"MEASURE UP TO THE STANDARD" A PRELIMINARY STUDY ON THE TEACHING & LEARNING OF MEASUREMENT SKILLS

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Abstract

The purpose of this paper is to share the outcomes of a 3-month study that focused on the teaching and learning of measurement skills of Primary Three pupils in Yangzheng Primary School using two specially prepared resource packages. Resource Packages 1 and 2 aim to teach pupils' specific sub-skills in the measurement of straight lines and curved lines respectively to address their difficulties in measurement. They comprise lesson plans and activity sheets developed by teachers in the school Mathematics committee. Our research indicates that pupils would benefit to a certain extent, from the teaching of the two resource packages.

Introduction

Yangzheng Primary School is a government school situated in Serangoon Ave 3. It is a neighbourhood school which caters to boys and girls of all races, religions and abilities. Our current principal, Mrs Lim Kian Huat, has been with the school since 30 October 2000. Mdm Asrinah came in as the Vice-Principal from 15 December 2005 to date. Our pupil enrolment is 1636 as at 1 December 2006, with the Chinese pupils making up approximately 80% of the total enrolment. Indian and Malay pupils make up approximately 8% and 7% of the cohort respectively, and other races and nationals take up the remaining 5%.

Yangzheng pupils have been performing quite well in Mathematics. The percentage of PSLE passes have been above national average for the past 5 years. One of our enablers was the banding of pupils in Mathematics from Primary 3 to 6. The top 80 – 84 pupils went to the A and B classes for each level where they were given extension activities to stretch their learning. The rest of the pupils were placed in the remaining classes according to their performances in Mathematics with the better students going to the C classes and the weakest in the F classes. The weakest classes have the smallest teacher-pupil ratio to enable more effective learning.

In our case study, the classes 3A and 3B comprise of pupils with high abilities in Mathematics. The pupils in class 3C are relatively good in Mathematics. From classes 3D onwards, the pupils are relatively weak in Mathematics with the weakest group in class 3F.

Despite using standard paper and pencil tests in assessing pupils, our school recognizes that it is not comprehensive enough in assessing pupils' learning in Mathematics. We believe that pupils should be given opportunities to *apply* mathematical understanding and concepts in practical tasks and to solve real-life problems. This is in line with the recent Ministry of Education's initiative, which emphasizes on "Teach Less, Learn More (TLLM)", which aims to encourage more active and engaged learning among the pupils.

The teacher researchers in our school agreed that an effective way to assess a child's understanding of mathematical concepts is to select problems which encourage them to use and apply their knowledge. Therefore, in 2005, our Mathematics department initiated the use of the Maths Practical Test as an alternative mode of assessment for Primary One to Five pupils to replace the Continual Assessments One and Two, which are standard paper and pencil tests. The change is to ensure that our pupils' abilities in Mathematics can be assessed more accurately. As it was the first year of implementation, we decided to address the problems and difficulties in the implementation of the Maths Practical Tests before we conduct it on our Primary Six pupils.

The Maths Practical Test consists of practical tasks that require the use of apparatus and tools to measure, construct diagrams, weigh objects and others etc. It makes up 20% of a child's overall marks in Mathematics at the Primary 3 level.

To prepare our pupils for the Maths practical tests last year, the Mathematics teachers in our school conducted a trial test for our Primary One to Five pupils in each level during curriculum time a week before their actual tests. The format and content of the trial tests were similar to that of the actual tests. Two stations were set up for each level. Instructions were written on the question papers and pupils performed the tasks according to the instructions given in each station. One teacher was deployed in each station to act as facilitator and to invigilate the candidates. The pupils in each class were divided into two groups with each group given about 15 minutes to complete their tasks for each station. To ensure that the tests were fair, similar resources and conditions were provided for the pupils in the same level.

After the Maths Practical Test was administered and the pupils' scores were collated last year, we were surprised to know / discover that our pupils; even those in the better classes, had performed badly. One of the contributing factors was pupils' difficulty in performing simple tasks in measurement. They were not able to make use of instruments (e.g. ruler, string, beaker, measuring cylinder, weighing scale) to measure given objects.

To overcome our pupils' learning difficulties, Yangzheng Mathematics committee members developed two resource packages targeted at our weakest group, the Primary Three pupils, to address the existing problems and at the same time, find out more about our pupils' common errors in measurement. Should the results be affirmative, the two resource packages can be modified to address the learning difficulties of the pupils in other levels.

