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Literature review and prospect on Mathematics Appreciation

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Abstract
Mathematics appreciation refers to a good individual feeling towards mathematics knowledge or mathematics activities. As an important factor for students' mathematics learning, the mathematics appreciation has attached many people's attentions in recent years, and a number of relevant researches have appeared. Review these researches completely, we found they mainly focused on the objects, contents and functions of mathematics appreciation and how to effectively teach it. While the systemic and specific and quantitative researches of mathematics appreciation were quite few, so this should be a direction of further research in the future.

Keywords: Mathematics Appreciation, Mathematical Beauty, Mathematical Culture, Mathematical Education.

1. Introduction

Mathematics appreciation refers to a positive individual feeling based on the individual certain mathematical cognition, and a kind of individual tendency to identify with mathematics and be keen on mathematical activities. The mathematics appreciation played an important role in the teaching and learning of mathematics (Huang, Q. A., Liu, D. Z. & Nie, X. Y.,2013) [1], there were increasingly people pay attention to mathematics appreciation and involved themselves in researches on mathematics appreciation. In order to effectively promote mathematics appreciation research activity, this paper intended to review and summarize the existing researches on mathematics appreciation based on the existing literature.

2. The Contents and Objects of Mathematics Appreciation

Zhang dianzhou believed that the contents of mathematics appreciation should include the rational beauty of mathematics, the humanities artistic conception of mathematics, the specific meaning of mathematics, the harmonious beauty of mathematics, the hierarchy on beauty of mathematics, the development of mathematics, the invariant quantities and invariant properties of mathematics, however in which the most important one was the beauty of mathematics (Zhang, D. Z., 2012; Zhang, D. Z., 2010; Zhang, D. Z., 2010; Zhang, D. Z., 2010) [2, 3, 4, 5].

Huang qinan, Liu dazhuo & Nie xiaoying argued the objects of mathematics appreciation included not only the beauty of mathematics, but also the true and goodness of mathematics. The true of mathematics was the truth properties of mathematics. The goodness of mathematics was the value of mathematics. And the beauty of mathematics was the artistic value of mathematics. The true, the goodness and the beauty constructed a three-dimensional mathematics appreciation whole. (Huang, Q. A., Liu, D. Z. & Nie, X. Y., 2013) [1]

Lu guangdi stated that the object of mathematics appreciation should be humanities mathematics, specifically including the history of mathematics, the aesthetics of mathematics, interesting mathematics, mathematical folk, mathematical culture and the stories of mathematicians, etc (Lu, G. D., 2013) [6].

Chen yingli thought that the contents of mathematics appreciation mainly included: the origin of mathematics, the beauty of mathematics, the fun of mathematics, and the application value of mathematics (Chen, Y. L., 2013) [7].

3. The Functions of Mathematics Appreciation

Huang qinan, Liu dazhuo & Nie xiaoying held that mathematics appreciation had a function of mathematics education, and it was very important for putting cultural goal of mathematics education into practice. Its function specifically represented in three aspects below. 1) It was beneficial for students to be fond of mathematics and love to learn mathematics via integrating mathematics appreciation into mathematics education. 2) It was helpful for students to have a real image of mathematics and make them accurately, objectively, vividly, and lively access to mathematics from the true, good and beauty of mathematics. 3) It was useful for students to experience the charm of trinity of the truth, goodness and beauty, and establish mathematics perception, cognition, and emotion three-in-one system. (Huang, Q. A., Liu, D. Z. & Nie, X. Y., 2013) [1]

Yang zezhong believed appreciating and experiencing the beauty of mathematics in the teaching and learning of mathematics not only could inspire students' interests in learning mathematics and activate the enthusiasm of their learning of mathematics, but also could enhance the students' understanding and mastery of mathematical knowledge to cultivate and develop students' creativity (Yang, Z. Z., 2008) [8].

Chen yingli (Chen, Y. L., 2013) [7] suggested that the effects of mathematics appreciation were equivalent to the combination of interests in mathematics, mathematical aesthetic abilities, mathematical insights, and mathematical creativity. It could mainly represent in two learning-teaching aspects below. On the one hand, mathematics appreciation promoted students' translation about learning attitude and learning style and stimulates students' desires to innovate in mathematics so that students had more comprehensive understandings of mathematics and interests in mathematics learning. On the other hand, mathematics appreciation improved the theoretical

level and the accomplishment in mathematics of mathematics teachers (Chen, Y. L., 2013) [7].

4. The Implementation of Mathematics Appreciation

Zhang dianzhou (Zhang, D. Z., 2012; Zhang, D. Z., 2010; Zhang, D. Z., 2010; Zhang, D. Z., 2010) [2, 3, 4, 5] thought that mathematics appreciation might be carried out from six aspects below in mathematics classroom. The first was to enjoy the universal values of mathematics, that was rational beauty of mathematics; the second was to appreciate the humanities conception of mathematics through connecting certain poetry and mathematical knowledge appropriately; the third was to appreciate the specific connotation of mathematics; the fourth was to appreciate the aesthetic level of mathematical beauty; the fifth was to enjoy the harmonious beauty of mathematics to connect the mathematics with the beauty; and the sixth was to appreciate the development of mathematics (Zhang, D. Z., 2012; Zhang, D. Z., 2010; Zhang, D. Z., 2010; Zhang, D. Z., 2010) [2, 3, 4, 5].

