ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

Evaluation and construction research of middle school mathematics classroom teaching based on situational cognition theory

Tianshui Peng[a], Jinhui Dong

Huanggang Normal University, Huanggang, 438000, China
[a]2975564120@qq.com

Abstract: *As an important link to ensure the quality of classroom teaching, teaching evaluation plays a great role in the teachers 'professional development and students' training. China's new curriculum reform also clearly points out that "we should establish an evaluation system to promote the comprehensive development of students". Therefore, it is very necessary to carry out the effective teaching evaluation in the field of middle school mathematics. Guided by the theory of situational cognition and referring to domestic and foreign literature, the paper constructs a middle school mathematics classroom teaching evaluation system with classroom atmosphere, learning motivation, knowledge mastery degree, the development degree of core literacy, the interdisciplinary ability to solve practical problems, and the culture and spirit of mathematics.*

Keywords: *middle school mathematics; situational cognition theory; classroom teaching evaluation*

1. Foreword

Teaching evaluation is an important link of school education and teaching activities, and a value judgment of the effect of teaching and learning. In the wave of global development of teaching evaluation theory, China's teaching evaluation reform has experienced from "selection first" traditional teaching evaluation to "development oriented" of modern teaching evaluation, to "literacy" contemporary teaching evaluation of the development of more than 40 years [1], and now, how to build the evaluation system to evaluate students' core quality, is particularly important. Is not hard to find, in the long development of the teaching theory and evaluation theory, evaluation theory is along with the development of teaching theory, they present a two-way spiral progressive relationship, in the last stage, constructivism became the mainstream, with the developmental evaluation became the late nineteenth century the most widely used evaluation theory, today also has a great influence. Now, in terms of the development of learning theory, situational cognition theory has replaced constructivism and become the mainstream.

Situational cognition theory is a new educational theory proposed in the mid-1980s. It emphasizes the interaction relationship between individuals and the environment, and advocates placing learning in specific scenarios. Different from the traditional education method that values knowledge and ignores the process of results, it believes that learning is not simply receiving information, but actively constructing the meaning of knowledge through practical activities. As a theory that is not completely independent, it takes into account the essence of the three theories of behavior, cognition and constructivism, and is regarded as a comprehensive theory.

At present, the research on situational cognition theory at home and abroad mainly focuses on the following aspects: first, to explore the connotation and characteristics of situational teaching method [2] [3] [4]; second, to analyze the implementation strategies and advantages of situational teaching method [5] [6]; third, to explore the combination of situational teaching method and other teaching methods [7] [8]. However, few scholars have discussed the combination of situational cognition theory and teaching evaluation.

In fact, mathematics as a strong abstract subject, pay more attention to the training of thinking ability and the formation of logical reasoning, in the current "examination" "the university entrance exam" is difficult to shake, to the test scores as the disadvantages of final evaluation increasingly appear, is not conducive to the cultivation of students' mathematical advanced thinking ability and the long-term development of mathematics learning.

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

2. The main problems existing in the current mathematics classroom teaching evaluation

In his article "Construction of mathematics Classroom Teaching Evaluation Index System", Ren Yudan mentioned many problems existing in the current mathematics classroom teaching evaluation index, and improved them, and put forward the table of junior middle school mathematics classroom teaching evaluation index [9]. On this basis, the study believes that there are still the following problems.

2.1. The evaluation methods are not rich enough, not flexible and diversified

As mentioned in the Mathematics Curriculum Standards of Ordinary High Schools (2017 edition 2020 Revision) (hereinafter referred to as Curriculum Standards), the subjects of teaching evaluation should be diversified and the evaluation forms should be diversified [10]. If the evaluation cannot fully and accurately reflect the students' quality and ability of mathematics learning, then the corresponding educational goals can not be achieved.

2.2. Subject separation creates a mathematical island

Mathematics is a formal science, and mathematics cannot be separated from other disciplines, otherwise it becomes meaningless. Traditional classroom teaching evaluation emphasizes the division of subjects, and it is difficult for students to combine different subject knowledge to form a systematic cognition, thus forming a mathematical island, which cannot truly reflect students 'ability to solve practical problems obtained by learning mathematics, and it is difficult to stimulate students' interest and enthusiasm in learning.

