

CHANGES IN PRIMARY SCHOOL MATH CLASSROOM SINCE THE NEW CURRICULUM REFORM

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Since “Mathematics Curriculum Standards in the Phase of Full-time Compulsory Education (Experimental Manuscript)” (referred to as the Standards) was enacted six years ago, the new math curriculum reform has been carried out all around China. Teachers tried to integrate the ideas and requirements of the Standards into their daily teaching practice, which brought new look to math classroom. The ideas, objectives, contents and suggestions that the Standards involved have increasingly become the focus of attention and the base of research for the mathematics educators and researchers. In light of this context, a series of obvious and profound changes have taken place in the primary school math classroom instruction.

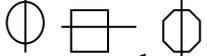
1. The focus now is placed on the close association of math and daily life, and the students are encouraged to learn math in rich contexts.

The math classroom instruction has changed from the former teaching mode of reviewing——introducing the new knowledge——giving examples——giving exercises. The math classes have become more interesting and lively. Teachers create rich contexts such as fairy tales and problems in daily life to attract and guide students to enter the mathematical world.

The new curriculum advocates that the contexts should be close to students’ daily life, with the aim to enable the students to feel the close association of math and life and thus feel the need and pleasure to learn math. So math instruction should start from students’ previous life experiences and personal knowledge so that the students can experience the process of abstracting the practical problems in life into mathematical models and then explain and apply these models. Consequently, how to create interesting contexts that are close to life, full of mathematical implications and need exploration has become the focus of teachers’ research.

As a matter of fact, students learn math long before they go to school and beyond the math classroom. In daily life they often run into various kinds of mathematical problems and have formed some kind of personal math knowledge. Though informal and unsystematic, and sometimes obscure and unclear, and some even wrong, these knowledge and experience are the starting point for students’ further math learning.

Here an example in math instruction will be given to illustrate this. In one math lesson, the objective was to help the students have initial knowledge of fractions. First, the teacher wanted the students to learn the mathematical concept of $1/2$. The teacher started from the question of how to divide one apple into two equal parts to

two children. From their previous life experience students answered that each child should get “a half”. Here the teacher didn’t immediately write $1/2$ on the blackboard, instead, he asked the students to express the concept of “a half” in their own ways. Most of the students employed graphs to show this (such as , but one student used half of one of the characters in his name to express the concept of “a half”. The teacher now didn’t eagerly make comments on their various expressions, but introduced the mathematical way of expressing “a half”, i.e., $1/2$. He then asked the students whether they liked this expression. Some students still thought that their own ways were better because anyway, graphs are more vivid than figures. Then the teacher asked them to express “one a hundredth” in their own way. Now all the students realized that the mathematical expression of “ $1/2$ ” was easier and can be generalized, so they accepted this new mathematical concept gladly. In this example, the teacher not only provided opportunities for the students to show their own expressions, but also brought the students to a full understanding of the new mathematical concept through elaborately designed questions. In other cases, some teachers encouraged students to create a mathematical way to express the concept of “a half”. So the students created $1/2$, $2/1$, 2 , and 2^1 , all of which were not only the students’ innovation, but also their primary understanding of fractions.

It’s very natural that children have an immature primary understanding of certain mathematical questions. This crude understanding is most individual and is the real reflection of math in children’s mind. It is right on the basis of this incomplete and inaccurate expression of math that children will come to a real understanding and a correct expression of math.

2. Students’ learning styles are more diversified, and inquiry learning, collaboration and communication are becoming important math learning styles.

In the current math curriculum reform in primary schools in China, an important idea is to encourage various learning styles. As a result, students’ independent thinking, practical abilities, collaboration and communication between teachers and students and within students themselves are becoming important learning styles. Learning is becoming an active, interesting and highly individualized process of thinking and practicing. The changes in these aspects can be seen from the following two examples.