Problem Statement/ Area of Focus Statement
The purpose of this action research is to find out whether the two resource packages are effective in developing Primary Three pupils' measurement skills.

Hypothesis
The two resource packages will ***develop*** Primary Three pupils' **measurement skills**.

For the purpose of our research,
"develop" means "to become better at or stronger in the ability to measure".

"measurement skills" refer to "the skills of using a single 30cm ruler and a metre ruler to measure the length of a straight side of an object in the first resource package and the second resource package teaches the skills of using a piece of string and a measuring tape to measure the length of a curved line".

Literature Review

This section will review the literature and related studies from books, journals and other printed materials for the purpose of establishing relationships among the topics in the Primary Mathematics subject.

Mathematical proficiency has five strands --- Understanding, Computing, Applying, Reasoning and Engaging (Jeremy Kilpatrick et al, 2002). The term "Computing" includes being fluent with procedures that involve measurement (measuring lengths), algebra (solving equations), geometry (constructing similar figures) and statistics (graphing data). Hence, being "fluent" means having the skill to perform the procedure efficiently, accurately and flexibly. Pupils are not considered to be mathematically proficient if they do not know when and where to apply and use what they have learnt. They need to know how to devise solutions and choose the most useful strategy for solving real life problems. In order to do that, they need to be engaged in learning, seeing Mathematics as "sensible, useful and doable" learning and problem solving (Jeremy Kilpatrick et al, 2002).

Practical tasks can be found in both applied and pure mathematics. The term "Practical", in the context of applied mathematics, tends to mean realistic tasks, such as measuring and constructing, weighing or using money in daily life (Hopkins & Christine, 1996). "Practical", in pure mathematics context, means using apparatus such as cubes, geo-strips and geo-boards so that the children are working in a practical (in the sense of using their hands) rather than in a theoretical way (Hopkins & Christine, 1996). As such, involving children in practical activities is a means of deepening children's involvement in mathematics.

A measurable attribute (e.g.length, mass, volume, area) is a characteristic of an object that can be quantified by comparing it to a unit (W.George Cathcart et al, 2003). The process of measuring is the same for each attribute: An appropriate unit is chosen and the object or event being measured is compared to the unit (W.George Cathcart et al, 2003). The unit used can be standard or non-standard. For example, the length of a shoe box can be expressed in terms of 30 cm (standard unit) or approximately 6 5-cm long paper clips (non-standard unit).

In the United States, there are two systems of standard units – the customary system and the metric system. Some examples of attributes being measured using the two systems are depicted in Table 1.1 below.

Table 1.1
Customary vs Metric Systems

Attribute being measured	**Customary System**	**Metric System**
Length	inch foot yard mile	millimetre centimetre metre kilometre
Area	square inch square foot square yard acre	square centimetre square metre hectare
Volume	cubic inch cubic foot cubic yard	cubic centimetre cubic metre
Mass	ounce pound ton	gram kilogram metric ton

In the Singapore context, the current system adopted for general measurement is the metric system.

Although the meanings, units, instruments and formulas associated with the various attributes are different, the processes, concepts and instructional sequence for each measurement topic is basically the same (W.George Cathcart et al, 2003). In other words, though there are many phases in the teaching and learning of measurement skills, they usually follow the same sequence. In the "pre-measurement" phase, children are required to *compare and order* objects according to certain properties to develop their conceptual understanding of measurement. They need not know what a unit is as they are not required to assign a number to the object that is being measured. In this phase, the use of appropriate language is important to allow the children to distinguish among the various attributes (W.George Cathcart et al, 2003). For example, in determining length, a child can be asked, "Which of the two rulers is *longer*?" In determining mass, the child can be asked, "Which of the two bags is *heavier*?"

The next phase involves using non-standard units for measuring a given object. The unit selected will be appropriate if it has the same attribute as the object to be measured. For example, it is appropriate to use straws to measure the length of a rectangular table. In this phase, children learn estimation, as the selected non-standard unit may not fit the length of the object exactly.

In the third phase, children learn to measure and estimate using standard units. In this phase, they should have some "measurement sense". Knowledge of the units appropriate for a given task and the ability to decide when and how to estimate are the components of "measurement sense" (W.George Cathcart et al, 2003). It also involves the use of measuring instruments such as rulers (length), weighing scales (mass) and protractors (angles).

