(G_6^{23}), H(G_7^{24})\}$.

Determine the final relationship. According to the previous conclusions, the scores of the corresponding groupings are adjusted with e_4, e_6, e_7, respectively. A more objective and reasonable scoring result is obtained. The final ratings are then ranked according to the final ratings.

3.3 Application of new studio teaching method in vocational skills

The flow chart of the activities of the new studio teaching method in vocational skills teaching is shown in Figure 6. Engineering students participate in the microteaching method vocational skills teaching activity for one month. The whole activity consists of four stages: preparation stage, initial project design stage, instructional design analysis stage, rehearsal stage and the final stage of results presentation and evaluation.

Preparation stage. The teacher releases the pre-class preparation tasks through the WeChat class group: pushing relevant high-quality MOOC online videos to students for them to observe and learn the skill base they need to learn; asking students to be familiar with the understanding of the textbook system, and asking them to independently choose to set up 6 learning groups, each with 5 members, to facilitate cooperative inquiry learning later.

Fig. 3. Presentation of the preparation stage of the new studio teaching method

Initial project design stage. After students understand the learning content and skill basics, they work in small groups to complete the learning and discussion of the content. The teacher analyzes the students' learning situation, vocational skills content and vocational skills priorities, selects appropriate technical tools and instruments, and completes the initial project design for teaching.

Fig. 4. Presentation of the initial project design stage of the new studio teaching method

Technical design analysis stage. Based on the cases used in the course, resources are retrieved and processed, and audio and video multimedia design is added to optimize the design of the course.

Rehearsal stage. Contextualization introduces the vocational skills to be learned, and the course increases interaction between the instructor and students as well as between students.

Students present their learning outcomes, and the teacher comments on their presentations and points to them. Students are guided to comment on each other's work and identify strengths and weaknesses. Students optimize their outcomes by commenting on them. The teacher can also carry out corresponding learning self-assessments to enhance students' understanding and mastery of the knowledge points.

Fig. 5. Presentation of students' outcomes and teachers' comments

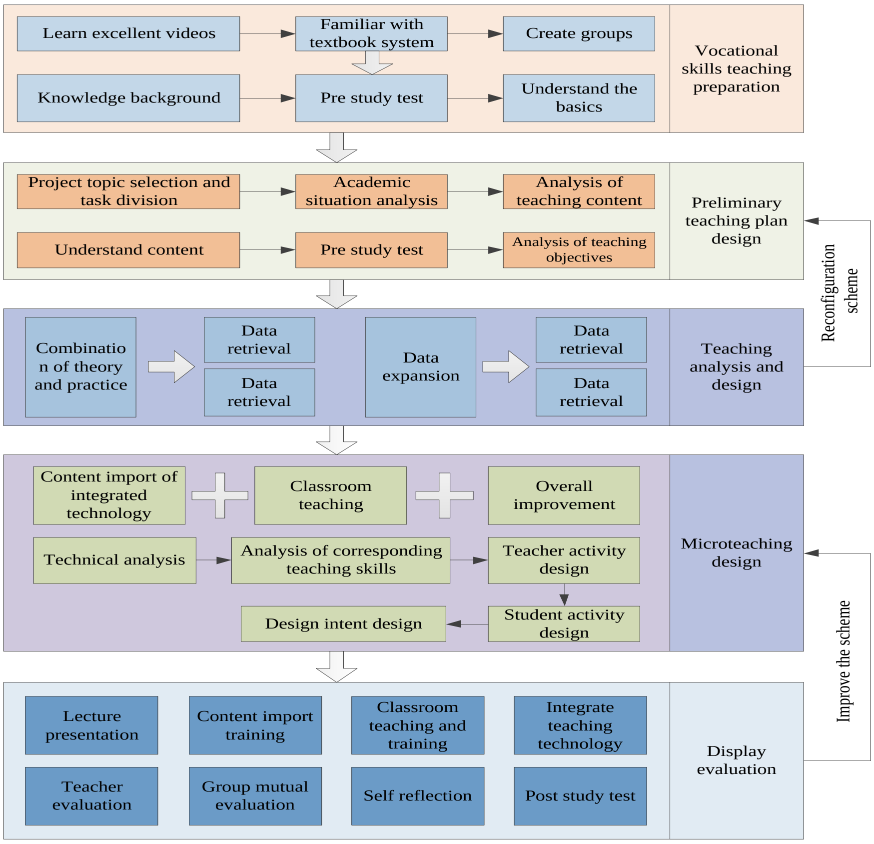

Fig. 6. Flowchart of the activities of engineering students' participation in microteaching method

4 Teaching example and effect

4.1 Teaching example

This study attempts to apply the microteaching method combined with the agile software development in teaching vocational skills, as shown in Figure 7. This model consists of two cycles: design-redesign, and investigation-exploration. Under the agile concept, the course teaching is divided into several small parts, each part is interlinked and independent, and the cycle is iterated many times through the combination of exploration and practice until the final learning is completed. The micro-vocational teaching model based on the agile software development contains the following key steps: understanding the challenges, the knowledge base required for the skills learned and the issues involved; understanding the objectives and requirements of the skills learned; analyzing and exploring the vocational skills learned and integrating them closely with practice; and presenting the learning outcomes and making reflective modifications and improvements based on the evaluation.

