

Concept Analysis of Mathematical Literacy in Western Mathematics Education Based on Multiple Intelligence Theory

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Keywords: Multiple Intelligences; Mathematics Education; Mathematics Literacy

Abstract: The theory of multiple intelligences is a new theory about the structure of human intelligence. The theory of multiple intelligences provides a new perspective for the evaluation of mathematics education and has great enlightenment for the evaluation of mathematics education. In the western mathematics education, the theoretical and practical research of mathematics literacy is mainly embodied in the elements and levels of mathematics literacy, the evaluation of mathematics literacy and the teaching of mathematics literacy. It has the dual qualities of both ideological and practical. Discriminating the concept of mathematical literacy in Western mathematics education helps people to recognize the essence and value of the concept, awaken the consciousness and belief of mathematical literacy education, help to enrich the theoretical research of mathematical literacy, and provide support for practical exploration.

1. Introduction

With the progress of science and technology and the rapid development of human society, the term "literacy" is increasingly appearing in various documents. All academic fields and all aspects of social life are discussing literacy in this field [1]. Such as "scientific literacy", "humanistic literacy", "mathematical literacy" and "information literacy". The so-called mathematical literacy refers to the attainment of mathematical knowledge, skills, abilities, concepts and qualities based on human innate physiology and influenced by acquired environment and mathematical education through individual practice and cognitive activities [2]. The theory of multiple intelligences is the basis of individualized education, teaching according to aptitude, innovative education and other practices. It provides a concrete and operable train of thought for high school mathematics classroom teaching practice. In all curriculum reforms, the reform of mathematics education is particularly important. The contradiction caused by the rapid development of society on the high standards of mathematics and the fear of mathematics of students is becoming more and more fierce. The wonderful mathematics class can make students feel excited and fail. The math class keeps students from stopping [3]. Through continuous reflection, students can finally integrate intricate mathematical concepts and rules into a more complete knowledge network, and connect the mathematical knowledge they learn to form a knowledge system of their own. There are mathematical literacy, not only in the mathematics exam can solve problems, but also in daily life, always showing a person who has studied mathematics, it is gradually internalized in the long-term mathematics learning.

2. The Concept and Terminology of Mathematical Literacy

2.1 Proposal of Concepts

As a social phenomenon, mathematical literacy is closely linked with social development and human development, and is the product of the changes of the times [4]. Mathematical literacy is a condition for individuals to interact with the outside world in a reasonable and effective way in different backgrounds and stages of development, under the influence of the needs of the times and social culture. The theory of multiple intelligences divides human intelligence into eight unique and interactive intelligence systems, which are embodied in each student in different combinations [5].

This definition of intelligence emphasizes the social and cultural nature of intelligent development, and especially emphasizes that intelligence is an individual's ability to solve practical problems or to produce effective products needed by society. From a variety of practical purposes, in this constantly updated modern society, the role of mathematics is endless. In this definition of intelligence, the social and cultural creativity and the creativity of intelligence are emphasized, and on this basis, a broader intelligent system is established, in which the intelligence contained in all is the learning and problem-solving that all human beings can use. And the tools created [6]. From the perspective of the function of mathematics education, mathematics education is responsible for cultivating qualified personnel for the society to meet the requirements of human development in the future. Different people may be good at learning in a specific intelligent way, so human knowledge representation and learning style have different forms. Students can use different smart ways to learn, remember, characterize and apply knowledge.

The presentation of mathematical literacy has a certain historical significance. Different eras, social and cultural traditions have different interpretations of the meaning of mathematical literacy and the requirements for human mathematical literacy. From this connotation and requirements, we can reflect the main melody of different eras and society. The basic structure of mathematical literacy must reflect the five conditions that enable individuals to acquire and apply mathematical knowledge; it must show the complex interrelationship between the five conditions; it must clearly reflect the “promoters” that make the five conditions develop [7]. The theory of multiple intelligence emphasizes that in teaching, it is recommended to use mathematics to learn mathematics in order to achieve good teaching results. Therefore, the evaluation of students should be based on the students' intelligent characteristics and learning methods to adopt a diversified evaluation. This means that when preparing for teaching design, teachers should consider various factors such as students themselves, teaching conditions, teaching content and so on, and stimulate the participation of students' various intelligences in order to achieve the goal of comprehensive and sustainable development. Human society has entered the era of knowledge economy, and mathematics itself has entered a new mathematical period marked by computer technology [8]. Mathematics has penetrated into every field of daily life. In many structural frameworks of adult mathematical literacy, attention to background is obvious, but different frameworks treat values and purposes differently. According to the characteristics of students' learning, we adopt different methods to guide, carry out diversified teaching design, and explore the most suitable teaching entry point to meet the students with different intelligence tendencies.

