

A novel method to improve classroom teaching with a pair teaching strategy: a case study on *C Programming Language* in BIGC

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ABSTRACT: The quality of teaching in university has a great influence on how students learn and develop. Nowadays, studies on teaching strategies are attracting more attention, but practical methods to improve teaching are not common. At the same time, most studies focus on how to improve teaching in theory. Teachers need specific and practical methods to help them improve their teaching. Classroom teaching is one of the more important aspects in higher education. Therefore, this article aims at providing specific implementation methods and recommendations for improving classroom teaching. The authors have introduced a method for improving classroom teaching using the *pair teaching* strategy. According to feedback from both teachers and students, the authors conclude that pair teaching can not only improve classroom teaching, but it can also increase students' learning interest, which improves teaching effectiveness. The significance of the study is that the authors provide valuable guidance for improving classroom teaching quality with the pair teaching strategy, and also demonstrate how to apply the pair teaching strategy in the *C Programming Language* at Beijing Institute of Graphic Communication (BIGC) as a case.

Keywords: Classroom teaching, major course, pair teaching, teaching ability

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 more and more students have been going to university with the expansion of higher education since 1999, but the unemployment rate among college graduates has been increasing. Parents and researchers now 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 ability, especially young teachers.

Li et al have analysed the Chinese literature on young university teachers' teaching since 2009, and came to the conclusion that young university teachers are educated, have potential and strong research capability, but they lack a knowledge of education theory and practical teaching experience [4].

Song has discussed how to improve university teachers' teaching from different aspects such as strengthening the guiding effect of the department and teaching team, creating three platforms (course construction; study on teaching and education; and lecturing composition), and perfecting four mechanisms, (teacher training; professional development; supervising; and guiding, managing and motivating) [5].

Although the scope of research on improving university teachers' teaching ability is expanding and the number of papers published is also increasing, there are few papers, which provide practical and easy to follow guidelines for teachers. Yang has mentioned that university teachers should acquire the ability to study students, control teaching information, have excellent language skills and apply a range of teaching tools [6]. However, Yang's paper did not illustrate how to acquire these abilities. Gao analysed the traditional mechanism on teacher training and discussed creating new mechanisms for improving teachers' teaching ability, which include fostering the concept of developing teachers and teaching, providing effective services to improve teachers' teaching ability and offering appropriate management space centred on teaching development [7].

The research outlined above has explored new ways to improve teaching, but this research does not provide practical guidance for teachers. In short, most of the research on improving university teachers' teaching focuses mainly on theory

and concepts. These concepts, such as *mentoring*, *training* and platform, are abstract, and lack concrete practical guidance [4].

This article provides a new way to improve classroom teaching, which can be put into practice easily. By defining *pair teaching* strategy, a case is presented, which has applied pair teaching in an automation course (*C Language Programming*) and analysed the results of the teaching method.

THE DEFINITION AND STRUCTURE OF TEACHING ABILITIES

Scholars have not reached 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 latter means the dedicated ability in specific teaching activities.

According to the definition, the mainstream recognition of teaching ability, Xu 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 [8].

The structure of teaching ability has no unanimous definition. Yue analysed the evaluation systems of teaching ability abroad [9]. 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 include analysing and mastering the curriculum, analysing 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, analyse and adjust their decisions, behaviours, measures and the resulting outcome.

Thus, although there is no unified definition of teaching ability, illustrations of teaching ability can show that teaching ability is not a single ability, but a comprehensive ability, which carries through the entire range of teaching activities. In this article, the authors 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 include the various skills and abilities, which should be acquired during teaching process. They 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 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 article 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 development. 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]. Williams et al introduced pair teaching and thought that the method could be used to prepare lessons, do experiments and arrange testing papers [11]. Although pair teaching may need more resources and increases teaching cost, the pair teaching strategy will bring benefits.

Other researchers have used similar theories in different courses and have achieved good results. Students plan and teach a lesson to their peers in *English Learning Class* [12]. Teachers are paired randomly and each teachers reviewed each other's classroom teaching in *Nursing and Midwifery* [13].

In this article, by applying the pair teaching strategy, two teachers cooperated with each other and worked on one course. The course was offered twice a year. In addition to teaching in class, the other educational activities are carried out by both teachers. For teaching effectiveness, this article emphasised two advantages of pair teaching in teaching: one is guaranteeing the quality of teaching by having teachers reviewing each other; the other benefits carrying out teaching activities, because of the flexibility resulting from having two teachers working on one course.

PAIR TEACHING APPLICATIONS

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 have finished. Then, a teacher must, at least, listen to the other teacher's class once in the same profession. In addition, a cadres and experts class auditing system has been formulated.

