

On the Practice and Research of Continuing Education for Mathematics Teachers in Primary and Secondary Schools Based on Lesson with Heterogeneous

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Abstract. Lesson with heterogeneous plays an effective role in applying educational theories directly into classroom teaching in the continuing education for mathematics teachers in primary and secondary schools. Different teachers teach the same content and conduct teaching exchange and seminar by following the order of "lecturing, attending lecture and evaluating lecture", which presents ways of interpretation and teaching methods on the same mathematic knowledge by different teachers, shows teachers personalized teaching styles and presents diversified classroom teaching, thus achieving the goal of improving professional quality of mathematics teachers in primary and secondary schools. What's more, it boosts the professional development of mathematics teachers and realizes the objective of continuing to train teachers.

1. Introduction

In the new round of "national training program for teachers in primary and secondary schools", short for "national training program", our college, as the first batch of selected training colleges, trains teachers more targeted, inclusive and effective compared with previous "replacement full-time training" in national training program.[1] And lesson with heterogeneous in which different teachers prepare the same teaching content on their own in accordance with their own teaching concepts and practical teaching experience is unique and welcomed and adored by trainees. They call it as "the most down-to-earth" training program. Such teaching activity is a multi-dimensional teaching and research model for cooperation, sharing, exchange and improvement. We can compare different ways of dealing with the same textbook content by different teachers and different teaching effects caused by different teaching strategies in teachers training. In addition, it is an efficient path to reflect teaching personality of teachers, present ways of interpretation and teaching methods on the same mathematic knowledge by different teachers and show teachers personalized teaching styles. In the meantime, each teacher can watch different models of classroom teaching and find out new teaching methods and existing problems. It is required teachers to update their educational concepts, innovate management model and vigorously promote curriculum reform if we want to deliver results in lesson with heterogeneous. The training method of "lesson with heterogeneous" can stimulate trainees to spark the fire of wisdom, promote their virtues and correct their defects and learn from others' strong points to offset their weaknesses, which can significantly improve teaching effect in mathematics classroom. [2] As we know, if "you have an apple and I also have an apple, then everyone still has an apple after exchange; on the contrary, If you have an idea and I have an idea, then everyone has two different ideas after exchange." Based on fully understanding textbooks and the design of teaching methods, "lesson with heterogeneous" underlines the thought and concept of "seeking common ground while reserving differences", which reflects different ways of dealing with the same textbook content by different teachers and different teaching effects caused by different teaching strategies. Teachers have changed their attitude from incomprehension of such training mode into active communication and participation in lectures and evaluating lectures, thus promoting the fundamental change of training and teaching and research mode and broadening teaching ideas of each teacher, which can effectively show teaching personality of different teachers, [3] unify

inheritance and criticism and realize resources sharing and complements each other's advantages. In addition, it can improve teaching quality in classroom, optimize classroom structure and reform students' learning style, thus substantially improving teaching efficiency in classroom.

2. Teaching form of Mathematic Classroom in Primary and Secondary Schools Based on Lesson with Heterogeneous

2.1 The way of lesson with heterogeneous is to respect educational law

As national training program, the primary mission is to promote mathematics teachers in primary and secondary schools who attend this program to fundamentally improve their teaching methods and their students' learning quality. [4]Then it should center on the development of teachers and respect the subject position of teachers, which is the basis for effective teacher training. Therefore, we have conducted extensive and in-depth investigation and firstly innovated training mode in the province to carry out significant and substantial exploration and practice while respecting educational law and subject position of teachers on the basis of summarizing previous experience of national training program, thus making fruitful results. And lesson with heterogeneous is one of the most important projects in this context, which is the most favorable program for trainees.

2.2 The activities of lesson with heterogeneous focus on key issues.

Classroom teaching is both the starting point and destination for mathematics teachers in secondary schools to greatly improve trainees' teaching methods in national training program. Thus, it becomes the key problem for teaching with great significance. And lesson with heterogeneous becomes the most direct way to improve teaching quality and ability for mathematics teachers in primary and secondary schools. [5]It must have to be led by educational concept and show teaching skills under the guidance of teaching method in order to achieve actual effective result in lesson with heterogeneous instead of merely a simple mathematic teaching activity in primary and secondary schools.

Different teachers prepare and teach the same content according to their own reality and understanding, which is called as lesson with heterogeneous. Since different teachers have different teaching styles and understanding on lessons and adopt different teaching methods and strategies, thus the same content is interpreted with different styles, methods and strategies. Then other teachers can compare these lectures, combine the teaching effects, find out the advantages and disadvantages and reflect on their own experience to deliver this lesson or enlighten those teachers who haven't yet delivered this lesson to re-prepare this lesson. [6] Lesson with heterogeneous is designed in accordance with the reality of primary and secondary schools students, existing teaching condition and teachers' characteristics, which provides a platform for face-to-face communication and interaction. In this platform, teachers can discuss hot and difficult problems in teaching and teaching art together, exchange for teaching experience and share successful joy, or even sleep fitfully and eat without relish to reflect on certain unsolved problems. Multidimensional, different styles and strategies spark fire and sublimate in such exchange. Such multi-level cooperation and discussion in an all-round manner can improve teaching and research level of teachers and enhance mathematic teaching quality in secondary schools.

