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Up-Side-Down (Dyakodo) Teaching and Learning Method of Mathematics

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Abstract

The paper presents results of a research on one method of teaching and learning mathematics based on observations on and experiences of 35 Form One learners and 6 teachers at a Zengeza school in Chitungwiza, about 21 kilometers south of Harare. The pass rate rose from 7% to an astonishing 61% in a space of a 20 school days. Cipra (1988), Steen (1988), and White & Mitchelmore (1996) have raised much concern in the failure by teachers to develop a conceptual understanding of mathematics topics because of the rote, manipulative learning that takes place in classrooms at introductory secondary school levels. Lithner (2003, 2004) also remarks that most exercises in mathematics textbooks may be solved by mathematically superficial strategies, often without essentially considering the core mathematics of the book section in question. It is along these lines that the up-side-down (dyakodo) teaching and learning method in mathematics has been found to be an effective method of teaching mathematics for understanding. The up-side-down (dyakodo) teaching and learning method allows learners to do lessons at home and then home-work in class in order to integrate important 'real-world' everyday life activities into the school activities.

Introduction

For a long time, the debate on the use of corporal punishment in school as a way of minimizing all forms of misbehaviour has lingered on the educational agenda of Zimbabwe. It has attracted a lot of attention even, of late, in the media, unearthing some context of biases and prejudice. This attention has been worsened by modern day technology which has seen almost every hand with a mobile phone all over the world and numerous child rights protection organizations that have mushroomed in the country.

The challenges presented by misbehaviour and mischief of students in different schools assume various degrees whereby, in some instances, the entire process of teaching and learning is disrupted (Monk & Dillon, 1995). Something has to be done to bring sanity back into our classrooms and education system as a whole using modern technology since, according to Allen and Seaman (2010), the continued growth of online education cannot be overstated as e-education is here to stay. Instead of seeing the mobile communication gadget in the hands of learners as a problem, this research shows that the same gadget can be a useful tool in the learning and teaching process.

Research problem

Mischief in schools has become rampant nowadays and is mainly mobile phone-related. The researcher decided to turn the situation around using the culprit gadget to motivate learners in their classroom activities. The researcher has observed that schools do not permit learners to bring mobile phones into the school premises, let alone the classroom. However, try as school authorities might, almost on a daily basis, learners still bring these gadgets to school and disrupt school

activities. The situation could be changed and this point of view provokes the beginning of this research.

The goals of the research were:

1) *To find an appropriate effective mathematics teaching and learning method that ensures maximum learner-participation.*
2) *To come-up with phone-based learning that enhances achievement in mathematics teaching and learning.*

Teaching mathematics in context

Mathematics is not a very popular subject in secondary schools as it is considered to be difficult (Holubova, 2008). A lot of research has been carried-out on how to teach mathematics for understanding (de Villiers, 2012). The aim of this study was to find unconventional mathematics teaching methods by taking advantage of what is available to make learning more interesting and motivational even for those who find the subject difficult. According to Holubova (2008, p.27) the education system nowadays *"is characterized by a gap between how students live and what they learn and how they learn"* (in italics for emphasis). The mathematics pass rate in this particular school was below the pass in other subjects, hence the need to find if something could not be done with regards the teaching methods since in other subjects the situation was not the same. The researcher decided to find if mobile technology could not be used as an effective medium of instruction instead.

Methods of research

Methods of research were centred on: homework, e-learning lessons, and revision exercise. The teacher made some e-lessons and sent them to the learners' smart **mobile phones**. The learners then went through

the lessons at home and came and did the homework in class; what had to be done in class was done at home and what had to be done at home was done in class.

The study was based on the topic of **mensuration**. The initial introductory lessons on the topic had produced a meagre 7% pass rate in a written revision exercise. It was at this juncture that the researcher, after consultations with the subject teacher, introduced the up-side-down (dyakodo) teaching and learning method. The learners were asked to bring their mobile smart phones to school. This drew a lot of excitement even though they had been told that they were going to use them for learning purposes only. The lessons were crafted using a computer and sent one by one to 35 Form One learners' smart mobile phones via **Bluetooth**. The learners would then go through the lessons in the comfort of their homes. In class they would then do the home-work. The exercise was carried-out continually for 5 school days. Some interviews and lesson observations were carried-out before a revision exercise was given.