In the past, when teaching arithmetic, great efforts were made in training students to “calculate fast and correct”. In terms of arithmetical methods, the teacher focused on explaining one particular method and making sure that all the students master this method through large amounts of various exercises and drills. For example, to solve the problem of $15-9$, traditional math instruction requires the students to use the method of “to solve subtraction by addition”, i.e., $9+6=15$, so $15-9=6$. But with the further implementation of mathematics curriculum reform in primary school, teachers come to realize that when students try to do arithmetic, they have their own different arithmetical methods resulting from their own particular life experience and

individual ways of thinking. The students can and should invent their own arithmetical strategies, which will be of great help to their understanding of mathematics. Meanwhile, all the students can benefit from listening to and responding to others' methods. In addition, students' strategies show their ways and levels of thinking, which helps teachers to reflect on and improve their teaching. So, in math instruction, teachers should encourage and respect students' independent thinking, and provide opportunities for students to share their different arithmetical methods. In the current math classroom teaching, teachers usually ask the students to think out various ways of solving $15-9$, and then share with the whole class. Some students subtracted 9 from 15 one by one. Some divided 15 into 10 and 5, $10-9=1$, so $1+5=6$. Some divided 9 into 5 and 4, $15-5=10$, so $10-4=6$. Some thought that $9+6=15$, so $15-9=6$. Still others thought that $15-10=5$, so $15-9=6$. For these different methods, the teacher gave positive feedback and encouraged students to share their methods with one another. Through communication the students finally chose the best method that fit them. Here students are no longer required to use the same single method as before.

In the reform of classroom teaching, teachers come to realize that putting forward a problem and solving the problem are equally important. But putting forward a problem is the weak point for Chinese students. So some teachers try to provide opportunities for students to put forward a problem. They set a relaxing environment and encourage the students to observe life from various perspectives, describe things and phenomena from mathematical perspective, discover the elements in them that are relevant to math and put forward a problem, no matter correct and mature or not. The following is an example of a classroom teaching of "basic knowledge of percentage". At the beginning of the class, the teacher asked the students to share examples in life of "percentage". They found many on the package boxes of beverage, on the labels of clothes, on newspapers and on the instructions of toys and became greatly interested in it. Then, encouraged by the teacher, the students asked questions about percentage from different perspectives. The following are several typical ones:

- (1) Why do people like to use percentage?
- (2) What's the difference between percentage and fractions?
- (3) What does percentage mean?
- (4) How to write percent in mathematics?
- (5) What's the use of percentage?
- (6) Which is more widely used, fractions or percentage?

After summing up these questions, the students tried to solve them in groups. And then the teacher and the students summed up what they had learned about percentage. At the end of this lesson, the teacher again asked the students to ask questions. The students talked actively. Some of them asked whether there was a way of describing an amount as if it was part of a whole which was 10 or 1000. This not only promoted

the students to have a more profound knowledge of what they'd learned, but also encouraged them to innovate.

3. The teacher creates a democratic and relaxing classroom atmosphere, where the students have more opportunities to innovate

In the classroom reform, the teachers come to the common recognition that math classroom is the basic place where students create, share and communicate. So the teachers all try their best to provide a relaxing classroom atmosphere, and provide more opportunities for the students to share their ideas and strategies. In this way different ideas collide to produce illumination to each student and thus promote the common development of different individuals.

The following is an example of the lesson “statistics” for students of first grade. The students were divided into groups and each group had a bag with four balls marked No. 1 to No. 4. The group members were asked to keep a record of the number of the ball each time they take blindly from the bag. Then the teacher asked them to share how they made the record.

Group one: We wrote down the number of the ball each time we took it from the bag. Like this: 4 1 1 2 3 4 2 1 2 3.....

Group two: We first drew four circles representing the balls of No. 1 to No. 4, and then we wrote down the number of the ball each time we took under its corresponding circles. Like this:

○	○	○	○
1	2	3	4
1	2	3	4
1		3	4
			4

Group three: Our practice is a little bit different from group two. We first wrote down No. 1 to No. 4 to represent the four kinds of balls and then we drew circles under them each time we took a ball. Like this:

1	2	3	4
○	○	○	○
○	○	○	○
○	○	○	
○		○	
○			

.....

And then the teacher asked the students to make comments on the above mentioned methods:

Student 1: I think all of them make good records.

Student 2: I disagree. The record of group one is not clear. Both group two and group three are better.

Student 3: I also think that the recording methods of group two and group three are better than that of group one because the results are quite clear.

