Results of Primary 6 Mathematics in TSA 2010

The territory-wide percentage of P.6 students achieving Mathematics Basic Competency in TSA 2010 was 84.2% which was almost the same as the performance levels in 2007 and 2008.

Primary 6 Assessment Design

The assessment tasks for P.6 were based on the *Basic Competency at the end of KS2 for the Mathematics Curriculum (Trial Version)* and the *Mathematics Curriculum Guide (P1 – P6), 2000*. The tasks covered the five Dimensions of the Mathematics curriculum, i.e. Number, Measures, Shape & Space, Data Handling and Algebra.

The Assessment assumed students had already mastered the Basic Competencies covered in Key Stage 1 (Primary 1 to 3) and therefore focused primarily on the basic and important areas of the Key Stage 2 (Primary 4 to 6) curriculum, testing the concepts, knowledge, skills and applications relevant to these areas. However, a small number of test items were set to test specifically some of the Basic Competencies covered in Key Stage 1 to determine whether or not P.6 students still retained some essential concepts and skills learnt in Primary 1 to 3. Furthermore, since some of the Basic Competencies in the Number, Measures and Shape & Space Dimensions are common for both Key Stages 1 and 2, four items (four score points) testing these common Basic Competencies were purposely set to be the same in the P.3 and P.6 Assessments. In this way, there was a basis for comparing the performance of P.3 and P.6 students on the same Basic Competencies which they had learnt during Key Stage 1. This comparison could indicate whether P.6 students still retained the Basic Competencies they had learnt during Key Stage 1 and performed better than P.3 students as expected.

The Assessment included a number of item types including multiple choice, fill in the blanks, solutions with working steps (or equations) required as well as open-ended questions in which students were required to justify their answers, with item types varying according to the context. Some of the items consisted of sub-items. Besides finding the correct answers, students were also tested on the ability to present their solutions to problems, including writing out the necessary statements, mathematical expressions, equations and explanations.

The Assessment consisted of 123 test items (191 score points) covering the five Dimensions.

These items were grouped into four sub-papers, each of 50-minutes in duration and covering all five Dimensions. Some items appeared in more than one sub-paper to provide inter-paper links. Each student was required to attempt only one of the four sub-papers.

The composition of the four sub-papers is illustrated as follows:

Table 8.3 Composition of the Sub-papers

Sub-paper	Number of Test Items (Score Points)					
	Number Dimension	Measures Dimension	Shape & Space Dimension	Data Handling Dimension	Algebra Dimension	Total
M1	21 (30)	9 (15)	5 (10)	3 (9)	4 (6)	42 (70)
M2	23 (32)	10 (14)	4 (8)	3 (9)	4 (6)	44 (69)
M3	22 (29)	9½ (15)	5½ (14)	3 (6)	4 (6)	44 (70)
M4	23 (30)	8½ (16)	4½ (9)	3 (7)	5 (7)	44 (69)
Total *	63 (82)	29½ (49)	11½ (24)	8 (21)	11 (15)	123 (191)

* Items that appear in two different sub-papers are counted once only.

Performance of P.6 Students with Minimally Acceptable Levels of Basic Competence in TSA 2010

P.6 Number Dimension

Students performed well in the Number Dimension. The majority of students understood the basic concepts of whole numbers, fractions and decimals as well as the skills in performing arithmetic operations. The majority of students had basic understanding of percentages. However, some students were weak in solving more complicated problems, for instance, with contexts related to percentages. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets as follows.

Understanding basic concepts

- Most P.6 students understood the concept of place value of whole numbers which was learnt in Key Stage 1 (e.g. Q1/M1; Q1/M2). However, some students could not recognise the place values of decimal numbers which was learnt in Key Stage 2 (e.g.

Q11/M1; Q10/M2; Q7/M3).

- Most students were able to write a number in numerals (e.g. Q5/M4) and order numbers up to five digits (e.g. Q1/M3).