Interview questions

The interview was carried-out after all the lessons had been done, right at the end of the study.

Question 1: How did you find learning mathematics using your mobile phone compared to conventional learning?

Most of the learners (31) found it fun and exciting to learn using their mobile phones. These learners indicated that they found the lessons clear and easy to follow. They also concurred that they could go through the lessons at their own pace and had room to repeat points

they were in doubt of as much as they could. However, other learners (3) found lessons difficult to follow no matter how many times they tried to re-visit them. One learner indicated having power problems with the mobile phone at home and could not make any progress alone.

Question 2: How did you find learning mathematics in the comfort of your home compared to classroom learning?

In schools the 'chalk and talk' method is used most often. The principle of "practice makes perfect" is quite common, particularly in mathematics. This method of teaching and learning based on this principle is not very different from rote-learning method where the learner will end-up knowing "how to get the answer" and not "why". However, most learners (32) were impressed by the unconventional learning method as it gave parents and the entire family the opportunity to participate in their learning rather than the 'practice' dossier given in class. These learners found it easier to relate what they learn in mathematics to their everyday life because examples were readily available. Some learners (2) did not find it easy as family members were not willing to assist.

Question 3: How do you find mathematics home-work done in class compared to that done at home?

Most learners found the home-work easy and fun. They admitted that they understood the concepts very well and found the exercise more or less like revision. The time taken doing it was not much such that a lot of time was spent discussing concepts and trying to derive meaning from grey areas.

Question 4: What type of effect has this teaching and learning method had on your learners?

This question was responded to by the mathematics head of department and 4 mathematics teachers and one ChiShona teacher. They all concurred that the method was a lot less time-consuming and gave learners an opportunity to make meaning of concepts at their own pace. Their level of understanding was elevated as evidenced by their participation during the home-work and revision exercises. The revision exercise produced a 61% pass rate.

Lesson observation

A class of 35, the Mathematics head of department, three mathematics teachers and one ChiShona teacher took part and the researcher took part in all the five lesson observations. Even though all the five lessons were done via mobile smart phones, only one is attached below which serves as an example. The aim of the outcome of the research was to motivate learners in the teaching and learning of mathematics to help them link home with classroom. The teacher started by summarizing the lesson which the learners had done at home before embarking into the homework which the learners were not aware of. Some feedback, assessment and professional development opportunities were availed to them.

Lesson (done at home using mobile smart phones)

CLASS: **1D**

TOPIC: **Mensuration**

DATE: **Monday 20 January 2014**

TIME: **7:15- 7:55 am**

Lesson objectives

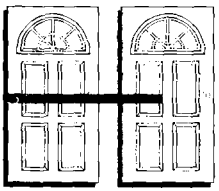
- To ascertain that learners understand the true meaning of SI units
- To give learners a chance to derive their own meaning from concepts
- To allow learners work at their own pace

Lesson presentation

How large is a millimetre?

How large is a centimetre?

How large is a metre?



1 metre

There are 100 centimetres in 1 metre, when we change cm to m we divide by 100.

Remember!

- When divided by 100, the units move two places to the right. This is how we change 427 cm to metres:

H	T	U	th	hth	tth
4	2	7	0	0	0

Divided by 100

Therefore 427cm = 4.27m

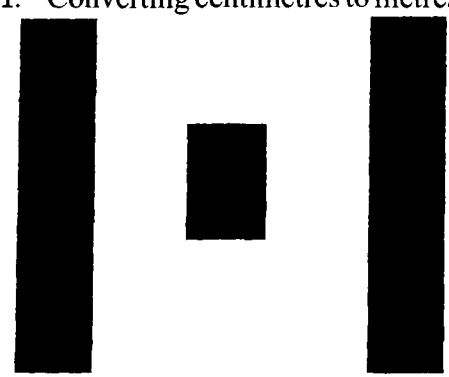
- To change from metres to centimetres we multiply by 100, when we multiply by 100 we move each digit two places to the left. This is how we change 3.51 m to cm:

H	T	U	th	hth	tth
		3	5	1	

Therefore 3.51m = 351cm

Examples:

1. Converting centimetres to metres



2. Changing measurements in metres into centimetres

Pupil assessment

Exercises (Done at home)

Metric units

1 kilometre (km) = 1000 metres

1 metre = 100 centimetres (cm)

1 metre = 1000 millimetres (mm)

Which one is larger?

a) 1 metre or 105 centimetres

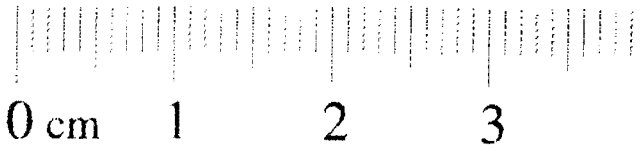
b) 4 kilometres or 4400 metres

c) 12 centimetres or 102 millimetres

d) 1200 millimetres or 1 metre

e) What is the length of the line in centimetres? _____ cm

What is the length of the line in millimetres? _____ mm



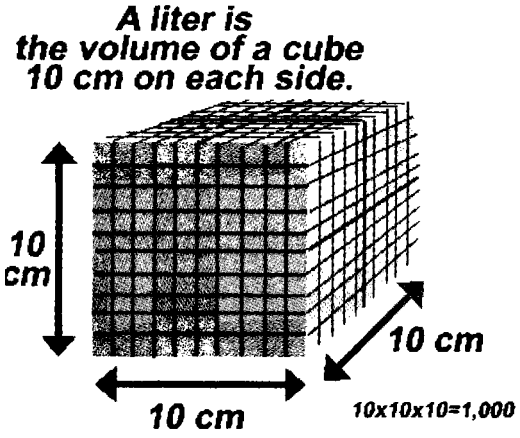
Summary or conclusion

Other types of measurements

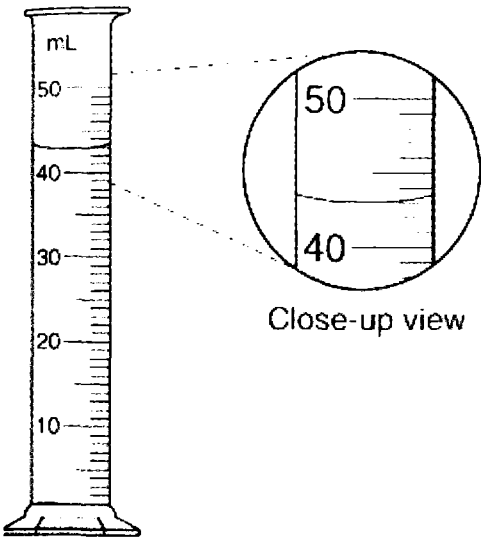
Volume is the amount of space an object takes up.

The base unit of volume in the metric system in the **litre** and is represented by **L or l**.

Standard: 1 litre is equal to one cubic **decimetre**



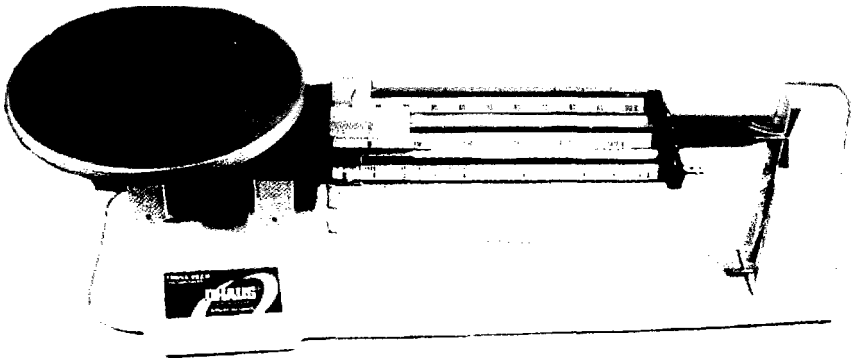
We use **graduated cylinders** to find the volume of liquids and other objects.



Graduated cylinder

We use **triple-beam balances** to find the mass of various objects.

The objects are placed on the scale and then you move the weights on the beams until you get the lines on the right-side of the scale to match up.