Student 4: I think the method of group three is the best because it's very easy to just draw a circle.

From the discussion we can feel that through equal communication, the teacher guided the students to share their ideas and thus formed an enthusiastic and orderly learning atmosphere. The teacher listened, asked questions and guided the students to share their ideas and products. Even for those "not so good" ideas, the teacher didn't simply correct the mistakes but encouraged the students to discuss and make their own judgment. The teacher now not only focuses the mathematical knowledge itself, but also shows great concern for the promotion of mutual understanding, respect and appreciation between students during the process of discussion.

4. The teachers' professional development is achieved in the process of promoting the all-round development of the students

In the new curriculum reform, the idea of "to promote the all-round development of each student" has been fully carried out in daily teaching. According to the two years of follow-up research and evaluation of the first round of 42 national level experimental regions of curriculum reform conducted by Ministry of Education basic education curriculum reform "professional supportive work group", there have been obvious improvements in students of the experimental classes. The students now enjoy learning more and like going to school. There have been improvements in students' all-round quality, ability to search and process information, communication and expression skills, questioning and innovative abilities as well as practical abilities. All these strongly show that great improvements have been made in primary school math classroom reform.

At the same time, the implementation of the new curriculum also forcefully promoted the teachers' professional development and facilitated the changes in teachers' roles. The following are the new roles of teachers:

1. Teachers as facilitators of students' learning.

By this it means that teachers not only transfer knowledge to the students in the traditional sense, but also promote the sound and harmonious development of the individual student stressing on their learning capabilities. The role of the teachers as facilitators of students' learning is the most obvious and direct characteristic of teachers' roles. The new curriculum promotes teachers to become the organizers, guiders and partners in the teaching and learning activities.

The role of teachers in classroom can directly influence teachers' teaching behaviors. In the new curriculum, the following changes have appeared in teachers' teaching behavior: teachers now offer guidance for the students to form good learning habits and master learning strategies, create rich teaching environment, stimulate students' learning motives, foster students' interests in learning, provide various conveniences for the students' learning, establish an acceptable, supportive and tolerant classroom atmosphere, share with the students some of their own feelings and ideas as participants in learning, seek truth together with the students and be responsible for their own mistakes and faults.

2. Teachers as researchers of education and teaching

The new ideas, methods involved in the new curriculum and the various problems that appeared in the implementation of the new curriculum can hardly be explained and dealt with by drawing on the past experience and theories. The teachers should not wait for someone else to tell them how to react and then employ others' research results into their own teaching without giving it a second thought. In this regard the new curriculum promoted the transformation of the idea of "teachers as researchers" into practice.

As a matter of fact, during the years of implementation of the new curriculum, the teachers in the experimental regions can actively undertake teaching research work with great initiative. Many teachers can now look at the various problems in their teaching practice from researchers' perspective, reflect on their own behavior, explore the newly emerged problems, and sum up their experience. Teaching and researching become complementary to each other. Many teachers now write teaching diaries. They often get together to discuss problems emerged in teaching experiments. Such communication and discussion help to solve the problems closely pertinent to teachers, through which teachers really experience the joy of doing research. This "action research" which integrates teaching with researching is the basis of teachers' further improvement, is the key for improving teaching standard and is the guarantee of the innovative implementation of the new curriculum.

3. Teachers as people who construct the curriculum

The new curriculum changed the role of teachers as people who implement to people who construct the curriculum. This is first shown in the innovative employment of the textbooks. The teachers now try to use the textbooks as curriculum resources and use them appropriately in accordance with the actual needs of their students.

Secondly, this is also shown in the development of the curriculum resources. One of the characteristics of this round of curriculum reform is to emphasize on the status and role of curriculum resources. Though there's a lack in curriculum resources, the teachers try actively to develop all kinds of resources by themselves. Practice has shown that the development and employment of curriculum resources have enlarged teachers' eyes, expanded the educational contents, enriched the experiences and life of both teachers and students, and most importantly, promoted teachers' abilities of

curriculum construction and their educational and teaching wisdom.

In one word, more concrete and real changes have taken place in the students, the classroom and the teachers since the new curriculum reform.