Multiples and factors

- While the majority of students understood the concept of factors and multiples (e.g. Q2/M1 and Q2/M3), some students confused the multiples and factors of a number. Almost half of the students could not use the listing method to find all the factors of a number (e.g. Q3/M1).
- The majority of students understood the concept of common factors and common multiples (e.g. Q1/M4; Q3/M3) but about half of the students could not use the listing method to find the common factors and common multiples of two numbers (e.g. Q4(a)/M3; Q5(a)/M1).
- Many students could find the highest common factors (H.C.F) (e.g. Q4(b)/M3) and the least common multiple (L.C.M.) of two numbers (e.g. Q5(b)/M1).

Fractions

- The majority of students understood the basic concept of fractions as parts of one whole (Q6/M1; Q3/M4).
- The relationship between fractions and the whole was well grasped by P.6 students (e.g.Q4/M1; Q5/M3).
- Most students performed well when converting improper fractions into mixed numbers and vice versa (e.g. Q7/M1).
- The majority of students understood the concept of equivalent fractions (e.g. Q6/M3).
- The majority of students could give the correct answer in comparing fractions (e.g. Q8/M1; Q8/M3).

Decimals

- Most students were able to use decimals in recording (e.g. Q10/M1).
- The majority of students were capable of converting decimals into fractions and vice versa except that some students did not reduce a fraction as an answer to its simplest form (e.g. Q11/M2; Q9/M3).

Percentages

- The majority of students understood the basic concept of percentages in simple contexts (e.g. Q20/M3).
- The majority of students were capable of converting percentages into fractions and vice versa (e.g. Q18/M1) except that some students did not reduce a fraction as an answer to its simplest form.
- Most students were capable of converting percentages into decimals (e.g. Q21/M3).

Performing basic calculations

- Generally speaking, students showed no problems in carrying out the four arithmetic operations on whole numbers and fractions, including mixed operations involving brackets and division with a remainder (e.g. Q9/M1, Q12/M1, Q13/M1; Q15/M2; Q10/M3, Q11/M3, Q12/M3; Q10/M4, Q11/M4). A few students forgot to reduce the fraction as an answer to its simplest form (e.g. Q13/M1).

Q13/M1
$4\frac{1}{6} - 2\frac{5}{6} = \boxed{1\frac{2}{6}}$

- In Q13/M4, some students forgot the computational rule 'performing multiplication/division before addition/subtraction' and choose D wrongly. Those students who chose B or C showed weakness in division of fractions, too.
- In the multiplication and division of fractions and whole numbers, the performance of some students was not satisfactory (e.g. Q14/M1).

Q14/M1
$\frac{2}{5} \times \frac{3}{8} \div 15 = \boxed{\frac{3}{26}}$

- The majority of students performed quite well in carrying out the four arithmetic operations on decimals including mixed operations (e.g. Q15/M1; Q16/M1; Q12/M2; Q13/M3; Q15/M4).

Solving application problems

- Most students could solve simple application problems involving whole numbers and fractions (e.g. Q17/M1; Q16/M2; Q17/M2; Q16/M4). Some students could not comprehend the situation where addition and subtraction of fractions were needed (e.g. Q15/M3). Their performance was worse in more complicated contexts involving multiplication and division by fractions and whole number (e.g. Q18/M4).
- Students on the whole could solve simple application problems involving whole numbers and decimals (e.g. Q19/M1). More than half of the students could not handle division who might confuse the dividend with divisor (e.g. Q18/M2).
- The majority of students were capable of solving application problems involving whole numbers and decimals in the calculation of money when the situation was simple and common in daily life (e.g. Q21/M2; Q19/M2; Q17/M3). However, their performance was worse when the contexts were more complex (e.g. Q18/M3; Q19/M4).
- Students performed well in solving application problems involving percentages (e.g. Q21/M1; Q23/M2). The majority of students did well on the familiar discount problems (Q22/M3).
- The majority of students could choose the most suitable expression in order to find an estimated value (e.g. Q20/M2; Q20/M4).