3. Exploration of mathematics classroom teaching evaluation based on situational teaching theory

Because teaching and evaluation are in the same line, the requirements for teaching also reflect the content of evaluation from the side. For example, students 'abstract ability is emphasized in mathematics teaching, and teachers will intentionally cultivate students' abstract ability in teaching, so that abstract ability will become one of the contents of mathematics teaching evaluation. Therefore, discussing the advantages of situational teaching theory in mathematics teaching also reflects its advantages in teaching evaluation.

3.1. The advantage of situational teaching theory in mathematics teaching

Situational cognition theory and constructivism theory have a common philosophical standpoint: they recognize the integrity, context and constructiveness of knowledge, but there are important differences between them. Constructivism emphasizes the internal construction process of the human brain, while the situational cognition theory focuses on the specific external situation [11], and more emphasizes the organic combination of people and the environment. In this sense, the learning theory has experienced the dialectical development process from "outside" to "inside", and then from "inside" to "outside". In a sense, the situational cognition theory has realized the transcendence of constructivism.

According to the research, the advantages of situational cognitive theory in mathematics teaching are mainly reflected in the following aspects:

3.1.1. Can more fully mobilize the students' enthusiasm for learning

In the current middle school mathematics classroom learning, there is an extreme lack of meaningful situations, and students' learning motivation is not strong, resulting in low classroom efficiency. While situational teaching attaches importance to students' independent learning and inquiry, by providing specific scenes and situations, to make students feel more interesting and challenging [12]. Students' learning enthusiasm has been improved, and students are more willing to actively participate in and explore the knowledge they have learned.

3.1.2. Can improve the students' math learning experience

Psychology believes that students 'success in mathematics learning can be translated into a positive emotional experience, thus promoting students' continued learning [13]. Mathematics is a highly abstract and generalized theoretical subject, with many formal and symbolic languages. The direct learning of students will be difficult and difficult to understand, while situational teaching puts mathematics learning in specific situations, allowing students to learn in actual scenes, and strengthens the connection between

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

mathematical knowledge and practice [14]. Students can better understand and master the knowledge they have learned, and improve the learning effect, and students' learning experience will be improved, which also responds to the thought of humanism on the subject status of students.

3.1.3. More emphasis is placed on cultivating students' comprehensive quality

In the process of mathematics learning, more attention should be paid to the inspiration and guidance of students' thinking, which will be applied on other subjects [15], which coincides with the theory of situational teaching. Situational teaching does not emphasize a single subject, but advocates the comprehensiveness and crossover between disciplines, so as to cultivate students' broad vision and critical thinking. Students can learn about the relevant mathematical knowledge and skills in the problem-oriented situational teaching, so as to solve the more complex practical problems, so as to enhance their comprehensive quality.

3.1.4. Can meet the personalized learning needs

Quality education emphasizes "student-centered" and attaches importance to the personalized development of students. However, situational teaching emphasizes the individuation and autonomy of learning, and advocates designing specific situational teaching programs according to students' different needs and backgrounds [16]. This helps to improve students' effectiveness and autonomy in learning, while making students feel more self-worth.

3.2. Basic principles of the evaluation of the design

The basic evaluation principles required in the Curriculum Standard, first is to pay attention to the achievement of students 'core literacy, second is to pay attention to the integrity and stage of evaluation, third is to pay attention to the process evaluation, and fourth is to pay attention to students' learning attitude, requiring to adhere to the "people-oriented" student view[9] [17]. There are also literature summarizing and extending this, mainly summarized as development, process, diversity and subjectivity. This evaluation design type belongs to the process evaluation, and this evaluation design follows the above principles.

