Strategies and Approaches for Cultivating Normal-school Mathematics Students' Math Problem Solving Ability

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Abstract

Normal school students are the new force of the future teachers, and the quality cultivation of them directly determines the quality of teachers. As mathematics students' math problem solving ability (MPSA) declines after the entrance of normal college, a great negative impact on the formation of future teachers' quality is being exerted. On the basis of analyzing the present situation of normal-school mathematics students' MPSA, this paper discusses the significance, strategies and approaches for cultivating MPSA.

Keywords: normal-school mathematics students; math problem solving ability (MPSA); strategy; approach

From 2016 onwards, student who wants to obtain a teacher certificate has to participate in the national unified examination (referred to as "national exam") which has a considerably low pass rate. After gaining the teacher certification, however, if anyone want to take a teaching position, especially in public schools, he or she must participate in a unified public recruitment examination. This means that normal school students are no longer standing a leading edge in the education industry.

In addition to examining the educational concept, professional ethics and educational regulations that enable an applicant to engage in the teaching profession, the basic abilities such as scientific and cultural qualities, reading comprehension, language expression, logical reasoning and information processing, and the applicant's basic knowledge of education and teaching, student guidance and class management, it focuses on the applicant's basic knowledge of the expected teaching subject. Also during their working, their teaching quality is still the mostly inspected by the employer.

Therefore, in training normal students, more attention should be paid to the cultivation of core attainment and qualities for a teacher, including solving math problems. Mathematics, as the backbone subject of primary and secondary school teaching, is playing a vital role in the high-school and college entrance examinations. We can even can say that the success or failure of math, to a large extent, will determine the result of the high-school and college entrance examinations. In normal school mathematics students' training process, one should put the development of MPSA in the most important position.

1. The connotation of mathematics normal students' MPSA

Teachers' qualities include reading comprehension, information gathering and feeling ability, oral

expression, written expression, media expression and modal expression, general ability, teaching ability, professional ethics and behavior, general knowledge, subject knowledge and educational science knowledge. The teaching ability includes the study and treatment of teaching materials, teaching design, classroom organization and management, classroom feedback and regulation, teaching measurement and evaluation and subject problem solving ability. For a math teacher, MPSA is by all means the core attainment. MPSA refers to the teacher's ability to solve and answer all kinds of math problems in the specific or crossed teaching boundaries.

For normal-school mathematics students, MPSA also includes solving a variety of primary and secondary school mathematics competition problems. Currently the officially or privately sponsored mathematical contests are mushrooming in different forms and scales. Although there are some controversies on these contests in the education field, it is very necessary for mathematics teachers to improve their ability and knowledge of solving math problems through studying mathematical competition problems and to deepen the depth of their understanding of mathematics subject.

2. Status quo: normal-school mathematics students' MPSA

The aim of normal schools, or teacher-cultivating colleges and universities, is to train primary and middle school teachers who will serve the elementary education in the future. Therefore, students in these schools are bearing the social responsibility and historical mission. The teaching ability and quality of normal school students as prospective teacher force in the future will largely affect and even determine the quality of basic education and training.

At present, the basic MPSA of normal-school mathematics students is not optimistic. In occasional tests of college or high-school entrance exams on students of the school that the author works for, their average score is around 80 (out of 150) only, which is very alarming. As the analyzing suggests, the main reasons for their declining MPSA are: (1) the emphasis is put on the teaching of theoretical knowledge in universities rather than in students' practical ability, causing the students to lack basic operational ability; (2) the advanced mathematics courses, such as ordinary differential equations, real variable functions and so on, are aloft from basic education courses, unable to adapt to the needs of basic education; (3) learning is a heavy duty for mathematics students who are really struggling in university courses; (4) students lack the proactivity in learning, reluctant in find time to study primary or high-school math problems; and (5) there is the absence of a certain height in math learning to establish a bond or bridge between the university mathematics and the primary and high-school mathematics.

In fact, a lot of normal-school mathematics students, in addition to tutoring as a part-time job, seldom will take the initiative to revisit the techniques on solving primary and secondary school problems ever since entering the university. Their good problem solving habits formed in the early high school period are slowly abandoned. At the end of their college year when they begin to realize the importance of MPSA during their internship, to start over is often less effective.

The cultivation of MPSA has gradually attracted attention of schools and students. At present, several normal schools have launched the Excellent Teachers Cultivation Program which aims to train a group of excellent teachers who are devoted to basic education with solid professional knowledge and strong

teaching ability. More explicitly, four specific objectives have been put forward: acquiring good teaching and scientific research ability; acquiring good teaching material analysis and processing ability; acquiring good MPSA and question setting ability; acquiring higher class management and control ability. At the same time, a four-year normal school student skill training frame is being implemented, and normal school students must complete their professional practice credits and practically gain the ability to apply the learned subject knowledge to solve problems after being trained on listening, hand writing, speaking, teaching, calculation and other basic skills, teaching techniques and microteaching.

3. Significance of cultivating mathematical normal school students' MPSA

3.1. MPSA is required for future teaching

Mathematician Polya pointed out that the primary task of secondary school teaching is to strengthen the training on MPSA. The value of MPSA lies in understanding the context of solution, and clarifying the reasons behind. In fact, problem solving practice can help to digest basic subject knowledge, optimize thinking quality, and strengthen the problem solving methods; moreover, it enables students to know better the taught material, form teaching ability and flexibly use teaching materials via the problem solving training.

3.2. MPSA is required for future scientific research

Math problem solving is an important content and part of research on mathematics teaching. Normal-school mathematics students should take advantage of the rich literature resources of university library, collect extensive data of problem solving, fully participate in problem solving practice, deeply analyze the process of problem solving and develop more research topics. They can also use the abundant peer resources to build problem solving research team, select appropriate research topics, and try preliminary teaching study. Such teaching research practices also greatly promote a normal-school student's qualities and core attainment as a teacher.

