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Contextualization: Teaching Estimation to Grade Five and Six Learners Using Maize Crop

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Abstract

Estimation is one of the motivating concepts in mathematics especially if one gets accurate or close to accurate answers. In this paper we look at how 26 primary school learners in Grade 5 and 6 in Masvingo district, Zimbabwe, learnt this mathematical concept practically using maize during their holiday lessons. They measured the length and circumference of maize cobs at the base, and counted the number of seeds. After that they then filled a bucket. The idea was to find out how many maize cobs it would take to fill a 20 kilogramme bucket, a 50 kilogramme sack, and subsequently a tonne. After that the learners went on to estimate the three features of maize cobs (length, circumference at the base and the number of seeds). The entire exercise was mainly based on estimating the number that can fill a bucket. After the study, the level of application of the concept was astounding as they went on to estimate the yields in their fields where the results were very close.

Introduction

There are many researches that show that students have problems in gaining a deep and correct idea about some mathematical concepts (Taber, 2011; Confrey & Sibel, 2006; Li & Tall, 1993; Bukova-Güzel, 2007). The researcher's idea for improving this was by trying to discover the concept of estimation with students through controlled and oriented discussion and hands on activities. Predominantly, the classroom interaction pattern at primary school level consists of oral input by teachers where learners occasionally chant in response (Majengwa, 2012). This shows that questions are asked to check on learners' attentiveness and that tasks are oriented towards information acquisition rather

than higher cognitive skills. They tend to resort to memorisation yet mathematics is a subject that should be used to solve problems hence the need for an approach of teaching that can enhance a deeper understanding of the concepts that underpin the topic.

Masvingo district falls in Zimbabwe's natural region 5 which has average annual precipitation below 500mm that falls from December to March. Average maximum temperatures range between 20 to 35 degrees Celsius in the summer season. The main livelihoods system is labour-based. The seasons are summer (*zhizha* in ChiShona language) from September to April, and winter (*chirimo* in ChiShona language), from May to August. Livelihood activities are planned in line with the rainy season which occurs from December to March. The basic agricultural crop is maize and land preparation begins just before the beginning of the dry season since all the people in this area are subsistent farmers. The yield is not much, on average well below a tonne. However, like in all communities, the relevance of school leaves a lot to be desired. According to Colley (2005), an education system is supposed to be a repository, carrier and transmitter of a society's myth, the institutionalization centre for that myth's contradictions, and the locus of the ritual which produces and veils the disparities between myth and reality. This shows that the way in which a system of education operates, especially its relationship with community, influences the learner in terms of relevance and adaptability.

It is through this type of teaching and learning activity that the researcher tried to bring the school closer home by making learners estimate the yield before harvest time. This might, in a way motivate parents in seeing value in education and minimize drop-outs usually associated with poor families. On the other hand, mathematics is not very popular in schools because it is considered to be

abstract and difficult to relate to everyday life (Holubova, 2008). Generally mathematics pass rate is normally very low as we go up to secondary school level and the blame is laid squarely on the primary school level door step; the learners lack the basics. Teaching and applying mathematics for understanding (de Villiers, 2012) was the main the aim of this study in a bid to find effective mathematics teaching methods and take advantage of what is available to make learning more interesting and motivational for those who find the subject difficult and give them a solid foundation.

In a maze of strange concepts, a learner would have at least the familiar estimation to spring up from. This might stick in the mind of the learner as it is an example of reinforcement outside the classroom situation. All this is further supported by Holubova (2008, p.27) who alludes that the education system nowadays *"is characterized by a gap between how students live and what they learn and how they learn"*. It is along these lines that the researcher has observed that most learners equate working in the fields to punishment and abuse. The situation could be changed: this point of view provokes the beginning of this research.

The goals of the research were:

1) To help the learner derive mathematical meaning from home and agricultural field activities
2) To assist the learner to apply mathematical concepts to everyday life activities that enhances achievement in mathematics understanding.