P.6 Measures Dimension

The performance of students in the Measures Dimension was satisfactory. On the whole, students had mastered the basic knowledge and skills learnt in Key Stage 1. They could apply the basic concepts and formulae to solve simple problems. Nonetheless, some students were not able to flexibly use the knowledge in solving problems with more complicated contexts. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Measurement of time, length, distance, weight and capacity

- About half of the students could not give the correct dates according to given conditions (e.g. Q25(b)&(c)/M2).
- Most students were able to tell time from a clock face (e.g. Q23(a)/M1) and digital clock (e.g. Q24/M2).
- The majority of students could use minutes and hours to record the duration of time (e.g. Q23/M3).
- The majority of students were able to apply the '24-hour time' accurately (e.g. Q23(b)/M1).
- The majority of students could choose appropriate 'ever-ready rulers' to measure distance (e.g. stride length in Q25/M1).
- Students were capable of measuring length with a ruler (e.g. Q24(b)/M3).
- Students were capable of comparing the weight of objects directly (e.g. Q24/M1) and choosing an appropriate measuring tool to measure the weight of a can of soft drink (e.g. Q27/M2).
- The majority of students performed satisfactorily when comparing the capacity of containers using improvised units (e.g. Q35/M3).
- Students performed well when dealing with capacity measurements on beakers (e.g. Q27/M1) though some students made careless mistakes in reading the scales of a beaker.
- Regarding the usage of appropriate units for recording measurements, students did well on length (e.g. Q22(a)/M1), distance (e.g. Q26(a)/M2), weight (e.g. Q22(c)/M1; Q26(b)/M2) and capacity (e.g. Q22(b)/M1; Q26(c)/M2).

Finding perimeters

- The majority of students were able to measure the perimeter of 2-D shapes directly. (e.g. Q27/M4).
- Most students could find the perimeter of a square (e.g. Q28(a)/M4). The majority of students could solve problems involving the perimeters of rectangles and composite figures (e.g. Q28(b)&(c)/M4).

- The meaning of the circumference of a circle was understood by many students. P.6 students could also recognise the relationship between the circumference and the diameter of a circle (e.g. Q28/M1; Q28/M2).
- The majority of students could apply the circumference formula both in finding the unknown circumference (with given diameter as in Q26/M3) and the unknown diameter (with given circumference as in Q26/M4).

Finding areas

- About half of the students could not give a correct answer to the area of an irregular 2-D shape on the square grid (Q30/M2). While some of them were carelessness in giving wrong units (cm or cm^3), many others used ineffective counting strategies.
- In general, P.6 students were able to find the area of squares, rectangles, parallelograms, trapeziums and triangles (e.g. Q29/M4; Q30/M4; Q26/M1). They could apply the formulas to find the areas regular figures but in many of them some gave the wrong unit of area (e.g. Q29/M3).

Finding volumes

- Most students could measure the volume of 3-D solids made up of cubes which were largely based on visual perception and counting (e.g. Q31/M2).
- The majority of students could find the volume of cubes though few students confused the unit of volume with that of area (e.g. Q30(a)/M1).
- Many students were not capable of recognising the relationship between capacity and volume (e.g. Q28/M3).
- The majority of students were capable of finding the volume of irregular solids by displacement of water (e.g. Q30/M3).
- The performance of students was apparently weak when flexible use of the volume formula for cuboids was required (e.g. Q30(b)/M1).

Speed

- The majority of students could record the speed of vehicles with an appropriate unit (e.g. Q29/M1).
- The majority of students could calculate speed correctly (e.g. the speed of a rocket in

Q33/M2). However, some students could not make suitable conversion in the unit of time in order to apply the speed formula (e.g. converting minutes to hours in Q23(b)/M3).

Q23/M3

(a) 全程用了 25 分鐘。

(b) 旅遊車的平均速率是 60 km/h，行車距離是多少？
(列式計算)

25 × 60
= 1500
∴行車距離是1500km。

P.6 Shape & Space Dimension

Students performed well in this dimension. They could recognise the characteristics of 2-D shapes (including triangles, quadrilaterals and circles) and 3-D shapes (including pyramids and cylinders). The students were adept in the eight compass points**.** Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Recognition of lines, curves and the eight compass points

- Some students were not able to identify the straight lines, curves, parallel lines and perpendicular lines in a figure (e.g. Q34/M1).
- Most students were good at recognising the eight compass points (e.g. Q35/M1) but the performance declined when the north direction was not pointing upward on the map (e.g. Q37/M2).