W.George Cathcart et al (2003) mentioned some common errors made by children in the first two phases. For example, children believe that the length of an object changes when it is

moved.

_____ Position A

_____ Position B

In the example above, children perceived that the length of the line at position A changes when it is shifted to position B. In fact, both lines still have the same length.

Some other common errors in the use of non-standard units are also depicted in Figure 1.1 below.

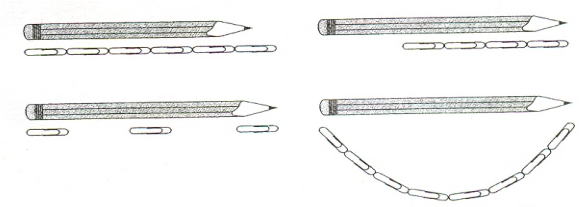

Figure 1.1 Common Errors in the Use of Non-standard Units

In our study, we seek to find out more about the common errors made by the pupils at Phase 3.

Implementation Processes & Resource Development

The Head of Mathematics Department (Chief Investigator) had undertaken the task of spearheading the research together with the Level Head and members of the Mathematics Committee. The Level Head and two other members of the Mathematics Committee were appointed as the co-investigators to aid the Chief Investigator in the implementation of the research project. Roles and duties were allotted to the research team members based on their academic qualifications, years of teaching experience and the levels taught. Selected members from our team were deployed to design the pre and post tests, attitude surveys, develop the resource packages on “Straight Lines” and “Curved Lines”, conduct interviews with selected pupils and collate teachers’ and pupils’ responses.

Teachers in the Mathematics Committee went through several phases to prepare for the experiment on measurement. These were:

a) Collaborative Planning for the project

Weeks before implementing the lessons, the research team met for a few discussions to decide on our target group, design, inquiry stages, allocation of duties among our research team and other logistics arrangement. We decided to conduct our research on all Primary Three classes in Yangzheng Primary School. The sample size is approximately 224 pupils.

The inquiry stages are given in Table 1.2 below:

Table 1.2
Inquiry Stages

Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Pre-tests 1 & 2 + Attitude Survey 1	Teaching of lesson using package on "Straight Lines" + Attitude Survey 2 + Interview with pupils	Teaching of lesson using package on "Curved Lines" + Attitude Survey 3 + Interview with pupils	Post-tests 1 & 2

(For more information on pre and post tests, attitude surveys and interviews with pupils, please refer to "Data Sources".)

Our research is deemed to have completed one cycle if Stages 1 to 4 are conducted.

b) Development of the Resource Package
The two resource packages on measurement of "Straight Lines" and "Curved Lines" were developed by two of the members of the research team based on some related reference books and journals (See "Literature Review"). The packages include lesson plans and activity sheets (See Appendixes 1.1 and 1.2). They were vetted by the Chief investigator. The pupils were required to measure the length and circumference of some real life objects.

c) Development of Pre and Post tests, Attitude Surveys, Lesson Observation Checklists and Template for the Reflection of teachers and observers
The pre and post tests were developed based on the activity sheets of the two resource packages (See Appendixes 2.1 to 2.4).
Attitude surveys were crafted to find out more about the attitude of the Primary Three pupils towards the learning of Mathematics and the two resource packages (See Appendixes 3.1 to 3.3).
The lesson observation checklists to be used by the observers during the lessons were developed based on the Specific Instructional Objectives (SIOs) of the lesson plans (See Appendixes 4.1 and 4.2).
Last but not least, the reflection template of the teachers and observers were crafted for the teacher researchers to reflect on the teaching and learning of the pupils (See Appendixes 5.1 and 5.2).

d) Deployment of Teachers and Objective / Participant Observers
Due to the large sample size, 4 teachers were deployed to teach the pupils. They were given the resources developed. The teaching strategies and the duration for each lesson were standardized. The objective/ participant observers were scheduled to observe the lessons. (See appendixes 6 and 7)

e) Implementing the Lessons
Lessons were carried out as scheduled in May, July and August 2006.

f) Preparing for the Interviews of Pupils

Selected members of the research team crafted the questions for the interviews of the pupils with the help of Dr. Chen Ai Yen. Schedules for the interview of pupils from two classes were planned (See Appendixes 8.1 and 8.2).

Data Collection

Both qualitative and quantitative data were collected. The chief investigator and a few other teachers were scheduled to do classroom observations. Their reflections and observation notes were collected and analysed.

