

APEC-Tsukuba International Conference V
Innovation of Classroom Teaching and Learning through Lesson Study-
Focusing on Mathematics Textbooks, e-textbooks and Educational Tools

CHENG Chun Chor Litwin
The Hong Kong Institute of Education

Report:

How can we innovate our teaching approaches for teachers in using textbooks in primary mathematics?

Introduction

The present primary mathematics curriculum in Hong Kong was revised since 2000. And since then different publishers provide different textbooks for the Hong Kong school to choose from. These textbooks have to be endorsed by the Education Bureau in Hong Kong. Most of the time, textbooks in Hong Kong consists of three package, the textbooks, the exercise and the teachers' guide. The teachers' guide usually is a compilation of the content of the textbooks, in text and in power points format, and some IT resources in using the textbooks. The idea was that such teacher guide can cover most of the teaching needs of the teachers in classroom, and also extends it to include extra mathematics problems for elite students. The efficient of the teachers' guide were sometimes being questions for such purpose as they are usually very packed in volume and can affect the process of classroom teaching. Unlike the counterparts in Japan, textbooks in Hong Kong are very rich and thick and teachers have relative less rooms for their own ideas of teaching. This may contradict the ideas of school-based learning where material could be developed for the needs of individual schools.

This report is to suggest ways for making teaching approaches innovative in using textbooks in primary mathematics. This includes the using of textbooks for teachers to develop their own mathematics question and also using computers software as a guide for mathematics investigation.

Background, Education in Hong Kong

A more completed syllabus was introduced in 1983 syllabus, and at that time, some schools teach the curriculum half year earlier. The present primary mathematics

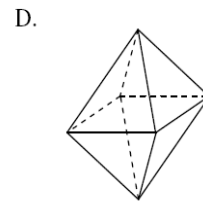
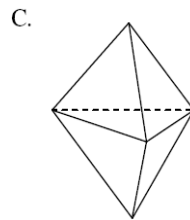
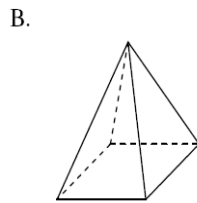
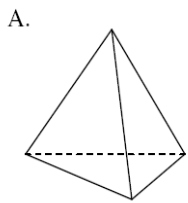
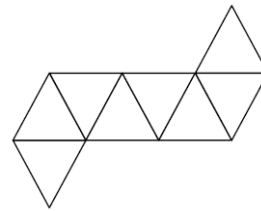
syllabus is used since 2000. And since 2004, a centralized assessment TSA is conducted in Primary 3, Primary 6, and secondary 3. These assessments affected the progress of teaching.

The following is some sample items in the TSA.

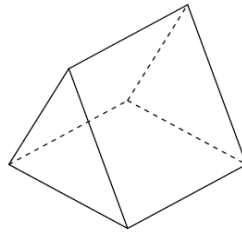
2. 把 0.030 981 捨入至三位有效數字。

- A. 0.03
- B. 0.031
- C. 0.031 0
- D. 0.030 98

13. 下列哪個立體圖形可由右方的摺紙圖樣摺合而成？

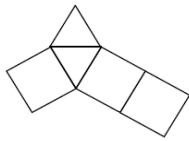


16.

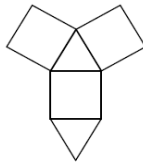


下列哪個摺紙圖樣可摺成以上的三角柱？

A.



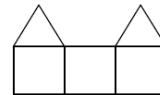
B.



C.



D.



Affect of curriculum change in 2000

In the 2000 primary mathematics curriculum, more teaching time is allocated to measurement and statistics. The following changes took place in this curriculum.

No ratio of teaching.

No index representations

No area of circle

No Positive and negative numbers.

More measurement and data handling.