3.3. Design and analysis of the situational evaluation index of mathematics

Teaching evaluation index refers to the specific content of the evaluation of various aspects in the process of education and teaching. Clarify each index can be convenient for educators to better evaluate. Contextual cognition theory advocates the influence of comprehensive situation on students, and classification is easy to produce a sense of separation. The elements of classroom teaching evaluation should be analyzed from different observation perspectives. Therefore, the design of indicators based on the idea of situational cognition theory.

3.3.1. Classroom situation effect

The classroom situation effect refers to the significance and fun of the classroom situation. The situational cognition theory emphasizes that learning should take place in purposeful, meaningful and situational scenarios, and puts forward the concept of learning community [18], and the class is a learning community. Community not only emphasizes the integration of time and space, but also is a common concept and pursuit. Students become a community in mathematics learning, learning will have a value pursuit, and mathematics learning will become meaningful. At the same time, the situation teaching can also make the classroom atmosphere lively [19], the classroom atmosphere is subtly influenced the students 'learning mood, good mood bring positive learning experience, this experience will enhance students' learning motivation, which is usually called "interested", also can correct students 'learning attitude, when attitude and motivation become correct and strong, students' math learning will continue to progress.

3.3.2. Degree of knowledge mastery

One of the purposes of situational teaching is to let the students flexibly grasp the corresponding knowledge in their learning. In order to fully understand the degree of mastery of students' knowledge, teachers can use various ways to assess the degree of mastery of students, such as:

Observe the students' learning process. Situational teaching advocates students 'active participation and inquiry, which means that students' performance is very important [20]. Teachers can observe the students' performance, such as the thinking process, problem-solving strategies, data collection and

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

processing, cooperation and communication, etc. Through the evaluation of students 'performance, we can judge the students' understanding and application of the knowledge.

Comment on the performance of the students' works. Situational cognition theory emphasizes that knowledge is the result of students' construction according to experience [21], that is to say, students transform knowledge into learning results, and the learning results can be expressed through actual works. The works can be designed by the students themselves, or they can work as a team. Teachers can evaluate the application degree of students 'knowledge through the evaluation of students' works.

3.3.3. The development degree of the core literacy

Table 1: The embodiment of situational teaching theory in core literacy in Curriculum Standards (excerpt) [9]

	Level a	Level 2	Level 3
Mathematical abstraction	Can directly abstract mathematical concepts and rules in familiar situations	Can abstract general mathematical concepts and rules in related situations	Be able to abstract mathematical problems in a comprehensive context
logical reasoning	Be able to discover the nature of quantitative or graphic, quantitative or graphical relationships by induction or analogy in familiar situations	Be able to find and put forward mathematical problems in the related situation, and express level 3 in mathematical language	In the comprehensive situation, we can find the appropriate research objects with mathematical eyes, and put forward meaningful mathematical problems
mathematical modeling	Be able to imitate the learned mathematical modeling process in familiar practice situations and solve problems	They can find problems in familiar situations and transform them into mathematical problems, and know the value and function of mathematical problems	It can use mathematical thinking to analyze in the comprehensive situation, find the mathematical relationship in the situation and put forward mathematical problems
Intuitive imagination	Can abstract the geometric figures of real objects in the familiar situation, and establish the connection between simple figures and real objects	Be able to imagine and construct the corresponding geometry in the associated context	It can ask mathematical problems through intuitive imagination with the help of graphics in a comprehensive situation
arithmetical operation	Be able to understand operation objects and ask mathematical problems in familiar mathematical situations	Ability to determine operational objects and ask operational questions in related situations	In the comprehensive situation, the problem can be transformed into operational problems, determine the operational object and algorithm, and clarify the direction of operation
DA	Ability to understand random phenomena and simple probability or statistical problems in familiar situations	Be able to identify random phenomena in the associated situation, know the association between random phenomena and random variables, and find and ask probability or statistical problems	Ability to find and ask random questions in a comprehensive context

Situational cognition theory is also applicable to evaluating students' core mathematical literacy. Mathematics core literacy refers to the core knowledge, skills and thinking ability that should be possessed in mathematics learning, including six aspects of "mathematical abstraction, logical reasoning, mathematical modeling, intuitive imagination, mathematical operation and data analysis", which is the main content of the whole evaluation system. The evaluation of mathematics core literacy has been provided with a more detailed reference in the appendix of the Curriculum Standards, which also involves the evaluation of relevant situations, as shown in Table 1.