Yang zezhong believed that in consideration of the implementation of mathematics appreciation was based on bringing of students' aesthetic feelings of mathematics, the implementation of mathematics appreciation should follow certain requirements. Specifically, the first was to begin with selecting the mathematical content that students were familiar with; the second was to promote students' feelings towards mathematical knowledge via combining relevant aspects in the teaching and learning in mathematics; the third was to pay attention to the role of "blank" in mathematics teaching and guide the students to associate and imagine; the forth was to pay attention to the guidance of students' valuing aesthetic and the conduction in students' emotion; and the fifth was to attach importance to the review and summary about students' successful experience in their experiencing mathematical beauty. In addition, he also put forward the problems that the teacher and students should pay attention to in the implement of mathematics appreciation below. For one thing, the teacher should learn more about mathematical beauty to have a better understanding of the knowledge of aesthetics theory, and have richer aesthetic experience, for another, the teacher and students should pay attention to choosing a relaxed environment and appropriate time to carry out the appreciation of mathematics. (Yang, Z. Z., 2008) [8]

It is worth mentioning that, Yang zezhong & Chen huanfa pointed out that in order to make students to actually experience the beauty of mathematics in the process of carrying out teaching and learning of mathematics appreciation via CAMI in middle school, teachers should obey the principles of the generation of aesthetic feeling of mathematics, carefully choose the teaching-learning content, appropriately use the multimedia computer technology to highlight the characteristics of the beauty of mathematics, carefully design the teaching-learning process to promote the students to have a deep understanding of the mathematical knowledge, reasonably utilize multimedia technology to promote the students' association and imagination, appropriately apply the sound, music and animation technology to the corresponding circumstance, and combine the multimedia technology with traditional methods in the teaching and learning of mathematics (Yang, Z. Z. & Chen, H. F., 2010) [9].

Gu xiaopei thought the implement of mathematics appreciation could go with solving famous mathematical problems, playing mathematical games, and writing mathematical papers (Gu, X. P., 2005) [10].

Chen yingli put forward three methods to implement mathematics appreciation in mathematics education, which were to penetrate mathematics appreciation into the teaching and learning of mathematics classroom, to set up special mathematics appreciation curriculum, and to imperceptibly exert influence from mathematics appreciation on students outside of mathematics classroom (Chen, Y. L., 2013) [7]. He also put forward several concrete strategies when he referred to the contents of mathematics appreciation. Specifically, the first was to enjoy the origins of mathematics via reading and appreciating, looking for the development histories of mathematicians, and carrying out academic lectures and other ways, the second was to appreciate the beauty of mathematics by enjoying the formal, fantastic, and integral beauty of mathematics, and the beauty manifested in the process of problem solving, the third was to make the students experience the interests of mathematics by the way of creating mathematics problem situation, providing students ample opportunities to explore and communicate, and making students personally experience mathematics activities and appreciate famous mathematical problems etc, and the fourth was to appreciate the application value of mathematics through creating the learning situation of mathematics application, strengthening students' practical operation and making the students visit films whose contents involve mathematics appreciation (Chen, Y. L., 2013) [7].

Wen weixing stated that considering that the beauty of mathematics was an effective carrier of spirits of humanities mathematics, the following ways to guide the students to value and discover mathematical beauty could be applied in the teaching and learning of mathematics. 1) Excavating humanities factors of mathematics to cultivate students' humanities spirits. 2) Fully using the historical materials of mathematics to promote students' humanities qualities. 3) Revealing the philosophy meaning in process of solving problems to improve students' humanities accomplishments. 4) Exhibiting teachers' personal charisma to enhance students' cultural tastes. And 5) constructing mathematics classroom culture to enrich students' cultural connotation. (Wen, W. X., 2012) [11]

5. Comments and Prospects

In summary, we could see that the number of the existing researches on mathematics appreciation was small, the majority of the existing studies were focused on the function of mathematics appreciation and the implementation of mathematics appreciation, and the methods used in these researches belonged to speculative theory methods or experience summary methods. Undoubtedly these studies and their results made illuminating sense of and had guiding value of the current mathematics education. However, they clearly had some problems as well.

Although some researches on mathematics appreciation attempted to construct the models, contents and ways of the teaching and learning of mathematics appreciation via combining qualitative research methods and quantitative research methods in order to make mathematics appreciation systematization, they always made people feel somewhat vague and fuzzy. Therefore, it was worth to study how to make the

contents, methods and procedures of mathematics appreciation more elaborate, concrete, and effective.

Secondly, current researchers paid too much of attentions to students, rarely discussed teacher's appreciation of mathematics and the influences from teachers' appreciation of mathematics on students. In consideration of this point, it was necessary to expand the scope of the research on mathematics appreciation.

In addition, the existing studies of mathematics appreciation rarely involved the changes of students' psychological activities in the process of their appreciating mathematics. Actually, it was difficult for teachers to lead their students to carry out the activities of mathematics appreciation in the teaching and learning of mathematics if they did not understand the process of the changes of the students' psychological activities in their appreciating mathematics. Consequently, the discussion about the changes of the students' psychological activities in their appreciating mathematics should be a key point in the study of further mathematics appreciation.

Undeniably, mathematics appreciation was very significant and valuable for improvements of both personal accomplishment of mathematics and the teaching and learning of mathematics. We believe that the researchers will quickly make a number of new progresses and breakthroughs in the future research on mathematics appreciation as long as they base on the previous researches, find right direction and appropriate starting point of research on mathematics appreciation.

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