Every intelligence of multiple intelligences is equally important in the whole. Teaching evaluation should not only aim at one aspect of intelligence, but also establish a comprehensive evaluation concept of "evaluating for multiple intelligences". The proposition of mathematical literacy has certain value. Nowadays, the praised high technology is essentially mathematical technology. Mathematics has created enormous economic benefits in the high-tech era, which embodies the instrumental and practical value of mathematics. Mathematical skills are the basic organizational principles, while always paying attention to the background. Mathematical skills are the basic organizational principles, but little attention is paid to the background. According to the theory of multiple intelligences, people's intelligence is equally important, and there is no distinction between primary and secondary. Therefore, the evaluation of students should be evaluated in many aspects. Of course, the diversification of teaching objectives is not just about the students' superior intelligence, but to create an atmosphere that allows superior intelligence to drive multiple intelligences, which coincides with the overall development of students advocated by modern education. Environment and education play an important role in enabling these intelligences to be developed and nurtured, and each kind of intelligence can be developed to a higher level through proper education and training. Mathematics plays an important role. Its application value and cultural value are closely related to the development of human civilization. Just like literacy and reading, mathematics will become a necessary cultural literacy for citizens.

2.2 Common Terminology

For mathematical literacy, the usage of words in western countries is different. Numeracy is commonly used in Britain and some of its former colonies, such as Australia and New Zealand. In the modern environment, individuals need more extensive and deep mathematical skills and appreciation levels, and need to understand the underlying rules under different branches of mathematics and system theory. Following the first Numeracy report in Clauser's report, people found that citizens' mathematical literacy did not match the demand for mathematical talents in various fields. Many countries actively sought countermeasures to reform mathematics education. In the view of multiple intelligence theory, the intelligence of self-knowledge and the intelligence of interpersonal communication are important components of the intelligent structure. The self-knowledge intelligence of students and the cultivation of interpersonal intelligence should also be carried out in the actual evaluation situation. In 1974, Zechariah of the Massachusetts Institute of Technology used QL for the first time and defined it as the ability that citizens must have to deal with things and arguments that affect themselves, the country, and the world in which they live.

The first appearance of "mathematical literacy" as a test-based concept was in the TIMSS test. Subsequently, the Organization for Economic Cooperation and Development also conducted a special evaluation project for mathematical literacy. In the early 20th century, courses in countries around the world were based on reading, writing, and calculation. However, with the changes of the times, 3Rs could not fully adapt to the needs of society. The situation involves all possible aspects of life. PISA infiltrates mathematics knowledge into contextual issues in the personal, public, and social fields to assess whether students have the confidence and curiosity to apply mathematical knowledge to solve problems in life [9]. Numeracy, QL and ML are used to express mathematical literacy in most literatures, and they are often used interchangeably. Intelligence is the ability to solve problems and create certain value in a unit or multicultural environment. It is a set of abilities that enable people to solve various problems in life. It is the ability that people accumulate new knowledge constantly when they discover problems or seek solutions to them. From the point of view of mathematical process, Numeracy and QL lay emphasis on the basic skills of number and quantity operation, while ML involves high-level mathematical abilities such as logical thinking and deductive reasoning.