The core literacy evaluation guide provided in the class standard can only provide a general direction for educators, but it is not implemented into specific behaviors. The two-dimensional table of the core literacy evaluation by Cui Zhixiang and Yang Zuodong provides a good template. Considering that the evaluation should be easy to operate, the research adds a description after each core literacy, combined with the two-dimensional table of the former, so there is the following general framework for evaluating

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

students' core literacy, see Table 2.

Table 2: Evaluation Framework of Mathematical Core Literacy (Improvement) [22]

The literacy category of the evaluated operation	Evaluation of the operating instructions Four dimensions (see Table 2 in paper [23], omitted here)
Mathematical abstraction	To evaluate students' ability to apply abstract thinking in mathematical problems, students can be evaluated [23] through the process and thinking of solving abstract problems, such as whether they can understand and apply symbols, variables, equations, formulas and other concepts, and use them flexibly in solving problems.
logical reasoning	Assess the students' logical thinking and reasoning skills. It can be evaluated by providing students with a series of logical questions or proof questions, and observing the accuracy and rationality of their thinking process and reasoning.
Intuitive imagination	Intuitive imagination evaluation: to evaluate students' geometric and image thinking ability in mathematical problems. We can provide students with geometric problems, graph transformation and other topics, to see whether they can accurately imagine and operate the graphics, and put forward the correct solutions.
mathematical modeling	Evaluate the students' ability to use mathematical models in practical problems. It can be evaluated by providing practical problems, requiring students to analyze the problems, put forward mathematical models, and calculate and analyze them.
arithmetical operation	Evaluate the students' basic mathematical skills and skills. Computational accuracy and proficiency in arithmetic, algebra, geometry and other aspects can be evaluated by written tests, verbal tests or computational exercises.
DA	Assess students' ability in processing and analyzing data. Their data processing ability can be evaluated by providing students with a set of data and asking them to organize, count, chart, and analyze the data.

3.3.4. Ability to solve practical problems across disciplines

One of the meanings of situational cognition theory is to advocate "middle school by example, middle school by doing" [24]. The ultimate purpose of situational teaching is to let students learn how to solve practical problems. Therefore, it is very important to evaluate whether students have the ability to solve practical problems. China's mathematics curriculum standards for compulsory education, the core literacy framework of the European Union, and the common core standards of the United States all emphasize the application of mathematical knowledge in different situations [25]. It can be seen that the ability of interdisciplinary application of mathematics is more and more important for students. In fact, the problems in the real world is more complex problems, including many disciplines, mathematics is people observe the world, thinking about the world, deconstruct the world, reshape the world, mathematics learning not just stay in solving the pure mathematical problems, also learn how to interdisciplinary problem solving, namely comprehensive application ability (such as mathematical modeling), it also conforms to the demand for interdisciplinary talents in our country.

3.3.5. Mathematical culture and spirit

Many mathematicians, ancient and modern, emphasize the role of mathematical culture and spirit, emphasizing that mathematics is not only a practical science, but also a humanities science, which permeates with society, culture and philosophy. Mathematical spirit and culture are the concentrated embodiment of mathematical ideas, methods and results in different historical periods and under different cultural backgrounds. Situational teaching is a kind of teaching mode that puts students 'learning environment in the real or related to real situation, and promotes students' learning through the problems created in the real situation. Some scholars suggested to infiltrate mathematics culture into course teaching that we should pay attention to situational teaching and infiltrate mathematics culture [26]. The connection is that situational teaching is a mathematics teaching mode that runs through the core of mathematical spirit and culture.

