

# Characteristics of Efficiency of Mathematical Instructional Behavior

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*This paper concludes high efficient mathematical instructional behavior factors through interviews with researchers of mathematics education, videotaped teaching from middle school mathematics, and surveys from mathematics teachers. Based on these characteristics, an efficient mathematic instructional behavior is supposed to be scientific, intellectual and artistic in comparison with low-efficiency teaching. The study contributes to better understanding how to be high efficient mathematics teachers.*

**Keywords:** high efficacy; characteristic; mathematical instructional behavior

Teachers' classroom instructional behavior plays an important role in the efficiency of mathematics teaching (Wang, 2006). The concept of efficiency of mathematics teaching was developed in 1896, which emphasizes on analysis of teacher's instructional behavior. Since then, various researches about teachers' instructional behavior were introduced to the field of mathematics education. For instance, in 1960s and 1970s, researchers were focusing on teachers' classroom teaching behavior with emphasis of relationship of student achievement and teachers' instruction; in 1980s, researchers were focusing on the teaching's behavior on relationship between student motivation and classroom learning activity. Broder and Dorfman (1994) suggested students' learning is the most important purpose for teaching. Recent year, research on teachers' classroom behavior has been paid a great attention in the field of mathematics education. The main reason is that teachers' classroom behaviors become more and more important for effective teaching and student achievement. Therefore, research on teachers' classroom behavior not only should be advocated but also is necessary.

What is teacher's instructional behavior in mathematic classroom? Authors give following definition: High efficient mathematic teaching is teacher's classroom instructional behavior that may stimulate students' high learning efficacy. In this short review, we try to draw the characteristics to

High Efficient Mathematical Instructional Behavior. Based on authors' conducted interviews with researchers of mathematics education, videotaped teaching from middle school mathematics, and surveys from mathematics teachers, following factors may play an important role for high efficient mathematical instructional behavior:

1. Mathematics teachers should focus on stimulate students' interest through examples of daily life or students' existing mathematical knowledge.
2. Mathematics teachers should focus on students' understanding of mathematics concepts by comparing between different concepts and representing principal concepts in various ways to help them form a good cognitive structure.
3. Mathematics teachers should focus on mathematical language and symbols and train students to form a good habit and ability to use mathematical language properly.
4. Mathematics teachers should focus on explaining important and difficult points of the content to students to keep whole lesson rhythmically.
5. Mathematics teachers should focus on the basis and levels of students' practice and exercise.
6. Mathematics teachers should always pay more attention to reveal the education nature of mathematics, such as pursuit of the true, the good and the beautiful, rational, concise mathematic language, coherence of knowledge, connectivity of mathematics ideas, rigorous reasoning, gorgeous mathematics thoughts, charms of application, etc.
7. Mathematics teachers should focus on showing students the origin and development of math concepts and symbols, to make students understand mathematics culture better.
8. Mathematics teachers should focus on summarizing mathematics laws and spreading of mathematical thoughts and methods, and let students better understand mathematics is a subject with characteristics of thoughts and methods.
9. Mathematics teachers should often make a creative process of the content, teaching in their own unique ways.
10. Mathematics teachers should focus on creating problems at different levels to lead students to think in their cognitive order.
11. In teaching process, math teachers should focus on creating situations to let students experience the "re-creation" process through observation, experiment, induction, analogy and other activities.
12. Mathematics teachers should focus on selecting examples with exploration values and doing proper variant teaching, to make students feel the beauty of mathematical methods and mathematical thoughts.
13. When students' answers are neither precise nor complete, mathematics teachers should continue to make more detailed inquiry to help students finished.

14. Mathematics teachers should focus on making guidance for students in need timely and properly from feedback (a look or an eyebrow etc.) of students.
15. When students get stuck in mathematics learning, mathematics teachers should focus on instructing them from thoughts and methods timely, not just answers.
16. Mathematics teachers should integrate their own characteristics into teaching to vitalize the whole lesson and attract students' attention.
17. Mathematics teachers should focus on teaching from a higher level of knowledge system to better establish vertical and horizontal linkages between knowledge points.
18. In the process of instructing, mathematics teachers should focus on revealing their thinking process of solving problems to students.
19. Mathematics teachers should be good at using a variety of instructional medias and models to optimize the teaching process.
20. Mathematics teachers should focus on teaching reflection and at the same time properly leading students to reflect on their learning.

Based on these characteristics, we have following conclusion. In comparison with low-efficiency teaching, an efficient mathematic instructional behavior is supposed to be scientific, intellectual and artistic. The indispensable constitutes of scientific characteristic are: (1) teaching the key connections among curriculum content by organizing each lesson with rational teaching target, primary knowledge and difficult points; (2) promoting students' learning by constantly optimizing their mathematical structure with not only cognitive systemic understanding to mathematical knowledge, but also non-cognitive drive to both the knowledge and skill, and the meta-cognitive methodology to mathematical learning as well; (3) fulfilling the cultivating function of the discipline with the spirit, idea, method and rational thinking embedded in mathematical education. As a supportive characteristic, being intellectual demands teachers' wisdom and creativity in both the selection of content and means to teaching and the control of teaching process and rhythm, and being artistic may require some awareness of aesthetic component at the lecture, gesture and writing aspects, and being scientific is both the premise and the destination to the effectiveness of mathematical instruction. Therefore, intellectual and artistic are crucial for high-effective mathematical instruction.

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