Knowledge of 2-D shapes

- Most students could recognise the diameter of a circle (e.g. Q32(a)/M1).
- Most students were good at recognising the centre and radii of a circle (e.g. Q36/M2).
- In general, students could identify 2-D shapes according to their properties (e.g. Q35/M2) and only a small number of them could not recognise a quadrilateral (e.g. Q34(a)/M3). Some students could not identify pentagons (e.g. Q34(a)/M2).
- The majority of students could recognise equilateral triangles (e.g. Q33(a)/M1), right-angled triangles (e.g. Q34(b)/M3) and isosceles triangles (e.g. Q32(b)/M1).
- Some students confused a circle with an ellipse (e.g. Q33(b)/M1).

Knowledge of 3-D shapes

- Most students could recognise cylinders (e.g. Q31/M1).
- Most students could distinguish between pyramids and prisms and give the correct numbers of vertices and edges (e.g. Q32/M3).

P.6 Data Handling Dimension

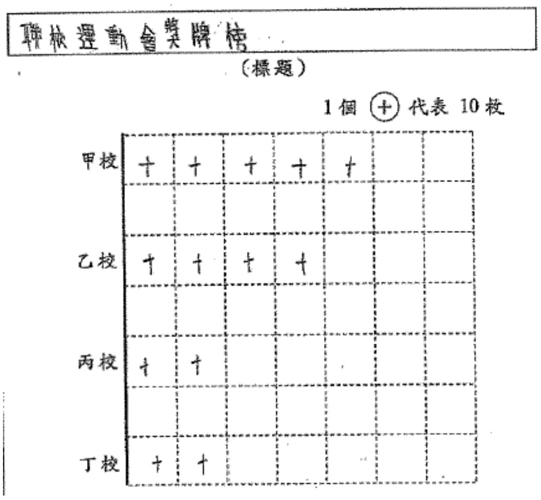
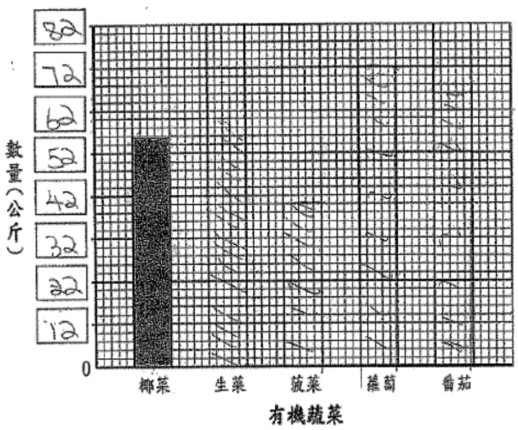
Students performed well in the Data Handling Dimension. The majority of students were capable of reading the data given in statistical graphs and making use of the data for further calculation and interpretation. They could also construct graphs from tabulated data. The majority of students could calculate the average of a group of data and solve simple problems of averages. Further comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Reading and interpreting pictograms and bar charts

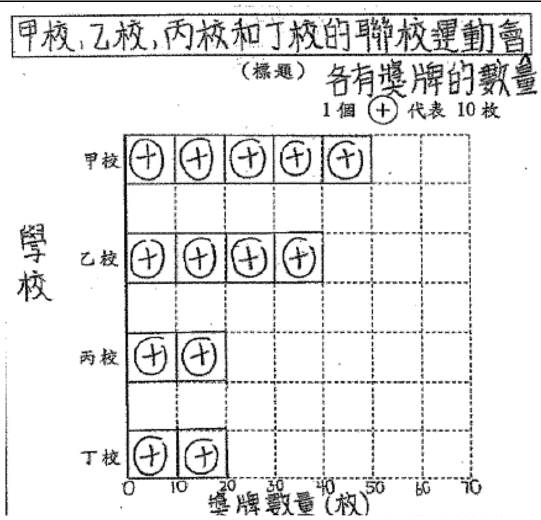
- Students were good at reading data directly from given pictograms (e.g. Q40(a)/M1) and bar charts (e.g. Q44/M3), including those of greater frequency counts (e.g. Q43/M3 and Q43/M2).
- Students performed well when they were required to make use of the data read from statistical graphs for further calculation and interpretation of information (e.g. Q43(c)/M2; Q44(b)/M3).