To some degree, the above work has improved teachers' teaching ability. As feedback has provided 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 the 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 out teaching reform by applying pair teaching. At first, the course, *C Language Programming* was chosen to apply pair teaching after analysing 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 the automation discipline. It can lay the 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 the teaching ability of teachers of *C Language Programming* has significance for both teachers and students.

After deciding on that course, the authors selected two teachers specialised 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 from applying the teaching strategy as presented by Andersson and Bendix was that the authors did not ask the two teachers to make preparations together *before* class, but asked them to teach together *in* class [14].

Considering the present teachers' working situation and teaching researching situation, it was difficult to ask two teachers to prepare lessons. Their schedules were difficult to synchronise and this could impede the implementation of pair teaching. Thus, after the two teachers decided on their teaching objectives, they prepared lessons and corrected homework separately, but the authors required two teachers to take part in teaching activities jointly, both lecturing and doing experiments.

During teaching students in Grade 2013 *C Language Programming*, the authors focussed on whether students could understand or not. This aimed to improve teaching abilities in class, and the authors carried out various flexible, not formalised teaching activities in class. To guarantee normal teaching activities were carried out smoothly, it was necessary to decide who the leading teacher should be every time, and the other one was designated as the assistant teacher. The exchanging of the role of leading teacher and the role of assistant teacher is a regular part of pair teaching.

Since the two teachers prepare lessons separately, they have their own understanding on the teaching content. This helps the leading teacher to deliver important knowledge and key points. In class, the assistant teacher takes the class along with the students. When there are problems, the assistant teacher and students can raise queries at any time instead of after class. If the assistant teacher thinks that the leading teacher does not express him or herself clearly enough, he/she can stop the leading teacher and make supplementary observations and interpretations.

The leading teacher and the assistant teacher should communicate and provide timely feedback. Considering that it is difficult to find spare time for teachers to communicate in class, two teachers need to provide five to ten minutes to offer feedback on teaching activities after class. In particular, they should propose constructive suggestions on language expression, content organisation, classroom management, etc. In addition to teachers' feedback, students' feedback is also important. Two teachers need three to five minutes to collect feedback from the students on their teaching. By analysing and drawing conclusions from student feedback, they 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*, two teachers found that they had made great progress in improving expression skills, information organising skills and communicating skills. At the same time, students received higher scores than before in *C Language Programming*.

There were 29 students in Grade 2013, automation discipline, ten of whom obtained excellent academic scores, while two students failed. In comparison with the 24 students in Grade 2012, five obtained excellent academic scores and eight students failed. There were 29 students in Grade 2011; three of them obtained excellent academic scores and six students failed. In Grade 2010, there were 30 students, two of whom obtained excellent scores and 10 students failed.

Although it was not enough to prove from this case that pair teaching can help improve teaching ability in class, it could be noticed that when two teachers took charge of one course, they could realise what students' feelings were and receive suggestions by taking part in teaching activities. What is more, teachers could improve teaching measures and methods effectively after reflecting on themselves. Compared with *peer lecturing* and *expert lecturing*, pair teaching is accurate and timely, and can lead to real feedback being received.

Although pair teaching has many advantages, there are some caveats for when this strategy is to be employed. First, teaching workload needs to be identified. The course, *C Language Programming* in automation discipline, has 48 class hours. When applying pair teaching, two teachers worked on one course, each of whom was allocated 24 class hours. The computing method of workload could be an obstacle in the long run.

Second, 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 one of peer lecturing and expert lecturing. If teachers are not familiar with the course's content, they cannot present constructive comments.

Last, but not least, the two teachers need to communicate and provide timely feedback. When applying the strategy, it is better, if communication and feedback is provided in class and questions and suggestions should be proposed immediately. Since the teacher could remember the teaching activities clearly, they could realise their problems and evaluate suggestions accurately when questions were put forward. On the other hand, if feedback was presented after a long period, the teacher might find it difficult to understand.

The results and experiences identified above arose when pair teaching was applied. More needs to be done in 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.

CONCLUSIONS

Pair teaching can be introduced in order to improve university teachers' teaching abilities. Combined with the situation at Beijing Institute of Graphic Communication, the authors illustrated how teaching abilities can be improved by applying pair teaching in the course of *C Language Programming*.

The results show that when two teachers were taking part in teaching activities in class at the same time, both of them made great progress in improving their language expression skills and class managing skills. Also, students achieved higher scores than in the past. Thus, pair teaching is an effective and valuable way to improve teachers' teaching abilities.

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BIOGRAPHIES



Yongbin Zhang graduated with a Bachelor of Computer Science from the Institute of South West Petroleum in China, in 1996; he received his Master's degree in Computer Science and a Doctor of Philosophy from China University of Petroleum in 1999 and 2002, respectively. Yongbin Zhang is currently working at Beijing Institute of Graphic Communication as an Associate Professor.



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