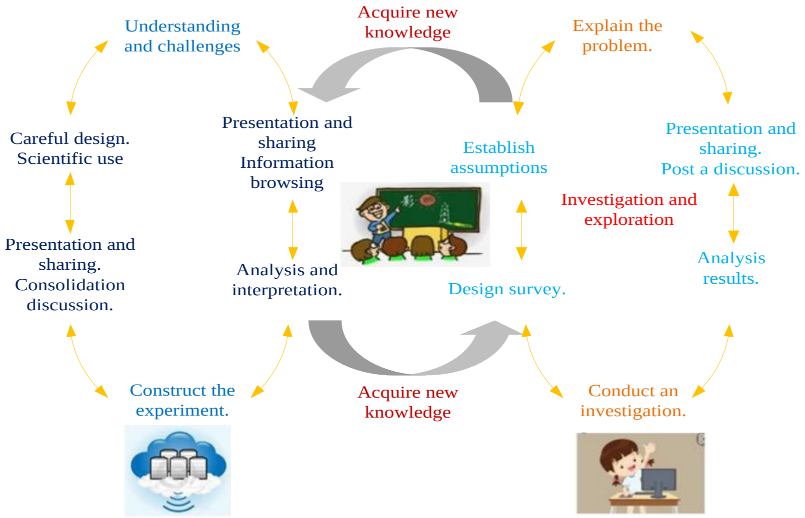

Fig. 7. Diagram of the micro-vocational teaching model based on the agile software development

4.2 Teaching effect

In this study, 100 sophomore students of engineering majors were enrolled, and all of them participated in the complete teaching process. After the course, two questionnaires were distributed to each student to investigate the evaluation of teaching and learning in the new model. The questionnaires were returned and valid, and the effective rate was 100%. Tables 2 and 3 show the statistical results of the two types of questionnaires.

Among them, Table 2 shows the evaluation of the experimental group's students on the teaching effect of using the virtual reality experimental teaching system. According to the table, more than 94% of students were satisfied with the teaching arrangement and overall, only one student was dissatisfied with the teaching arrangement, and no one expressed great dissatisfaction. The students were very satisfied with the teaching overall.

Table 2. Students' overall evaluation of teaching (n)

	Very satisfied	**Quite satisfied**	**Generally satisfied**	**Unsatisfied**	**Very unsatisfied**
Teaching arrangement	50	45	3	1	0
Teaching overall	51	43	6	0	0

Table 3 shows the evaluation of the teaching effect of using the virtual reality experimental teaching system by the students in the experimental group. Students were evaluated in six aspects: active classroom atmosphere, stimulation of learning interest, improvement of independent learning ability, improvement of teamwork awareness, improvement of learning efficiency and mastery of vocational skills, and the data from the table statistics show that the students' recognition of the teaching effect was extremely high.

Table 3. Students' evaluation of teaching effect (n)

Research content	Strongly agree	Comparatively agree	Generally agree	Disagree	Strongly disagree
Active classroom atmosphere	52	39	5	3	1
Stimulation of learning interest	51	40	4	3	2
Improvement of independent learning ability	50	38	7	4	1
Improvement of teamwork awareness	52	44	3	1	0
improvement of learning efficiency	49	37	8	3	3
mastery of vocational skills	50	41	6	3	0

The new vocational skills teaching method in this research breaks the shackles of the traditional teaching model, which makes students' learning interest, learning ability, teamwork ability and mastery of skills improve greatly, and is a successful breakthrough in teaching model innovation. The main reason for this is that the skills training of basic vocational skills, instructional design, and vocational operations in the micro-model is based on a simulation and role-playing situation. Therefore, in the process of teaching skills, teachers and students constantly explained the responses made by each other and took corresponding countermeasures at any time. The results of positive teacher-student interaction acted on factors affecting the formation of operational skills, such as intelligence level, knowledge experience and theory, motivation, explanation and demonstration, feedback, practice and reflection, thus promoting the formation of students' operational skills. Second, in this research model, students received timely feedback and guidance from the teacher, which greatly reduced the time students spend on incorrect movements and improved the efficiency of learning manipulative skills. The teacher made feedback and guidance to each group of students' theoretical knowledge learning or operational skills practice in three sessions, such as feedback and evaluation of theoretical learning, preliminary test of operational skills and final test of operational skills, which were more helpful to help students master new skills. Moreover, this teaching model was conducive to the development of individualized vocational skills. Under agile teaching, by systematically recording the whole process of students' vocational skills learning and their achievements at each stage, each student's strengths and weaknesses could be clearly displayed, which not only enabled teachers to precisely adjust students' weaknesses, but also provided a reference basis for students' future development planning, giving full play to each student's strengths and advantages to create excellent professional talents.