The collection of data also involved structured formal interviews and collating attitude surveys of the pupils. Focus group discussions with pupils were also recorded using audio and video tapes.

Qualitative Data Collection

Triangulation is employed which involves the cross validation of data using multiple data sources or multiple data collection procedures. In this research, qualitative data is collected from the Maths Teachers, the participant observers, the objective observers and interviews with the pupils. The objective observers and participant observers observed the activities, people and physical aspects of the classroom situation.

Quantitative Data Collection

Standardized pre and post test scores are collated and the means for each class are computed. The total scores for all the 4 items on the semantic differential of the attitude surveys were determined for each class.

Data Sources

* Pre and post tests – The pre and post tests are identical. Pre-test 1 and post-test 1 assessed pupils' level of attainment in measuring straight lines and curved lines of a 2-dimensional plane. Pre-test 2 and post-test 2 assessed pupils' level of attainment in measuring curved lines of two 3-dimensional objects. (See Appendixes 2.1 to 2.4)

*Attitude Surveys—Attitude Survey 1 was conducted immediately after the pre-tests to gauge pupils' attitude towards the learning of Mathematics. Attitude Surveys 2 and 3 were conducted after the teaching of the resource packages on "Straight Lines" and "Curved Lines" respectively to gauge if pupils had enjoyed the activities. (See Appendixes 3.1 to 3.3)

*Interviews with pupils – A small group of pupils with different abilities were interviewed after each lesson to assess their attitudes, how much they had learnt from the lessons and whether they were able to apply the skills acquired in real-life problem solving. Summaries of the pupils' responses were collated. (See Appendixes 8.1 to 8.2)

*Lesson observation checklists --- These are the field notes made by objective or participant observers in the course of their lesson observations. Basically, the observers focused more on the learning of the pupils and how the latter responded to their teachers.

*Lesson reflections – The reflections came from both the teachers and objective or participant observers after the lessons.

Findings, Implications and Recommendations on Lesson Observations on Measurement of Straight Lines (Refer to Table 1.3)

Table 1.3
Findings, Implications and Recommendations on Lesson Observations on Measurement of Straight Lines

	Student Behaviour	Findings	Implications	Recommendations
	Pupils are able to :			
1.	Start measuring **from the zero mark** with their rulers.	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils need closer guidance in mastering the skill.	A visualizer should be used to facilitate pupils' observation of the skill being shown by the teacher.
2.	**Place their rulers flat** against the sides that they are measuring.	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils need to know that they can make use of their concepts of parallel / perpendicular lines and they also need to improve their psychomotor skills.	Pupils need to be reminded to look for parallel / perpendicular lines to ensure that their rulers are not slanted. Alternatively, the width of the object (door) could be indicated by taping its corresponding width on the floor to show a clear straight line. Also, objects used for measurement of straight lines should be completely flat.
3.	Read the rulers (30 cm and metre rulers) **from left to right** and not right to left.	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils are weak in their perception of "left" and "right".	Teachers need to check to ensure that the pupils are completely sure of the positions "left" and "right" , before beginning the activity.
4.	Use a marker / pencil (not their fingers) for **marking** when they move the ruler forward	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils were afraid of vandalizing the door and other surfaces.	To ensure that pupils use pencils and not fingers as markers, one of the group members should be reminded to carry a pencil and soft eraser.

	Student Behaviour	Findings	Implications	Recommendations
	for measurement.			
5.	Use a single 30cm ruler to measure a straight side **without leaving any gaps**.	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils did not realize that they must always start from zero, even for subsequent measurements.	Pupils need to be constantly reminded to be mindful of this oversight and they can be taught to check one another, too.
6.	Use a single metre ruler to measure a straight side **without leaving any gaps**.	67% of the teachers interviewed reported that only some of the pupils are able to use a single metre ruler to measure a straight side without leaving any gaps. Only 23% of the teachers interviewed reported that their pupils are able to achieve this skill.	Most of the pupils lack training to work as a team to handle a metre ruler.	Pupils must be trained to work as a team to facilitate the proper measurement of the object and to maintain greater accuracy, eg, one member can lay the ruler, another member mark the point and another member record the length.
7.	Decide which ruler would be more **appropriate** for measuring straight sides of different lengths.	100% of the teachers interviewed reported that only some of the pupils are able to decide on the appropriate ruler to use in measuring straight sides of different lengths.	Pupils are weak in decision-making skills.	A few minutes could be spent discussing the use of the various measuring tools before the start of the activity.