Publishers for Primary Mathematics

All textbooks used in Hong Kong schools needed to be endorsed by the Education Bureau. Now there were 6 set of textbooks. Usually all school have their whole year teaching plan and progress. This is followed by the whole year (3 to 5 classes for each year). Sometimes school put soft topic to be taught at the end of year, this include measurement and statistics, so that they could focus on teaching of calculation which are more difficult.

ICT and software or power points are used for the topics of three-dimensional objects, such as prism, so that teachers could show the properties. This is used alongside with the real objects.

Q1

How do you use your textbook in your country?

Sharing the methods of textbooks and knowing theories on curriculum and textbooks.

The textbooks in Hong Kong are very well written and are very thick. One of the approaches taken by the textbook is filling in the blank of the procedure.

For example, finding the area of a triangle, base = 8 and height = 3, many textbook introduced the following format.

$$\text{Area} = \frac{(\quad) \times (\quad)}{2}$$

Students need to fill in the blanks.

We include some examples from the textbooks here.

Example:

There are three pieces of land, each is $4\frac{4}{5}$ square meter, and each square meter need $3\frac{3}{4}$ liter of water. How much water is needed?

$$\text{Water needed} = 3\frac{3}{4} \bigcirc 4\frac{4}{5} \bigcirc 3$$

$$= \frac{(\quad)}{(\quad)} \bigcirc \frac{(\quad)}{(\quad)} \bigcirc 3$$

$$= \text{_____ (Litre)}$$

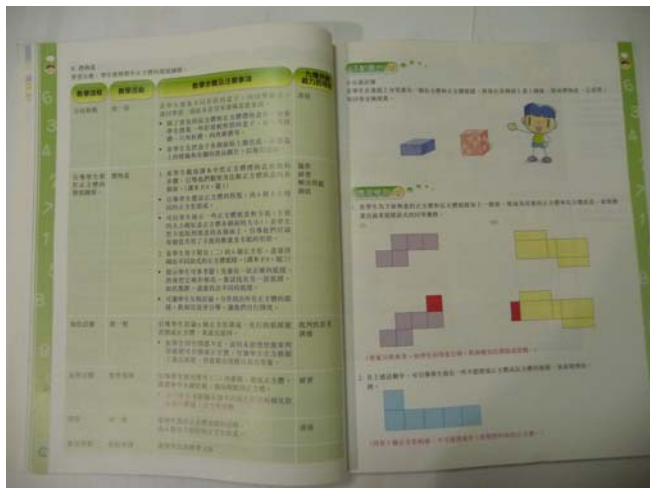
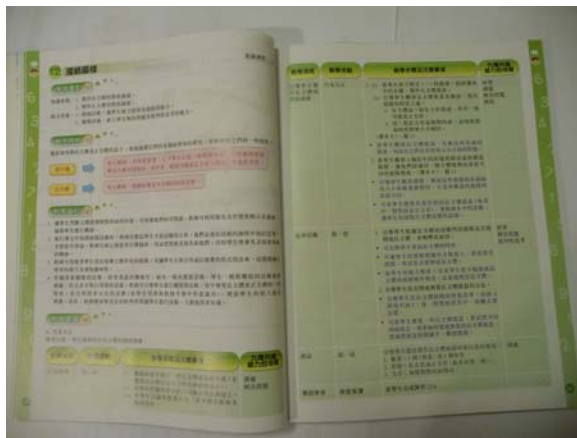
Example

There are 45 orange balls and 75 white balls.

Find the fraction of orange ball in respect to the total number of balls.

$$\text{Answer} = \frac{(\quad)}{(\quad) + (\quad)} = \frac{(\quad)}{(\quad)}$$

And usually, teachers' guide book are very rich in supplementary information for teaching. Teachers need to pick and adapt according to their needs.



Q2

How can we use our textbook meaningfully?

Elaborating the model approaches using textbooks to develop mathematical thinking and communication

The following are results and suggestion:

Teachers need to base on their theory of work.

Provide framework of teaching in concepts,

Provide items for exploration.