How to achieve the above-mentioned goals? We should firstly study three educational theories. The first theory is Polya' problem-solving theory.[7] It should grasp its 4-step process: "understanding the problem, devising a plan, carrying out the plan and looking back". The second theory is Freudenthal's mathematics education theory. It should know that mathematics comes from reality, rests in reality and is applied into reality. Every student has their own different "mathematic reality". And one of missions of mathematics teachers is to help students to construct mathematics reality, on the basis of which teachers should develop their mathematics reality. Therefore, in teaching process, [8] teachers should make full use of students' cognitive rules, existing life experience and mathematics reality. Then it should take further step to study the mathematics education theory of constructivism. Teachers should not simply impart knowledge into students. Students themselves should construct knowledge and actively build the significance of knowledge rather than passively receive information. Such construction cannot be

replaced by other people. Teachers must build the mode in which students can understand mathematics. They should establish "archive" that reflects construction status of each student in order to measure students' ability in construction. [9] Teaching is the interaction between teachers and students and among students. Students decide for themselves whether the construction is reasonable or not. The third is Ausubelian theory of learning--accepting learning theory and mathematics learning. Through studying these three educational theories, trainees can master the nature of each educational theory and apply them into teaching activities of lesson with heterogeneous.

2.3 Diversified teaching and research activities in lesson with heterogeneous

It is insufficient to be led by educational theories. It must master common teaching methods. [10] We aim to the disciplinary knowledge of mathematics of "graphics and geometry" in primary and secondary schools to mainly introduce cooperative inquiry method, scaffolding instruction, guided trial and effect feedback method, guided trial method and other teaching methods to trainees. With respect to the knowledge of "statistics and probability", we mainly introduce inquiry method, experimental method and inductive method and at the same time our reform on classroom problem-solving teaching mode featuring "understanding-reflection -exploration-improvement" based on improving students' core quality and other teaching methods such as how to "use textbook to teach" to trainees. In the part of "graphics and geometry", we decide to use "median and number in 8th grade" as the content of lesson with heterogeneous. Among mathematics teachers in 5 counties which are in this training program, one trainee is recommended to give the lecture based on careful preparation. And the school which hold lesson with heterogeneous should recommend one mathematics teacher to take part in the lecture. It requires that each lecturer should present at least one educational theory and one teaching method and show their unique teaching style in the classroom teaching in the same lesson with heterogeneous.

After class, discipline instructor and trainees evaluated and discussed together. First, three trainees comment on this lecture from the aspects of the use of methods to solve disciplinary problems, capability training for teachers and guiding and demonstration role of activities on the growth of teachers. The trainees ask questions and interact with each other. At last, the chief expert in this discipline concludes, guides and evaluates the rules of problem-solving in this field. In the process of lesson with heterogeneous, educational theories and teaching methods are well presented in classroom teaching. In the process of organizing teaching, each teacher who attends lesson with heterogeneous no longer adopts one-way model characterized by imparting knowledge-exercises-conclusion but uses problems to guide students to inquiry and cooperate with each other in a decentralized manner after centralized study, adding scene practice after creating environment. In activities, facing with the same teaching content and different students, teachers construct outstanding teaching design, present different teaching styles in the classroom, endow static textbooks with life and vigor and shape creative classroom teaching mode with unique and diversified characteristics in accordance with their own life and emotional experience. [11] Students actively take part in teaching activities in pleasure atmosphere, which can effectively boost their interest in learning mathematics and motivate their learning enthusiasm. Meanwhile, the whole teaching process can be well organized, thus achieving the effectiveness of classroom teaching. Lesson with heterogeneous brings up diversified classrooms, which is conducive to both mutual discussion and exchange among teachers and the improvement of teachers' professional quality and basic skills.

3. Summary

Lesson with heterogeneous provides a study and communicative platform for trainees. And it is a research activity in real classroom teaching situation. According to course contents, each teacher, together with their team trainees, formulates design, carries out teaching, tests effect and improves themselves together, which is horizontal teaching and attending lecture with mutual instruction among colleague. Teachers can ask questions, analyze and discuss through attending and evaluating the lecture, thus improving their own teaching behavior and enhancing teaching level. Teachers who attend the lecture are both learners and researchers. The purpose of lesson with heterogeneous is to make different teachers

construct teaching design of different significances, present different teaching style, infuse fresh life into static textbooks and cultivate personalized students according to the actual situation of their students, their own knowledge background, life, emotional and teaching experience when facing with the same teaching content. [12]Such activity not only embodies the lecture, but also provides scientific foundation for further research and analysis, and self-reflection materials for self-improvement of teachers and their colleagues.

The well-organized lesson with heterogeneous is carried out orderly with careful guidance of discipline instructors, active participation of trainees and meticulous preparation of teachers. Since teaching is a long process, teaching reflection can effectively promote professional development of teachers and shorten the journey into a famous teacher, which is the specific practice to apply educational theories and methods into real classrooms. Such teaching, communicative and research activity centers on "lecturing, attending the lecture, evaluating the lecture", [13] provides study and exchange platform for teachers and cultivates and trains young teachers, thus promoting teachers' professional quality. And it presents different ways of dealing with the same textbook content by different teachers and different teaching effects caused by different teaching strategies to us and shows teachers unique teaching styles and different teaching design, plan and methods, making trainees who attend the lecture feel the teaching art and charm of mathematics. What's more, it makes teachers spark more creative fire in the collision of ideas, both realizing the most effective teaching and improving teachers' classroom teaching level and professional quality. And the same lesson with heterogeneous is welcomed and adored by trainees. They call it as "the most down-to-earth" national training program for continuing education. The same lesson with heterogeneous centering on "lecturing, attending the lecture, evaluating the lecture" is a communicative and research activity which provides study and exchange platform for teachers and cultivates and trains young teachers, thus effectively promoting the professional quality of mathematics teachers in primary and secondary schools.

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