Improving Classroom Teaching Abilities with Pair Teaching Strategy in Higher Education: A Case Study in BIGC

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Abstract. Quality of teaching in university has a great influence on students’ learning and developing. Nowadays, studies on teaching strategies have attracted more attention, but practical methods to improve teaching abilities are not common. At the same time, most studies focused on how to improve teaching abilities in theory. Teachers need specific and practical methods to help them improve teaching abilities. Classroom teaching is one of the most important aspects in higher education. Therefore, this paper aimed at providing specific implementation methods and recommendation guidelines to improve classroom teaching abilities. We introduced how to improve classroom teaching abilities with Pair Teaching strategy. According to feedbacks from both teachers and students, we got a conclusion that pair teaching can not only improve both teachers’ classroom teaching abilities, but also increase students’ learning output, which improves teaching effectiveness. The significance of the study was that we provided valuable guidance to improve classroom teaching abilities with pair teaching strategy, and we also demonstrated how to apply pair teaching strategy in C programming language in Beijing Institute of Graphic Communication as a case.

Introduction
Teaching quality of university teachers is the key factor which affects teaching effectiveness and learning quality [1]. It also has a direct influence on the quality of higher education [2] and the sustainable development of universities [3]. In China the number of students in university has been increasing with the expansion of higher education since 1999, and the unemployment rate has also been increasing among college graduates [1]. Parents and researchers have pay more attention to higher education quality. Therefore, Chinese scholars have done a lot of research and practical work on how to improve teachers’ teaching abilities, especially young teachers. Paper [4] has analyzed Chinese literatures on young university teachers’ teaching since 2009, and came to the conclusion that young university teachers are educated, potential and have strong research capability. But they are lack of education theory and practical teaching experience. Paper [5] has discussed how to improve university teachers’ teaching from different aspects such as strengthening the guiding effect of the department and teaching team, creating 3 platforms named course construction, study on teaching and education, lecturing composition, presenting 4 mechanisms named teacher training, professional development, supervising and guiding, managing and motivating.

Although the scope of research on improving university teachers’ teaching ability is expanding and the number of paper published is also increasing, there are few papers which provide practical and easy to follow guideline for teachers. Paper [6] has mentioned that
university teachers should acquire the ability of studying students, controlling teaching information, grasping excellent language skills and applying various teaching tools. But it does not illustrate how to acquire these abilities. Paper [7] analyzed the traditional mechanism on teacher training and discussed creating new mechanism to improve teachers’ teaching ability, which includes fostering the concept of developing teachers and teaching, providing effective services to improve teachers’ teaching ability and offering appropriate management space centered on teaching development.

Above research has explored new ways to improve teaching but do not provide practical guide for teachers. In short, most of researches on improving university teachers’ teaching abilities are mainly focus on theory and concepts. There concepts are abstract such as “mentoring”, “training” and platform, which are lack of concrete practical guidance [4].

This paper will provide a new way to improve teachers’ classroom teaching abilities which can be put into practice easily. By defining “Pair Teaching” strategy, we presented a case which has applied Pair Teaching in an automation course named “C Language Programming” and analyzed the result of the teaching method.

### The Definition and Structure of Teaching Abilities

Scholars haven’t reached a consensus on the definition of teaching ability. The definition of teaching ability in “The Comprehensive Dictionary of Education” is that “Teaching ability is a kind of teachers’ psychological characteristics which aims at achieving teaching objectives and engaging in teaching activities successfully. It consists of general skills and special skills. The former means the cognitive ability are presented in teaching activities, and the later means the dedicated ability in specific teaching activities.” According to the definition, the mainstream recognition of teaching ability [8] thinks that teaching ability is composed of intelligent basis of teaching ability (analytical thinking skills, creative thinking skills and practical thinking skills), general teaching ability (teaching monitoring skills, teaching cognitive skills and teaching skills) and specific teaching ability.

The structure of teaching ability has no unanimous definition, either. Paper [9] analyzed the evaluation systems of teaching ability abroad. The adopted teaching ability structure includes teaching cognitive skills, teaching design skills, teaching operating skills and teaching reflecting skills. Among them, teaching cognitive skills are teachers’ analytical skills on teaching goals, teaching tasks, learners’ characteristics, teaching methods, teaching strategies and teaching situation. They mainly includes analyzing and mastering the curriculum, analyzing and processing textbook, teaching design skills, understanding students’ personalities and learning preparatory, etc. Teaching design skills includes detailed planning and scheduling capabilities on teaching objectives, teaching contents, teaching strategies and measures. They also consist of teaching objectives designing ability, teaching internal strength integrating ability, teaching strategy designing ability and teaching plan writing ability. Teaching operating skills are mainly teachers’ problem solving ability. They mainly include language skills, non-verbal skills, selecting and using teaching media ability, etc. Teaching reflecting skills are that teachers take themselves and their own teaching activities as objects and examine, analyze and adjust their decisions, behaviors, measures and the resulting outcome.