Constructing pictograms and bar charts

- In general, the students' performances in constructing pictograms (e.g. Q42/M2) and bar charts (e.g. Q41/M1) were satisfactory.
- Most students were capable of writing down a proper title for a statistical graph though some students did not draw their statistical graphs carefully and accurately (see the following examples of students' work).

<table>
<tr><td>Q42/M2</td><td>Q43/M4</td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

- A small number of students added a 'frequency axis' to a pictogram unnecessarily to record the frequency of data. (see the examples of students' work for Q42/M2 below).

<table>
<tr><td>Q42/M2</td></tr>
<tr><td>
</td></tr>
</table>

Concept of averages and its applications

- The majority of students were able to calculate the average of a group of data (e.g.Q42/M3, Q42(a)&(b)/M1).
- In application problems, some students could not find the average of data given in two separate tables (e.g. Q42(c)/M1) which showed that their analysis and synthesis abilities were relatively weak.

P.6 Algebra Dimension

In general P.6 students performed satisfactorily in the Algebra Dimension. The majority of them could use symbols to represent numbers, understand the concept of equations and solve simple equations up to two steps. They could solve simple problems using equations. More detailed comments on their performance are provided below with examples from different sub-papers quoted in brackets.

Using symbols to represent numbers

- In general, students could write down algebraic expressions pertaining to a simple context (e.g. Q38/M2). However, some students confused the dividend with the divisor and chose D as the answer (e.g. Q38/M3).

Solving simple equations

- Most students understood the concept of an equation and they could distinguish an equation from other algebraic expressions (e.g. Q37/M1).
- Students performed well in solving simple equations up to two steps and involving whole numbers or fractions (e.g. Q36/M1 and Q40/M2).
- They also did well in solving simple equations up to two steps and involving mixed numbers (e.g. Q38/M1) or decimal numbers (Q40/M3).
- Students could manage application problems by ‘the method of solving an equation’ but some of them did not define the symbol and placed it before the coefficient (e.g. Q41/M3).

Q41/M3
$y12 + 3 = 75$ $y12 + 3 - 3 = 75 - 3$ $\frac{y12}{12} = \frac{72}{12}$ $y = 6$

General Comments on P.6 Student Performances

The overall performance of P.6 students was good. P.6 students did well in the Number, Data Handling and Shape & Space Dimensions while they demonstrated satisfactory performance in the Algebra and Measures Dimensions. By and large, P.6 students mastered the basic concepts and computational skills stipulated in the document *Basic Competency at the end of KS2 for the Mathematics Curriculum (Trial Version).*

However, some students still had difficulties in handling some basic concepts and skills such as common multiples and common factors, place values in decimals, fractions, characteristics of quadrilaterals, perimeter and area, volume and capacity, etc.

In general, students were weak in solving application problems involving more complicated contexts as shown in the example of Q23/M4 below:

Q23/M4
是罐頭的百分之： 400 − 320 = 80%

When students were required to show the working, some students missed the brackets as shown in the example of Q19/M1 below:

Q19/M1
應找回： 50 − 37.5 + 8.9 = 50 − 46.4 = 3.6元 ∴應找回3.6元.

Some students were careless in solving equations or doing computations as shown in the examples of Q39/M1 below.

Q39/M1

設哥哥的零用錢是y元。

$$\frac{2}{5}y-10=80$$

$$\frac{2}{5}y-10+10=80+10$$

$$\frac{2}{5}y=90$$

$$\frac{2}{5}y\times\frac{5}{2}=90\times\frac{5}{2}$$

$$y=$$

∴哥哥的零用錢是225元。

Let the amount of Jack's pocket money be x.

$$\frac{2}{5}x-10=80$$

$$\frac{2}{5}x=70$$

$$x=\overset{35}{\cancel{70}}\times\frac{5}{\cancel{2}},$$

$$x=175$$

∴ Jack's has \$175 pocket money.