Findings, Implications and Recommendations on Lesson Observations on Measurement of Curved Lines (Refer to Table 1.4)

Table 1.4
Findings, Implications and Recommendations on Lesson Observations on Measurement of Curved Lines

	Student Behaviour Item	Remarks (if any) on Behaviour Observed	Implications	Recommendations
	Pupils are able to :			
1.	Start measuring from the **zero mark** with their measuring tapes.	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils need closer guidance in mastering the skill.	A visualizer should be used to facilitate pupils' observation of the skill being shown by the teacher.
2.	Fit the string or measuring tape as **closely** as possible to the curve that is to be measured.	62.5% of the teachers interviewed reported that most of the pupils are able to fit the string or measuring tape as closely as possible to the curve that is to be measured. Only 37.5% of the teachers reported that some pupils are not able to do this.	Pupils need to improve in co-operative learning.	A visualizer should be used to facilitate pupils' observation of the skill being shown by the teacher as the actual process can be shown in enlarged format. Also, pupils need to learn to work more co-operatively to ensure that there is back-up in holding the tape.
3.	Place the tape measure so that the numbers read **from left to right.**	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils are still weak in their perception of "left" and "right", especially if they are unable to see the demonstration clearly.	Teachers must use a visualizer to ensure that all the pupils are thoroughly familiar with the metric measurements on the left side of the measuring tape so that they would not use the "inch" unit for measurement.

	Student Behaviour Item	Remarks (if any) on Behaviour Observed	Implications	Recommendations
4.	State that the **same length** of string can form **different patterns**.	100% of the teachers interviewed feel that only some of the pupils are able to achieve this skill.	It would be difficult for most of the pupils to know the length of the strings used, just by looking at the patterns.	Teachers need to show the pupils the strings of similar lengths first, before forming the patterns.
5.	Use a piece of string and a ruler to determine the length of a **curve less than 30 cm long**.	100% of the teachers interviewed feel that most of the pupils are able to achieve this skill.	A few pupils have difficulty in ensuring that the string fitted the object (hook) as closely as possible.	It would be helpful to provide pupils with scotch tape for them to use it to hold the string.
6.	Measure the length of the **curved part** of an object using a **tape measure**.	50% of the teachers interviewed reported that most of the pupils are able to measure the length of the curved part of an objects using a tape measure. However, the other 50% of the teachers reported that only some of their pupils are able to do this.	Pupils were unsure of the exact position of the "edge" of the object (stool).	Teachers can demonstrate the activity with another object that have curves. For example, a metal plate or a stool.

Quantitative Data Analysis

Table 1.5
Analysis of the Results based on the Pre-tests and Post-tests on Straight Lines and Curved Lines

Class	No. of participants for pre tests (n1)	No. of participants for post tests (n2)	Pre-Test 1 (20)	Post-Test 1 (20)	Findings	Pre-Test 2 (10)	Post-Test 2 (10)	Findings
3A	38	38	15.5	19	Improve	7.8	8.1	Improve
3B	41	41	10.9	14.1	Improve	6.6	7.3	Improve
3C	40	40	17	19	Improve	8	9	Improve
3D	40	36	17.25	15.8	-	6.3	4.5	-
3E	38	34	10.2	11.1	Improve	7.6	9.7	Improve
3F	27	24	10.7	10.8	Improve	8.5	6	-
Total	224	213						

Based on Table 1.5, the analysis of the results showed that majority of the classes benefited from the two resource packages taught. Only pupils in class 3D did not show any improvement in both tests. Based on teacher's and observer's feedback, in the lesson on measurement of straight lines, many pupils did not start measuring from the zero mark when they were measuring an object more than 30 cm or 1m. Many pupils just "made a mark and continued measuring the object". This reflects that the pupils were not serious in their learning. Some of them were still using fingers as markers even though the teacher had stressed not to do so. In the lesson on measurement of curved lines, the teacher commented that some pupils did not start measuring from the zero mark when they were given a different instrument --- measuring tape. There was little transfer of knowledge from the first lesson. Besides that, pupils demonstrated difficulty using a string and a ruler to measure the length of a curve that was less than 30 cm long. This was probably due to their poor psychomotor skill. The observer added that as the class was relatively weak, more guidance by the teacher was needed when the pupils worked in small groups.