3.3. MPSA is needed for improving professional development

At present, all countries attach great importance to the professional development of teachers. From the perspectives of "professional consciousness, professional knowledge and professional competence" brought by the United States, and the perspectives of "professional commitment, professional knowledge and professional practice" by Australia, the professional development is expressed. Whatever ability is being developed, it is rooted and growing in a variety of practice. Normal-school mathematics students should harness various practice platforms, accumulate problem solving experience, master the thinking methods, and improve MPSA, through part-time job and primary and secondary school internships, through communication with classmates, and through a large number of problem solving training practices, so as to upgrade the qualities and core attainment as a teacher, and to provide power for achieving professional development.

4. Strategies for cultivating normal-school mathematics students' MPSA

4.1. Learn the theory. Lay emphasis on learning problem solving theory from *Elementary Algebra*, *Elementary Geometry*, *Elementary Number Theory*, *Competition Mathematics* and other courses. Learning problem solving theory is a systematic project; only with a certain problem solving theory as a guide can one stand at a higher level to see problem solving process, and only with it can one turn the process of MPSA training into efficient learning behavior, and achieve new upgrade in the process.

4.2. Analyze typical examples. Analyze and research problems in the high-school or college entrance exams as well as various international and domestic competitions, and choose the most representative problems to do in-depth study. With a specific problem as a clue, sort out a series of related problems, and gradually form a category. Through analysis on a variety of typical cases, probe into problem solving ideas, summarize problem solving rules, and then naturally generate solutions. With this methodology as a guide, classroom teaching and teaching research can be flourished with rich first-hand materials.

4.3. Reflect the process. Some say that "teaching is an art of pity". Again, no problem can be solved perfectly. After solving the problem, seriously reflect on the process of solving it, study the proposition intention, think over different solutions and optimize the problem solving strategy. Through the research on the old problems and the collection of the new, deepen the understanding of subject knowledge, comprehend the thinking pattern and promote the optimization of thinking structure and the sublimation of the quality of thinking, so as to improve the application of subject knowledge in problem solving.

4.4. Focus on problem explaining. Normal-school mathematics students should give the answers to mathematical problems through independent thinking and extensive reading of literature, improve the process of solution through team discussion, and turn MPSA internal force into mathematical literacy through the problem explaining. In problem explaining that is based on the education theory and problem solving theory, a teacher faces his peer and expresses generally how a specific problem is solved. Problem explaining is a very critical means to improve MPSA of mathematics students. What to explain? The significance and meaning of the problem, the way and seeking of thinking, the induction and comparison, the expanding and promotion, how to reach the goal, the educational value, etc. What to discuss? The applicability and solution of the problem, the student's understanding of the subject, the value of improving the student's learning effect and so on. Simply put, Problem explaining settles on talking about the problem, the thinking way, the thought, the promotion, the value, etc.

5. Approaches for normal-school mathematics students to improve MPSA

The cultivation of MPSA is of great significance to the formation of teacher quality of normal-school mathematics students, and thus more attention should be paid to methods and strategies of the cultivation. Cultivating of MPSA should be different from the simple problem solving in secondary school which only focuses on getting the answer, chooses only their familiar part to solve and therefore ignores strange

areas. The normal-school mathematics students should pay more attention to understanding the problem accurately, using the appropriate solution proficiently, and integrating the comprehensive subject knowledge so as to promote the in-depth study on the curriculum standards and the syllabus, in order to actually raise their teacher quality and core attainment via MPSA.

Normal-school mathematics students should make full use of college time, and link the basic subject knowledge, basic ideas and basic methods into a network by answering and researching the questions on teaching materials. Through the study on original problem types in high-school or college entrance examinations and various model tests, continue to accumulate new knowledge and new methods, and grow with the time in the practice of solving problems. Through the study of related competition problems, they will be familiar with those novel, simply expressed and solution-cleverly-set good exam questions, and train their thinking agility, depth and creativity. Through accumulating and sorting out good questions, prepare for the future classroom teaching and after-school counseling preparation, and collect more valuable materials for problem solving research, teaching research and teaching reform.

As to the specific methods to improve MPSA, firstly, normal-school mathematics students can seize spare time and practice on solving random questions at any time anywhere. Such random problem solving training mainly cultivates normal-school students' MPSA, which is flexible, easy to operate, and easy to link, deform, expand and promote the questions. Secondly, they should also squeeze a block of time for time-limited training. Time-limited training is mainly to help developing good problem solving habits. Choose questions from the college or high-school entrance examinations, good questions from model tests as well as middle to high class questions in math competitions, reduce the problem solving time, and then start the time-limited exercise to train the problem solving thinking and cultivate thinking ability.

6. Conclusion

It is suggested that, in the process of cultivating normal-school mathematics students, normal schools can adjust the traditional mode of cultivation by combining the requirements of "National Exam" (teachers' qualification certificate exam), focus more on training students' comprehensive practical ability, including problem solving and teaching, to form and optimize the four-year system of practical ability cultivating model. In practice, we should strengthen the training of listening, speaking, reading, writing and problem solving, so that they can be familiar with educational theory and laws and regulations, and constantly improve their class lecturing, teaching method explaining, problem solving and explaining levels, so that students can be handy in the Q&A session after obtain a certificate in the written test.

With respect to the math MPSA, better MPSA would not only help normal-school math students to pass the teacher certification examination, but also empower them to face the employment market with self-confidence. After entering the primary school or the secondary school, they can easily deal with classroom teaching and student guidance, become skilled in education, teaching and class management soon, finish the internship quickly, and grow into outstanding young teachers and backbone teachers promptly.

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