5 Conclusions

In this paper, a new model of vocational skills teaching is proposed, introducing the concept of agile software development and applying skill studios and information entropy-based micro-vocational skills teaching evaluation strategies. Finally, students involved in the teaching of the new model are interviewed by means of a questionnaire. The following conclusions are drawn.

1. Under agile software development, shortening the course time while highlighting the key points allows students to master the knowledge points in a shorter period of time, and to provide stage summary feedback, which helps students achieve their learning goals in a short period of time and enhances their confidence in learning. At the same time, microteaching breaks the constraints of traditional teaching location and time, students can learn more conveniently, and teachers have enough time to assess students' learning.
2. The introduction of the skills studio allows for better communication among teachers, which not only greatly improves their vocational skills teaching, but also can drive the vocational skills learning atmosphere and plays a key role in the training of high-quality vocational skills students.
3. The evaluation of micro-vocational skills teaching strategies through information entropy can correct scoring inconsistencies, improve the correctness and objectivity of evaluation results, and contribute to the improvement and exploration of vocational skills teaching.
4. However, the new teaching model also has some shortcomings, for example, the integration of information technology and microteaching is not enough, and the expert grouping in the chain evaluation strategy has a certain subjective consciousness.

In conclusion, under this new teaching mode, students' motivation to learn vocational skills is increased, they have better mastery of professional skills, learning and practice are combined, and teaching and skills are closely linked, which is a big improvement for the training of vocational skills students. In the next research, better vocational skills teaching models will be explored to make the development of vocational skills education better and better.

6 Acknowledgment

This study was granted financial support by 2021 University Philosophy and Social Science Foundation Project of Jiangsu Province (Project No.: 2021 SJA 0930).

7 References

[1] Baytiyeh, H. The flipped classroom model: when technology enhances professional skills. International Journal of Information & Learning Technology, 2017, vol. 34(1), pp. 51-62. https://doi.org/10.1108/IJILT-07-2016-0025

[2] Zhu, Y.Teaching Reform of "Production and Operation Management" Course Based on Analysis of Influencing Factors. Heilongjiang Education (Higher Educational Research and Evaluation, 2022, vol. 26(1), pp. 62-63.
[3] Du, Y.T., Zhao, L., Yang, X.J. Research of a Software Test Model-Ladder Model Based on Agile Development. Journal of Test and Measurement Technology, 2021, vol. 26(4), pp. 305-309.
[4] Katz, R. Integrating Analysis and Design in Mechanical Engineering Education. Procedia CIRP, 2015, vol. 36, pp. 23-28. https://doi.org/10.1016/j.procir.2015.01.042
[5] Verhaest, D., Lavrijsen, J., Trier, W.V., et al. General education, vocational education and skill mismatches: short-run versus long-run effects. Oxford Economic Papers, 2018, vol. 70(4), pp. 974-993. https://doi.org/10.1093/oep/gpy026
[6] Oviawe, J.I., Uwameiye, R., Uddin, P. Bridging Skill Gap to Meet Technical, Vocational Education and Training School-Workplace Collaboration in the 21 st Century. International Journal for Research in Vocational Education & Training, 2017, vol. 3(1), pp. 7-14. https://doi.org/10.11648/j.ijvetr.20170301.12
[7] Juarez-Ramirez, R., Jimenez, S., Huertas, C., et al. Promotion and assessment of engineering professional skills: A project-based learning approach in collaboration academy-industry. International Journal of Engineering Education, 2017, vol. 33(6), pp. 2033-2049.
[8] Idris, A., Buba, U., Suleiman, L., et al. Relevance of Vocational Skill Acquisition Programmes for Employment in an Era of Dwindling Economy in Bauchi Metropolis. American Economic & Social Review, 2017, vol. 1(1), pp. 45-49. https://doi.org/10.46281/aesr.v1i1.147
[9] Ouyang, C.P., Yang, X.H., Li, M., et al.Exploration on TBL teaching mode for deep professional skill training of team-type software engineering talents. Experimental Technology and Management, 2017, vol. 34(9), pp. 169-172
[10] Jin, W.L. Pilot teaching exploration based on the training mode of world skill competition -- Taking the major of automobile body maintenance technology as an example. Educational research, 2020, vol. 3(2), pp. 116-117
[11] Kang, Q. On the reform of curriculum teaching mode to strengthen the cultivation of vocational skills. New Curriculum Research, 2020, vol. 24, pp. 29-30
[12] Deng, X. Construction program for multi-functional language training laboratory —— Taking Foreign Languages Department of Luoding Polytechnic as an example. Journal of Hunan Post and Telecommunication College, 2014, 13(1), pp. 135-138

8 Author

Yun Yu is an assistant research fellow in Logistics Division, Wuxi Institute of Technology, Wuxi, China (email: yuyun@wxit.edu.cn).

Article submitted 2022-02-16. Resubmitted 2022-03-17. Final acceptance 2022-03-20. Final version published as submitted by the author.