The pupils in class 3F did not show any improvement in Test 2 which tests them on the measurement of curved objects in real life. Based on the teacher's and observer's feedback, pupils demonstrated difficulty in using the string to measure curves probably due to poor psychomotor skills and the lack of home support.

Table 1.6
Outcomes of Attitude Surveys on Teaching & Learning Activities

Item	No. of participants (n3)	Very Boring (%)	Boring (%)	Interesting (%)	Fantastic (%)
Attitude Survey 1 : How do you feel about the learning of Mathematics?	214	12.15	5.14	45.79	36.92
Attitude Survey 2 : How do you feel about the activities which teach you how to measure straight lines?	212	9.43	7.08	47.64	35.85
Attitude Survey 3 : How do you feel about the activities which teach you how to measure curved lines / surfaces?	210	10	6.19	51.43	32.38

Table 1.6 shows that prior to the teaching of the two resource packages, 17.29 % of the pupils feel that learning Mathematics is boring and very boring (see "Attitude Survey 1"). Pupils' attitude towards the learning of Mathematics is generally positive with majority of them feel that learning Mathematics is interesting and fantastic (82.71%).

Most of the pupils are interested in the activities on "Straight Lines" with 83.49 % feeling that the activities are interesting and fantastic. The pupils seem to be slightly more interested in the activities on "Curved Lines" with 83.81 % feeling that the activities are interesting and fantastic.

Other Suggestions for Future Teaching

The learning points in the interviews, reflections recorded by the observers and teachers involved in the research also indicated that;

- it is crucial to group the pupils properly and provide specific instructions on expected group behaviour before the lessons to ensure that they are purposefully occupied in carrying out the activities and to avoid confusion and excessive noise in the Maths Room.
- the size of the groups should not be greater than 4 to ensure maximum participation of every pupil.
- materials should be issued according to task requirement to ensure that pupils stay focused on the present task and not be distracted by materials that would be used subsequently.
- it is imperative to give clear explanations and demonstrations regarding the use of the various measuring tools.
- teachers need to use proper Mathematical terms during lessons, for example, "curved length" and "length around the edge of the stool" instead of "curved distance" and "distance around the stool" respectively.
- strings could be used to measure curved lengths greater than 30cm.

- durable tape measures of standard length should be used as classes that had lessons later had to use tapes that were torn during earlier lessons.
- Pupils should be given all the various kinds of measuring tools and be allowed to decide on the appropriate tools to use, especially in the measurement of 3 - dimensional objects.
- more thought need to be given to the choice of straight and curved objects being measured to ensure that less cumbersome (stool) and more real-life objects (water bottle) are used.
- it is necessary for common errors made by the pupils to be highlighted for corrective purposes, clarification of doubts and reinforcement of skills learnt.

Our findings show striking evidence that pupils from the higher, middle and lower ability classes demonstrate similar levels of enthusiastic response to learning when they participated fully in hands-on activities involving measurement skills. This would imply that pupils are motivated to learn when they are active participants in a learning atmosphere which encourages the use of manipulatives and teamwork.

P3 pupils could be taught the terms “circumference” and “perimeter” to foster earlier and increased learning.

Logistically, the deployment of teachers could be improved to ensure that there is consistency in the teaching. It is better to have one teacher to teach a particular skill.

During the interview, it would be more feasible to interview them in pairs to minimize their level of discomfort in the presence of a video camera and hence, they would be more willing to speak up.

From the interview sessions, it was apparent that most of our pupils are unable to apply their skills in measurement in real life situations. One of the pupils knew that he was supposed to use a string to measure curved surfaces, (eg, a shoe), but he applied the skill wrongly by using the string to go round the shoe to measure the length of the shoe.

We feel strongly that our pupils should be made aware of the importance of acquiring measurement skills to solve real-life problems. As we have managed to complete one cycle, it would be appropriate to continue the action research with the next cycle being focused on language, building of psychomotor skills and real-life application.

Conclusion

Our research indicates that most of the pupils had benefited from the teaching of the two resource packages. This is affirmed by the results of the post tests. The attitude surveys also showed that pupils were interested in the activities taught. However, there are mixed findings based on teachers’ feedback after the lesson observations. Majority of the teachers who were involved in this study reported that pupils have acquired most of the sub-skills in the measurement of straight lines. However, there are rooms for improvement, especially in the teaching of curved lines. We therefore recommend that the two resource packages be modified accordingly to the recommendations discussed before we extend the use of the packages to future teaching and learning.

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