The mathematical spirit and culture emphasize the diversity of mathematical thinking forms, the courage against difficulties, the emphasis on conjecture and intuition, and the respect for abstraction,

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

simplification and proof. This is similar to the characteristics of situational teaching, which also pays attention to the creation of realistic situations in teaching, so that students can naturally think about and explore the mathematical knowledge and thoughts behind the problems through situations and problems. The choice of mathematical spirit and culture as one of the evaluation indicators is not only because of its compatibility with the situational teaching theory, but also because of its rich value, such as strengthening the cultural connotation of mathematics, cultivating the aesthetic taste of mathematics, and improving the philosophical thinking ability of mathematics.

Finally, the above indexes are sorted out, and the following evaluation system is obtained in table 3:

Table 3: Evaluation system of middle school mathematics classroom teaching

Evaluation Angle	Level 1 indicators	Secondary indicators	Evaluation instructions
Mathematics teaching situation	Classroom situation effect	The significance of the learning context	The positive effects of the learning environment or scenario on the learning processes and outcomes.
		The interest of the learning situation	The learning environment or scene is attractive and interesting, which can stimulate students' curiosity and learning motivation, and make the learning process more enjoyable and active.
Students' sense of gain in mathematical rational value	mathematical knowledge	Knowledge mastery	Students' grasp of the basic concepts, theorems and formulas of mathematical knowledge
	Core literacy in mathematics	Mathematical abstraction, logical reasoning, mathematical modeling, visual imagination, mathematical operations, and data analysis	Can refer to the core quality of mathematics discipline Horizontal division [9] And the evaluation and operation instructions in Table 2
	Skills and abilities	Ability to solve practical problems across disciplines	The performance of students 'mathematical thinking in interdisciplinary problems and the students' application of mathematical knowledge in other subjects
Students' sense of gain of perceptual value in mathematics	Mathematical culture and spirit	Mathematical culture	Whether we can understand the ideas, methods and principles contained in mathematics, and whether we can express mathematical concepts and ideas with clear and accurate language and symbols
		The spirit of mathematics	Test the students to explore the truth, rigorous verification, pioneering and innovative, win-win cooperation spirit

4. Summary and reflection

Traditional mathematics teaching evaluation is heavy theory, light practice, the reproduction of knowledge and ignore the creative test problems, thus can not reflect the students 'ability to solve mathematical problems in real life, when students can't receive timely feedback, lost the ability of applied mathematics, students will lose interest in learning mathematics. Only by putting the evaluation in real life and social environment can students realize that what they tested is the real ability. Therefore, the

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

design of this evaluation index is more inclined to the comprehensive evaluation of quality and ability, etc. In the six evaluation indicators, "classroom atmosphere" and "learning motivation and attitude" are investigated from the level of student will; the degree of knowledge mastery, core accomplishment and interdisciplinary solution ability are investigated from the level of students 'mathematical knowledge and quality; the last mathematical culture and spirit is the investigation of students' rational thinking and perceptual spirit of sublimation, the whole process experiences a progressive growth process of "learning mathematics, using mathematics, love mathematics", the purpose is to make mathematics accompany students grow through life, so that students establish the concept of lifelong learning.

Although situational teaching theory has many advantages, behaviorism, cognitivism and constructivism also have their own advantages, teaching method, teaching method, similarly, evaluation method, but no evaluation method. In the actual teaching process, teachers cannot completely rely on the situational teaching theory, and may not completely follow the designed index points in the classroom evaluation. They should be able to adapt to changes, that is, to have "evaluation and know ability".

