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The use of historical materials in mathematics teaching: the case of logarithms

Abstract

Dividing the level of curriculum helps us to analyze the issues that arise in the implementation of the curriculum. Mathematics curriculum can be divided into four levels: the “intended” curriculum, the “intended implemented” curriculum, the “implemented” curriculum and the “attained” curriculum (Garden, 1987). This presentation mainly studies the “intended” curriculum, the “intended implemented” curriculum and the “implemented” curriculum of the history of mathematics in the mathematics curriculum.

In mainland China, the “intended” curriculum is the goals and requirements in mathematics curriculum standard. Reflecting the cultural value of mathematics is one of the basic ideas. The curriculum standard states: “Mathematics is an important part of human culture. The mathematics curriculum should properly reflect the history, application and development trend of mathematics, the role of mathematics in promoting social development, the social needs for mathematics, the ideological system of mathematical science, the aesthetic value of mathematics, and the innovative spirit of mathematicians. The mathematics curriculum should help students to understand the role of mathematics in the development of human civilization, and to form gradually the correct view of mathematics.”

In order to achieve the “intended” curriculum mentioned above, the “intended implemented” curriculum sets up some teaching materials in textbooks, which aim to provide teachers with abundant teaching resources, and help students to construct a better understanding of mathematical knowledge. Among the most widely used mathematics textbooks in China, there are 24 teaching materials, 12 of which are about the history of mathematics.

Table 1 Historical Materials

	English Title
1	The development of function
2	The invention of logarithms
3	Solving equations in history in China and foreign countries
4	Descriptive geometry and Monge
5	Euclid's <i>Elements</i> and axiomatic methods
6	Descartes and analytic geometry
7	Cyclotomic method
8	Probability and cryptology
9	Trigonometry and astronomy
10	The origin of vector and vector notation
11	Helen and Qin Jiushao
12	Fibonacci sequence

Below is the main content of the material “The invention of logarithms”.

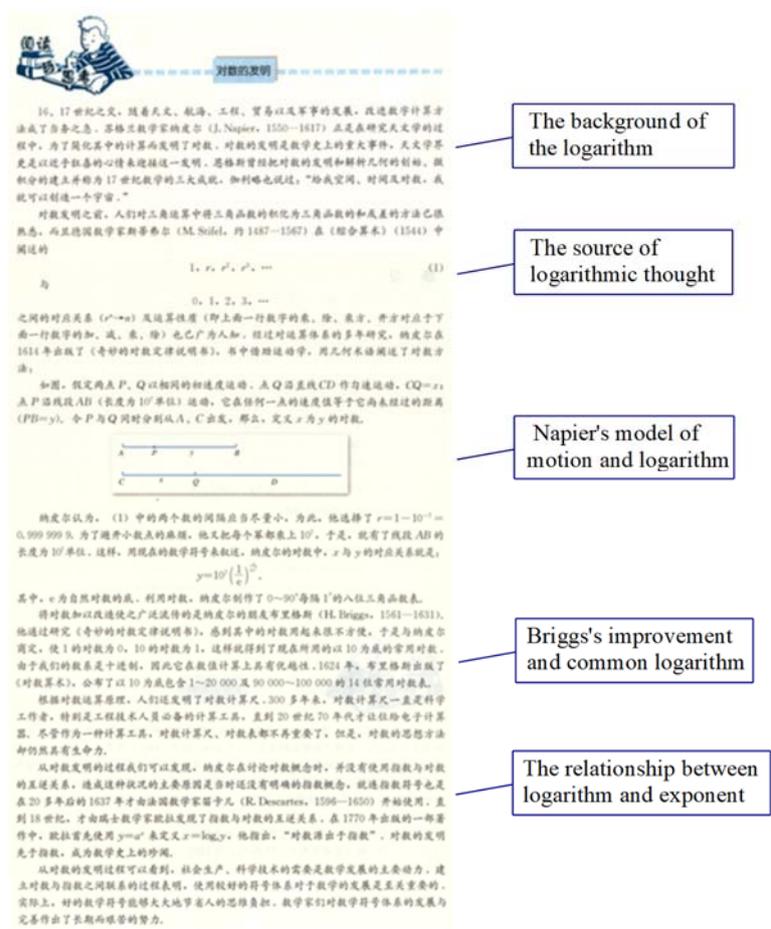


Figure 1 Teaching Material about logarithms

The “implemented” curriculum refers to the implementation of the curriculum in practical teaching. What is the use of historical materials in textbooks since 2004? Taking the historical material about logarithms as an example, this study surveyed 315 teachers from different primary school in China and interviewed 8 of them.

Question 1: How much attention do teachers pay to historical materials in teaching?

In the survey result, 1.9% of teachers are always concerned about historical materials, and 23.5% of teachers often concerned, 49.5% of teachers sometimes concerned, 21.9% of teachers seldom concerned, while 3.2% of teachers never concerned.

Question 2: How do teachers use historical materials?

The use of historical materials can be divided into three categories: positive, neutral and negative. 72.4% of teachers are positive, they will integrate the appropriate historical materials into teaching to create a situation or introduce the process of the development of relevant mathematical concepts. 25.4% of teachers are neutral; they will ask students to read, understand and think after class. Unfortunately, there are a 2.2% of teachers who have a negative attitude towards historical materials. They have no requirement for materials, and even think that integrating them into teaching will affect the progress.

Question 3: Why do or do not teachers use historical materials?

In the interview, teacher T1 said: “The historical material about logarithms can stimulate students’ interest in learning and help students understand the invention of logarithms”. Teacher T2 said: “Since class time is limited, there is no time to arrange the teaching of historical materials. And there is a lot of supplementary work to do, so I have no choice but to let students read by themselves”. Teacher T3 said: “Mathematics is so difficult. Integrating the historical materials into class will greatly influence the progress of teaching.” Therefore, the factors that influence teachers’ use of historical materials mainly include the correlation between materials and examinations, the correlation between materials and mathematics, the progress of teaching and the base of students’ knowledge.

The survey results of the “implemented” curriculum show that the use of historical materials is not ideal; teachers are less concerned about them. Though some teachers tried to use this material, the application mostly stayed at a fairly low level, such as “complementation” or “replication”, and failed to fully realize the requirements in the “intended” curriculum. From the perspective of historical material itself, we need to develop more resources to improve the use of it. Here are some suggestions: (1) to focus on the interesting stories that happened to Napier to make the material more interesting; (2) to make more natural the transition from a discrete arithmetic and geometric progression to the model of continuous motion model, so as to improve the students’ capacity of learning and meet the students’ cognitive basis; (3) to reveal the significance and practical value of logarithms for improving the effectiveness of computations; (4) to show Napier’s persistence, responsibility, modesty and cooperation aiming to enhance the humane character of mathematics.

References

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