Let y be the number

$$=y\frac{2}{5}-10=80$$

$$=y\frac{2}{5}-10+10=80+10$$

$$=y\frac{2}{5}+\frac{2}{5}=\overset{18}{\cancel{90}}+\frac{2}{\cancel{5}_1}$$

$$=y=80+20$$

$$y=100$$

Jack's pocket money is \$100.

Best performance of P.6 Students in TSA 2010

Students were ranked according to their scores and the performance of the top 10% of them was singled out for further analysis. Among the top performing P.6 students, about one third of them achieved a perfect score or lost at most two score points in the whole assessment. That is, they demonstrated an almost complete mastery of the concepts and skills being assessed by the sub-papers they attempted.

Most of the top performing students understood the difficult concepts including the factors and multiples of a number, the common factors and common multiples of two numbers, the highest common factor of two numbers, etc. They could solve application problems involving whole numbers, fractions and decimals. Furthermore, they understood the concept of equations and could solve problems by the 'method of solving an equation'.

The top performing students could find the perimeters and areas of common 2-D shapes. They could find the volume of cubes and cuboids and solve simple problems involving speed. Most of the top performing students could recognise the characteristics of 2-D shapes and the eight compass points. They excelled at reading data from pictograms and bar charts as well as solving simple problems of averages.

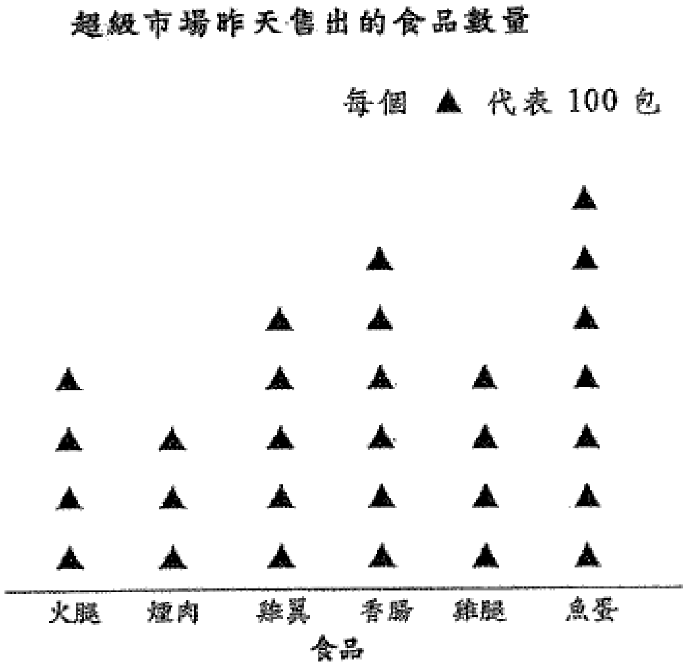
Their performance of the top performing P.6 students in 2010 was significantly better than their peers in the following basic competencies:

- Recognise the place values of digits in whole numbers (e.g. Q1/M1; Q1/M2).
- Use the listing method to find common multiples and common factors of two numbers (e.g. Q5(a)/M1; Q4(a)/M3).
- Solve problems involving whole numbers and fractions (e.g. Q17/M1; Q18/M4).
- Solve problems involving whole numbers and decimals (e.g. Q19/M1; Q18/M2).
- Tell time from a clock face and a digital clock (e.g. Q23(a)/M1; Q24/M2).
- Record the capacity of containers with an appropriate single unit (e.g. Q22(b)/M1).
- Understand the relationship between capacity and volume (the relationship between litre and cubic centimetre) (e.g. Q28/M3).
- Solve simple problems involving speed (e.g. Q23/M3; Q32/M4).
- Recognise the characteristics of pyramids with the recognition of vertices, edges and faces (e.g. Q32/M3).

- Use symbols to represent numbers (e.g. Q38/M3).
- Solve problems by simple equations (involving at most two steps in the solutions) (e.g. Q41/M3).
- Read and interpret pictograms with a one-to-one or one-to-hundred representation (e.g. Q40/M1).
- Construct pictograms using a one-to-ten representation (e.g. Q42/M2).

The top performing students were able to analyse data and apply their knowledge to obtain an answer to a problem (see the example of student's work in Q40(b)/M1 below).