Thus, although there is no unified definition on teaching ability, illustrations of teaching ability can show us that teaching ability is not a single ability but a comprehensive ability which carries through the entire teaching activities. This paper divided teaching ability into teaching
abilities in class and extracurricular teaching abilities according to activities in class and out of class. Teaching abilities in class mean various skills and abilities which should be acquired during teaching process. They mainly include language skills, non-verbal skills, and the ability of understanding students, classroom monitoring ability and problem solving and processing ability. Extracurricular teaching abilities mean all the teaching abilities except teaching abilities in class. They mainly include pre-class understanding ability, designing teaching methods ability, after-class reflecting ability, teaching research ability and self-learning ability, etc. These two abilities are complimentary and the ultimate goal is to improve teaching quality and promote people training.

Since teaching ability relates to a wide range of aspects, this paper focuses on studying how to improve teachers’ teaching abilities in class especially improving expression skills which include language skills, skills to use other means to transfer knowledge and skills to understand students.

**Pair Teaching Strategy**

The concept of Pair Teaching is derived from Pair Programming in computer software developing. In 1995, Larry Constantine noticed that when two programmers are working on the same task, they write codes much faster and there are fewer errors. Pair Programming has become an important ingredient of Agile Software Development which was proposed in 1996 [10].

Paper [11] introduced Pair Teaching and thought that the method can be used to prepare lessons, do experiments and arrange testing papers. Although pair teaching may need more resources and increases teaching cost, pair teaching strategy will bring more benefits.

Other researchers have used the similar theory in different courses and have achieved good results for improving students learning output. Students plan and teach a lesson to the peers in English Learning Class [12]. Teachers are paired randomly and each teacher reviewed each one’s classroom teaching in Nursing and Midwifery [13].

In this paper, by applying Pair Teaching strategy, two teachers cooperated with each other and worked on the same one course. We asked two teachers to go to classroom together. When one of the two teacher was giving lecture, the other teacher sat behind the classroom. Because this was the first time for pair teaching trail, we gave more flexibility to the two teachers. We did not plan the order of teaching. The two teachers decided who would give lecture in this lecture and who would do in next lecture by themselves.

In addition to teaching in class, the other educational activities including feedback and discussion after class, were carried out by both teachers. For teaching effectiveness, this paper emphasized two advantages of Pair Teaching in teaching: one is guaranteeing the quality of teaching by reviewing each other; the other one is benefiting carrying out teaching activities because of the flexibility resulted from two teachers working on one course.

We interviewed the two teachers at the end of the course with questionnaire including how many pieces of feedback getting from pair teaching partner and from regular peer evaluation respectively.

We also analyzed students’ course grades and compared students’ final scores (pair teaching) with previous year students’ final scores (normal single teacher teaching) of the same course.
Pair Teaching Application

Beijing Institute of Graphic Communication has done a lot of work to improve teaching quality from different aspects. Firstly, there are evaluating activities by students after courses are finished. Then, peer evaluation is executed every year. In peer evaluation, a teacher must at least listen to the other teacher’s class for 45 minutes once a year in the same profession according to the arrangement of the university. In addition, we have formulated level cadres and experts class auditing system, etc.

To some degree, the above work has improved teachers’ teaching ability. As feedbacks have little guidance, the effect of improving teachers’ teaching ability is not significant.

In order to improve university professional teachers’ teaching ability effectively, the automation discipline in School of Electromechanical Engineering starts from improving teaching abilities in class and explores how to improve teachers’ teaching ability, especially expression abilities.

The automation discipline was set up in September, 2013. And it carried teaching reform by applying Pair Teaching. At first, the course, “C Language Programming” was finally chosen to apply Pair Teaching after analyzing the professional courses and considering the importance of the course in the curriculum system and previous students’ evaluation. “C Language Programming” is an elementary course for students in automation discipline. It can lay foundation for future learning of “Programmable Logic Controller” and “Fundamentals of Mono-Chip Computers”. Since “C Language Programming” is the first professional course for freshmen in the first semester. Thus, improving teaching ability of “C Language Programming” has significance for both teachers and students.

After deciding the chosen course, we selected two teachers specialized in the course or related courses to be responsible for teaching the same course jointly.

The research focused on improving teaching abilities in class by applying Pair Teaching. One major difference of applying the teaching strategy from paper [14] was that we didn’t ask two teachers make preparations together before class, but ask them to teach together in classroom. Considering present teachers’ working situation and teaching researching situation, it was difficult to ask two teachers to prepare lessons together. Because their schedules were difficult to synchronize, it would impede the implementation of Pair Teaching. Thus, after two teachers deciding their teaching objectives, they prepared lessons and corrected homework separately. But we required two teachers to take part in teaching activities jointly, in both lecturing and doing experiments.