Metric Units

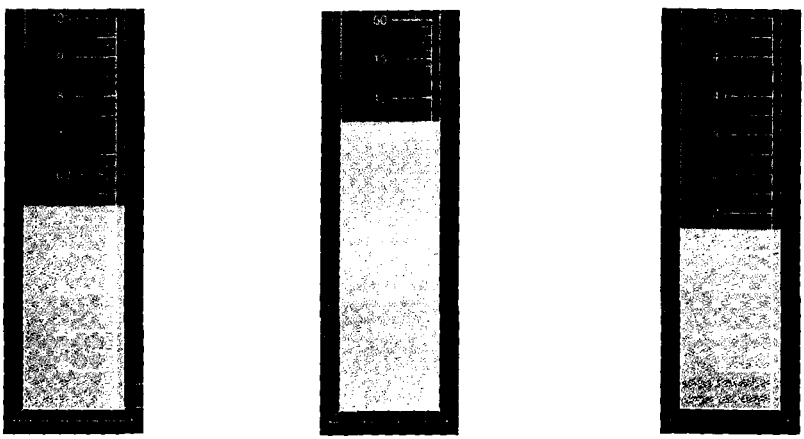
1 kilogram (km) = 1000 grams (g)

1 gram (g) = 1000 milligrams (mg)

Pupil assessment

Homework (done in class)

1. What is the volume of water in each cylinder?



2. Which is larger?
   a) 1 kilogram or 1500 grams
   b) 1200 milligrams or 1 gram
   c) 12 milligrams or 12 kilograms
   d) 4 kilograms or 4500 grams

Results and discussion

There are a lot of advantages and disadvantages of up-side-down (dyakodo) teaching and learning method. Our finding is that teaching and learning using what learners like most moves lesson delivery from whole-class to personalized instruction, from lecture and recitation to

discovery. It invokes constructive discussion with a cooperative social structure. All students learn the same thing in different ways and different students learn different things at the same time. The lesson activities are done outside the classroom environment thus reducing the gap between school and home. Up-side-down (dyakodo) teaching method leads to team-work; learners learn to work independently but with the same goal. When home-work is done in class learners will have a chance to be innovative in their work.

When learners do the actual lesson at home, they have more time to go through it and have a chance to replay parts they would not have understood. It also gives students freedom to generate artefacts which is critical to their construction of knowledge and can serve to bridge the gap between phenomena in the classroom and real-life experiences at home that can lead to the introduction and use of local languages in the teaching and learning environment. Parents and relatives at home are also given an opportunity to make direct contributions in the teaching and learning of the subject.

There are some shortcomings in this method as it disadvantaged those learners who are not able or unwilling to do anything without close teacher supervision and monitoring. Some teachers prefer 'privacy' when it comes to things they say when they teach so they are not prepared to video-record their lessons.

Recommendations

- To incorporate the up-side-down (dyakodo) teaching and learning method into our classrooms, the following should be conducted by all stakeholders; ministry of primary and secondary education, teachers' training colleges, universities and schools:

i) Seminars;
ii) Task-focused teaching methods;
iii) Observation in schools;
iv) Micro-teaching.

- Teachers should focus on motivating learners in mathematics and science. For motivation, it is necessary for the teacher to have:
  i) good understanding of the problem;
  ii) bring the school closer to the practical life;
  iii) use video-recorded lessons;
  iv) use simple language.
- Teachers should investigate and embrace the up-side-down (dyakodo) teaching and learning method, game-based, problem-based learning, project-based learning, e-learning techniques, and motivation by adventure in pedagogy, computer-based instruction and experiments.
- Mobile phone-based teaching and learning should be a part of class motivation activities. In particular, mathematics is irreplaceable for the development of any nation because modern technology involves mathematics.

Learning mathematics leads to the development of thinking skills and understanding other sciences since it is the basis for all types of analytical and measuring systems.

Conclusion

This study sought to explore ways of minimizing misbehaviour in the classroom without using force, which is in this case corporal punishment. Preferred ways of dealing with it seem to ignore taking the lessons into the thick of things, using what the learners enjoy most, to deliver lessons. Lack of commitment on the part authorities and lack of

innovativeness by educators could be fuelling misbehaviour in the educational arena with everyone still relying on corporal punishment to serve the situation. As a developing country, we are exposed to new trends and causes of misbehaviour so there should be modern ways to deal with them that we have to collectively come up with.

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