3. Discrimination of the Concept of Mathematical Literacy

3.1 The Connotation of the Concept of Mathematical Literacy

The specific area refers to the place where people develop their mathematical literacy, including family, work, society and so on. The Australian Association of Mathematics Teachers pointed out that mathematical literacy is the effective application of mathematics to meet the needs of family life, work and participation in community and public life. The reason why the theory of multiple intelligences has attracted much attention in educational circles is that it expounds from the perspective of psychology that students are inherently different. They do not have the same psychological tendency or the same intelligence, but they have their own intellectual strengths. We want to emphasize that mathematical knowledge and skills that have been defined and can be defined in the context of mathematics curriculum do not constitute the core content of our assessment. Mathematical literacy is a collection of skills, knowledge, beliefs, attitudes, habits of thinking, and general communication and problem-solving skills. This is necessary for people to effectively deal with real-world situations or tasks that contain mathematical and measurable elements. Mathematical processes are thought and reasoning, argumentation, communication, modeling, problem solving and solving, representation, use of symbols, forms, and technical language. According to the theory of multiple intelligences, education is not the concentration of all kinds of information that has been mastered, and then returns to or applies to non-scenario situations, but focuses on the development of creative and thinking skills.

Mathematical literacy can not be reduced to knowledge of numerology, facts, procedures, skills to perform certain operations and methods. The theory of multiple intelligences emphasizes that

every individual can not have the same intelligence. A single individual has a high degree of intelligence, but does not necessarily have the same degree of other intelligence. Intelligence level is not static, it can develop dynamically. As long as the appropriate environment is provided and enough encouragement and guidance are given, any intelligence of most people can be developed and reached a satisfactory level. The researchers first theoretically divide the mathematical literacy into five levels, and take the three aspects of "the ability to solve problems by mathematical methods, the ability of mathematical reasoning, and the ability to use mathematical concepts and methods flexibly in the real world" as the core of teaching. . The implied ability to imply in the concept of mathematical literacy is to propose, express, and solve mathematical problems in various fields and environments. The field of human intelligence is multi-faceted. The intelligence that people need to solve problems is also multi-faceted. In real life, everyone needs to make full use of multiple intelligences to solve various practical problems.

3.2 The Relation between Mathematical Literacy and Related Concepts

The concept of mathematical literacy exists in various definitions, each of which takes into account the relationship with mathematics, environmental culture and curriculum to varying degrees. Everyone has different degrees of intelligence, and all intelligence can be applied to inventions. In contrast, mathematical literacy usually requires inference based on estimates and approximations and incomplete or sometimes inaccurate data. Mathematical communication and expression is not only the basic component of mathematical literacy, but also an important tool for the development of mathematical literacy. This kind of problem is only a response, rather than a time-based thinking, only the answer, the problem-solving ideas, strategy and creativity. It is usually not officially expressed, uses everyday language, and has many different applications. The losers at one scale are likely to be successful at another scale. The evaluation of mathematics learning should also reflect the spirit of this "humanism" and promote the all-round development of students.

Mathematics professional literacy refers to the facts and skills that are required for specialized mathematics practitioners. It pays attention to the connotation and operation of mathematics itself, and pays attention to obtaining unified mathematical ontology, conditional and practical knowledge, and has obvious professional characteristics. Revealing the connotation and evaluation of mathematical literacy from a broader perspective, not only for printed materials containing mathematical content, but for a wider range of realistic backgrounds. Each of the multiple intelligences is independent and interrelated. On the one hand, the nine intelligences are relatively independent, each of which has a thinking mode different from other intelligences; on the other hand, they complement and interact with each other to form a unified intelligences as a whole, which is manifested as a kind of behavior ability of the subject. Under this new evaluation concept, the evaluation of mathematics learning has changed from static evaluation to dynamic evaluation, focusing on understanding and process, and integrating evaluation into curriculum and teaching. Mathematical literacy is not so abstract, but towards the application of more abundant life situations. Most of its definitions involve the combination of background, purpose and purpose.

4. Conclusion

Mathematics literacy, as an exotic product, has attracted local attention in recent years, and occupies a place in the syllabus (curriculum standards). The diversity of students' intelligence and their individual differences determine that the evaluation methods of mathematics learning should also be diversified. There is a lack of research on this issue at home and abroad, which should be the direction of joint efforts. At present, there is no unified and mature understanding of the structure of mathematical literacy in academic circles. The western research on the elements of mathematical literacy is clear, not only the research object is clear, but also has a certain theoretical basis. Mathematical literacy is not equal to mathematics. The mathematics knowledge education that the school cares about will not be automatically transformed into the teaching strategy of mathematics literacy of mathematics literacy education. The idea of multiple intelligence theory coincides with the requirements of mathematics curriculum standards, and it is meaningful to verify

the research of mathematics instruction design based on multiple intelligence theory.

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