During teaching students in Grade 2013 “C Language Programming”, we centered on whether students can grasp or not, aimed at improving teaching abilities in class, and we carried out various flexible, not formalized teaching activities in class. To guarantee normal teaching activities carried out smoothly, it was necessary to decide who the leading teacher is every time, and the other one was assistant teacher. The exchanging of the role of leading teacher and the role of assistant teacher is regular. Teacher A was leading teacher this time, and teacher B would be leading one in the next class while A became the assistant teacher.

Since the two teachers prepare lessons separately, they have their own understanding on teaching contents. It will help the leading teacher deliver important knowledge and key points. In class, the assistant teacher will take the class with students together. When there are problems, the assistant teacher and students can propose at any moment instead of after class. If
the assistant teacher thinks that the leading teacher doesn’t express clear enough, he/she can stop the leading teacher and make supplements and interpretations.

The leading teacher and the assistant teacher should communicate and make feedbacks in time. Considering that it is difficult to spare time for teachers to communicate in class, two teachers need to spare 5 to 10 minutes to make feedbacks on teaching activities after class. Especially, they should propose constructive suggestions on language expressing, content organizing, classroom managing, etc.

In addition to teachers’ feedbacks, students’ feedbacks are also important. Two teachers need 3 to 5 minutes to collect students’ feedbacks on teaching. By analyzing and concluding students’ feedbacks, we can take further steps to improve classroom teaching.

**Results and Discussion**

By applying Pair Teaching in teaching students in Grade 2013, Automation Discipline “C Language Programming” in 2013, one of the pair teachers got 15 pieces of useful advice from partner while the other one got 20. They got only 3 and 2 ones respectively from peer evaluation in 2012. The two teachers found that they have made great progress in improving expression skills, information organizing skills and communicating skills.

At the same time, students have got higher scores than before in “C Language Programming”. There were 29 students in Grade 2013, Automation Discipline, 10 of them got excellent academic scores and 2 students failed. While students in Grade 2012 were 24, 5 of them got excellent academic scores and 8 students failed.

With pair Teaching, there was no significant difference for proportion of excellent students (p-value = 0.4285). But the difference is significant for proportion of students failed (p-value =0.03609).

Although it was not enough to prove that Pair Teaching can help improve teaching ability in class by this case, we noticed that when two teachers took charge of one course, they could realize students’ feelings and suggestions by taking part in teaching activities. What’s more, teachers could improve teaching measures and methods effectively after reflecting on themselves. Comparing with Peer Lecturing and Expert Lecturing, Pair Teaching is accurate and timely, and can get real feedbacks.

Many reasons helped both teachers improve their teaching abilities. One reason was that teachers felt less stressful in pair teaching than in peer evaluation. Because the two teachers taught in turn and had equal role, they could help each other mutually and did not worry about evaluation. The other reason was that the two teachers spent more time to get to know each other in classroom than peer evaluation. In this case, two teachers in pair teaching taught together for 1440 minutes (32 lectures) while peer teacher just stayed for 45 minutes (1 lecture).

Although Pair Teaching has many advantages, there are some caveats when we are going to imply this strategy. Firstly, teaching workload needs to be identified. The course, “C Language Programming” in Automation Discipline, has 48 class hours. When we were applying Pair Teaching, two teachers worked on one course. Each of them was allocated 24 class hours at last. The computing method of workload will be an obstacle in the long run.

Secondly, two teachers need to take part in teaching activities at the same time, and both of them need to know the content of course very well. If two teachers cannot take part in teaching activities simultaneously, the strategy will become peer lecturing and expert lecturing. If both
teachers are not familiar with contents of the course, they cannot present constructive comments.

Last but not the least, two teachers need to communicate and give feedbacks in time. When we were applying the strategy, we usually communicated and made feedbacks in class and propose questions and suggestions immediately. Since the teacher remembered the teaching activities clearly, they could realize their problems and evaluate suggestions accurately when some questions were put forward. On the contrary, if feedbacks were presented after a long period, the teacher might feel difficult to understand.

The above are our impressionable results and experiences when we were applying Pair Teaching. More need to be done in the future research on applying strategy in teaching activities, such as carrying out extracurricular activities and the effects of applying the strategy to improve extracurricular activities, etc.

Conclusion

In order to improve university teachers’ teaching abilities, we introduced Pair Teaching. Combined with the situation of Beijing Institute of Graphic Communication, we illustrated how to improve teaching abilities by applying Pair Teaching in the course of “C Language Programming” in detail. The result shows that when two teachers were taking part in teaching activities in class at the same time, both of them have improved language expression ability and class managing skills. Also, students have achieved higher scores than before. Thus, Pair Teaching is effective and valuable to improve teachers’ teaching abilities.

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