Q40(b)/M1



你認為是否適合以一個▲代表一包食品製作上圖？為什麼？

答案：* 適合 / 不適合 (*圈出答案)，因為

數量太多，無法有效顯示數據。

Answer: It is * suitable / not suitable (*circle the answer) because it isn't easy to calculate the total.

In solving application problems by the method of solving equations, the top performing students could present their solutions logically and show their working steps and conclusions clearly (see a student's answer for Q39/M1 below).

Q39/M1
設哥哥有y元， $\frac{2}{5}y = 80+10$ $\frac{2}{5}y = 90$ $y = 225$ ∴哥哥有225元

Comparison of Student Performances in Mathematics at Primary 6 TSA 2007, 2008 and 2010

The percentages of students achieving Basic Competency in 2007, 2008 and 2010 are provided below.

Table 8.4 Percentages of P.6 Students Achieving Mathematics Basic Competency in 2007, 2008 and 2010#

Year	% of Students Achieving Mathematics Basic Competency
2007	83.8
2008	84.1
2010	84.2

Due to Human Swine Influenza causing the suspension of primary schools in June 2009, the TSA was cancelled and no data has been provided.

A comparison of the strengths and weaknesses of P.6 students in TSA 2007, 2008 and 2010 provides useful information to teachers who can help students improve their effectiveness of learning. The percentage of students achieving mathematics basic competency in 2010 was almost the same as that of 2007 and 2008. The following provides a comparison of the student performances for these years in each of the five dimensions.

Number Dimension

- The overall performance of 2010 P.6 students on the concepts of place values and arithmetic operations on whole numbers, fractions and decimals was good. Students in general had a better understanding of the place values of digits in whole numbers than that of decimals.
- P.6 students had room for improvement in using the listing method to find the common factors, common multiples, the highest common factor and the least common multiple of two numbers.
- The standard of students was stable in interchanging improper fractions with mixed numbers and comparing fractions.
- The performance of students was stable in interchanging decimals with fractions.
- Students in 2010 could present their solutions and working steps clearly in solving application problems involving whole numbers, fractions and decimals. They also showed improvement in logical thinking.
- P.6 students performed well in estimating the answers of calculations.
- P.6 students kept good performance in interchanging percentages with fractions or decimals. Students in 2010 showed slight improvement in understanding the concept of percentages and the ability to solve simple percentage problems.

Measures Dimension

- Students in 2010 could master the basic competencies learnt in Key Stage 1 (e.g. measuring length with a ruler, choosing the appropriate units of measurement for recording length, distance, weight and capacity; etc.).
- Students in 2010 had room for improvement in recognising the relationship between the circumference and diameter of a circle.
- Students‘ performance declined this year in measuring the area of 2-D shapes using square centimetre.
- Students in 2010 performed well in finding the perimeter and area of given 2-D shapes.
- Students in 2010 did slightly better than previous years in finding the volume of cubes and cuboids. They needed improvement in recognising the relationship

between volume and capacity and in finding the volume of irregular 3-D solids.

- The performance of students in 2010 needed improvement in solving speed problems.

Shape & Space Dimension

- Students in 2010 performed well in recognising parallel and perpendicular lines as well as the eight compass points.
- Students in 2010 maintained good performance in recognising the characteristics of 2-D shapes.
- The performance of students in 2010 improved in identifying 3-D shapes and recognising the numbers of vertices, edges and faces of 3-D shapes.

Data Handling Dimension

- Students in 2010 performed well in reading data directly from statistical graphs. They were capable of giving reasonable explanations by analysing data extracted from given statistical graphs.
- Students in 2010 showed improvement in using data given in statistical graphs to give response to questions.
- Students in 2010 performed well in drawing pictograms or bar charts from tabulated data. However, there were still some students who did not draw statistical graphs neatly and unnecessarily added a 'frequency axis' to a pictogram.
- Students in 2010 could find the average of a group of data but were not able to apply the knowledge flexibly in solving simple problems of averages.

Algebra Dimension

- Students in 2010 performed well in the Algebra Dimension.
- Students showed improvement in using symbols to represent numbers and understanding the concept of equations.
- Students performed quite well in solving simple equations up to two steps and solving application problems by simple equations.