References

[1] Wang Yandong. The enlightenment of the evolution of modern learning theory to the cultivation of core literacy—The theoretical basis of the teaching of "cognition and situation" [J]. Middle school politics teaching reference, 2017, (36): 16-18.
[2] Leng Ping, Mei Songzhu, Wang Yanrong. The situational teaching misunderstanding in mathematics classroom [J]. Teaching and Management, 2011, (31): 54-56.
[3] Zhang Yanan, Fang Jinbin, Zhai Jinxin. On the four pairs of relations of mathematics teaching situation design [J]. Math Bulletin, 2017, 56 (4): 8-11.
[4] Xie Mingchu. The significance of situational cognition theory for mathematics education [J]. Educational Research, 2009, 30 (8): 69-73.
[5] Zhang Dingqiang, Zhang Yuanyuan, Wang Tong. Mathematics situational teaching: understanding the status quo and increasing the run classroom [J]. Teacher training in Primary and secondary schools, 2017, (05): 58-61.
[6] Fu Xianghua. Analysis of the value and way of applying life situation teaching in middle school mathematics classroom [J]. Teaching Management and Education Research, 2020, (24): 92-94.
[7] Liu Jingli, Ren Zhipeng. The function and reflection of situational teaching in the reform of mathematics education in China [J]. Education Guide, 2019, (08): 76-79.
[8] Zou Yuyang. A classroom case design for middle school mathematics situational teaching [J]. Primary and secondary school Mathematics (High school edition), 2022, (3): 27-31.
[9] Ren Yudan. Construction of the evaluation index system for mathematics classroom teaching [J]. Educational Science Research, 2021, (11): 33-39.
[10] Ministry of Education of the People's Republic of China, General High School Mathematics Curriculum Standards (2017 edition 2020 revision) [M]. Beijing: People's Education Press, 2017.
[11] Xie Mingchu. The significance of situational cognition theory for mathematics education [J]. Educational Research, 2009, 30 (08): 69-73.
[12] Wu Jiadong. On the Application of Computer Scene Teaching in High School Mathematics Teaching [J]. Digital Communication World, 2017 (09): 185.
[13] Wang Shuai. The effect of achievement goals on high school student math performance—a moderated mediation model [J]. Journal of Mathematics Education, 2023, 32 (04): 28-35.
[14] Luan Qingfang. Research on the influence of mathematics situational teaching on mathematics emotion of junior high school students [D]. Yangzhou University, 2006.
[15] Cheng Wen. Research on strategies to improve the efficiency of mathematics classroom teaching in middle schools [J]. Exploration in Education, 2010, (01): 76-77.
[16] Ji Yu, Li Guang. From nature to consciousness—the historical track of students' core literacy development [J]. Scientific Research in Education, 2018 (07): 31-35.
[17] Ministry of Education of PRC. Basic Education Curriculum Reform Outline (trial) interpretation [M]. Shanghai: East China Normal University Press, 2001.
[18] Jean L, Etienne W. Situated Learning: legitimate peripheral participation [M]. Cambridge University Press, 1991-9-27.
[19] Shi Jun. Teaching should integrate four core concepts [J]. Middle school politics teaching reference, 2012, (29): 53.
[20] Zhang Liang, Jin Yule. What kind of teaching epistemology is needed for the development of core literacy? -Outline based on situational cognition theory [J]. Educational Research and Experimentation, 2019 (05): 32-37.
[21] Yun Ge. Analysis of the role and value of the history of mathematics in basic education [J].

ISSN 2663-8169 Vol. 5, Issue 23: 170-177, DOI: 10.25236/IJNDE.2023.052329

Intelligence, 2022 (31): 186-188.
[22] Cui Zhixiang, Yang Zuodong. An evaluation framework of a mathematics core literacy in the compulsory education stage [J]. Journal of Mathematics Education, 2021, 30 (05): 47-52.
[23] Zheng Xuejing, Chen Qinghua, Wang Changping. Research on the current status of mathematical abstract literacy among high school students [J]. Journal of Mathematics Education, 2017, 26 (06): 26-32.
[24] Xie Mingchu. The significance of situational cognition theory for mathematics education [J]. Educational Research, 2009, 30 (8): 69-73.
[25] Zhang Qiaoping. Mathematical Literacy in Mathematics education in Western countries: Comparison and Outlook [J]. Global Education Outlook, 2017, (3): 29-44.
[26] Liao Guanghe, Lin Jian, Zhang Jingxin. Analysis of the examination level of mathematics core literacy in the college entrance examination based on mathematics culture [J]. Teaching and Management, 2019, 785 (28): 41-44.