Teachings of basic concepts are based on the textbooks, and teachers usually have to develop their work sheets.

A concrete example is included to illustrate the above points.

Example: Teaching the formula of area a triangle

Teachers divided the concepts into three stages.

Stage 1, find the area and develop formula for a right angle triangle.

Stage 2, find the area of a acute angle triangle, students are encourage to think of using the formula of area of right angle triangle to develop the formula of acute triangle.

Stage 3, the formula for an obtuse angle triangle, as the height is outside the triangle. Combine the three stages, students can develop a general formula for the area of a triangle.

Example:

Teaching of HCF

There are usually three tactics, using listing, prime factorization and short division.

As this is the usual practice by teachers, many textbooks used the same approaches to provide three ways of learning the concepts.

Q3

How you use blackboards and projectors in your country?

Sharing the various ways of utilizing traditional equipments in classroom such as blackboards as well as projects and computers.

In 2000, the Education Bureau enforced a suggestion that starting from 2002, all classrooms teaching should be accomplished by 30% time of using IT (later called ICT). And at that time, all publisher build up e-textbooks, which are usually the PDF files of the textbook. So that teachers could use these file during classes. This make the teachers guide a burden for the publishers, this is why the textbooks are not too cheap in Hong Kong. All textbooks are go with teachers guide, exercise pack and sometimes even teaching aids such as calculators.

In the Hong Kong classroom, projector is used with visualizer so that hand on working or students work could be displaced at classes. Also, it is used as an aid for

discussing students work during classes.

Blackboards work is not very focused in Hong Kong schools. Pre-service teachers did not focus much or practice on designing the blackboard presentation.

In fact, the using of software like Maple help to solve the question of using numbers 1 to 9, each time using one numbers and no repetition ($ABC+DEF= GHJ$). There are 164 different answers, and the following is part of the solutions obtained by using software.

1) $241 + 596 = 837$	11) $281 + 673 = 954$
2) $341 + 586 = 927$	12) $281 + 394 = 675$
3) $541 + 386 = 927$	13) $381 + 294 = 675$
4) $541 + 296 = 837$	14) $381 + 546 = 927$
5) $251 + 397 = 648$	15) $581 + 346 = 927$
6) $351 + 297 = 648$	16) $681 + 273 = 954$
7) $271 + 683 = 954$	17) $291 + 573 = 864$
8) $271 + 593 = 864$	18) $291 + 384 = 675$
9) $571 + 293 = 864$	19) $291 + 546 = 837$
10) $671 + 283 = 954$	20) $291 + 357 = 648$

Q4

How can we innovate our teaching approaches for teachers?

Knowing the innovative tools to develop e-textbooks and sharing the methods of teaching.

Teaching approaches in mathematics need to be motivated by the material and problems in mathematics. As teaching is driven by mathematical thinking through problems, design of mathematical problems are important.

Hence, a few theories and frameworks are needed for teachers to develop their teaching approaches. For example, using the ELPS approach (experience, language, picture and symbol). Teachers , some of the task objective are mentioned and also the technique may be mentioned if not damaging the structure of teaching.

For investigations on specific problems, more general teaching techniques are used, for example, trial and error in tackling the problems, group discussion and

presentation, modification of the solution in representation. And in this context, the important part of teaching is the pace of learning and thinking, and also the questions used by teachers. The questions and partial answer guided the students to solve the problem, and the teacher's questions and partial answer has a role in reducing the cognitive load of students in the learning.

If e-textbooks is used as the same way as we are using printed books, there is not much difference, only that the media is different. For e-books to be more powerful than printed books, perhaps sound and movie are important elements. If we all go to a web and obtain similar material, these materials could be prepared before hand. Hence there is a discussion of which element/topic that are more efficient delivered by e-textbooks. This is an open question.

References

Education Bureau (2000), Primary Mathematics Curriculum, Hong Kong SAR.