Methods of research

In this study, the methods of research were: lessons, interviews, and project work. The study was qualitative in nature to allow for a holistic and contextual analysis of the problem. The design ensured an in-depth study of the effects of

the method of instruction had on learners' academic achievement. The research focused on Grade 5 (10 learners) and Grade 6 (16 learners) and was carried-out during April holiday lessons in Makambe, Madamombe village in Masvingo district, Zimbabwe. A practical lesson based on maize seeds and cobs was given followed by some interviews to gather information on what the learners had experienced. The researcher discussed with the learners and observed how they learners worked and discussed amongst themselves. A small project, whereby they assisted their parents to give a rough estimation of the yield summed up the entire study. The timing was just before harvest time so the learners were able to pick portions or whole maize plantations for their projects. According to Confrey and Sibel (2006), the current trend in mathematics philosophy is that mathematics is fallible science based on human creation. The author views mathematics as a subject of structured certainty where the learner constructs meanings that are open to revision and transformation. Solving mathematics problems is considered a good mental exercise that is crucial to improving students' mental capacity (Cappetta & Zollman, 2009). The topic is introduced in Grade Five according to the Zimbabwe Schools Examination Council (ZIMSEC) syllabus.

Data collection procedure

Lesson

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 best way to do it is to use what they are familiar with, harvesting. We organized a lesson during April holidays. The time was ideal as harvest time is just before schools open. They were then given an assignment to estimate the yield in their own fields using the skills they had learnt during the lesson.

Topic: Estimation Date: 09/04/15 Time: 09:00 hours

Lesson Objectives

- To ascertain that learners construct the meaning of estimation hands on through practice.
- To help learners apply the concept of estimation in agriculture and other real life activities.
- To assist learners work on their own to apply mathematical concepts learnt in class.

Introduction

Estimation is approximating or giving a number/figure in an exercise or activity. In this exercise our working definition is going to be approximating the number of seeds in a maize cob so as to find how many of them it would take to fill a 20-litre bucket, then a 50-kilogramme sack, and then a tonne. The learners would then use this knowledge to estimate the yield in their fields.

Lesson presentation

The learners were put into six groups of five and one of six. They were given different maize cobs to measure the diameters and lengths. They would then count the number of seeds to come with a ratio of diameter: length: number of seeds. These were put in different containers and labeled.

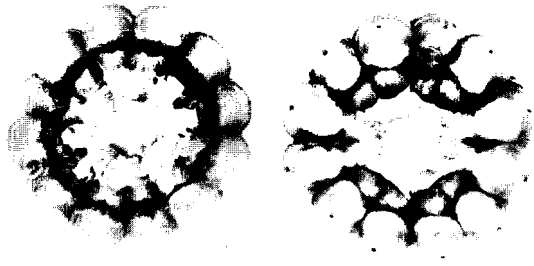


Figure 1. Cross-Section and Length of a Maize Cob.

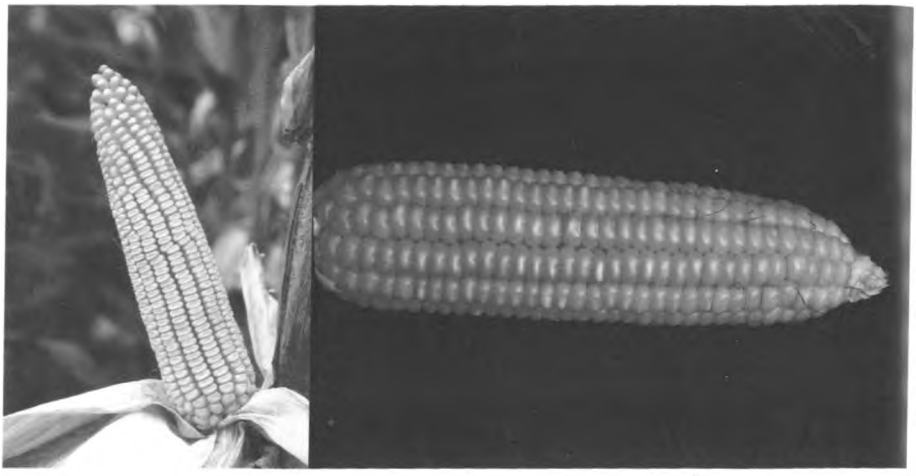


Figure 2. Maize Cobs.

After this exercise the groups were given maize cobs whereby they would estimate the diameter, length and number of seeds. The groups were then temporarily disbanded and the researcher would ask volunteers to come and have a feel on a cob before coming up with estimation, which are then verified and those with correct answers awarded some marks. The exercise would continue until everyone participated. The next exercise was group work to find out how many seeds it would take to fill a 20litre bucket. The learners would take the seeds they had labeled pour them into the buckets. They would then calculate the number of cobs needed to fill the bucket from different cob sizes. From there the learners would then pick on a cob and estimate how many of them would be required to fill a bucket.

Interview

After a week the researcher met with the subjects to consolidate the lesson and probe them on what they had done. The main questions and responses were analysed.

Question 1: ***How did you find learning mathematics using maize seeds and cobs?***

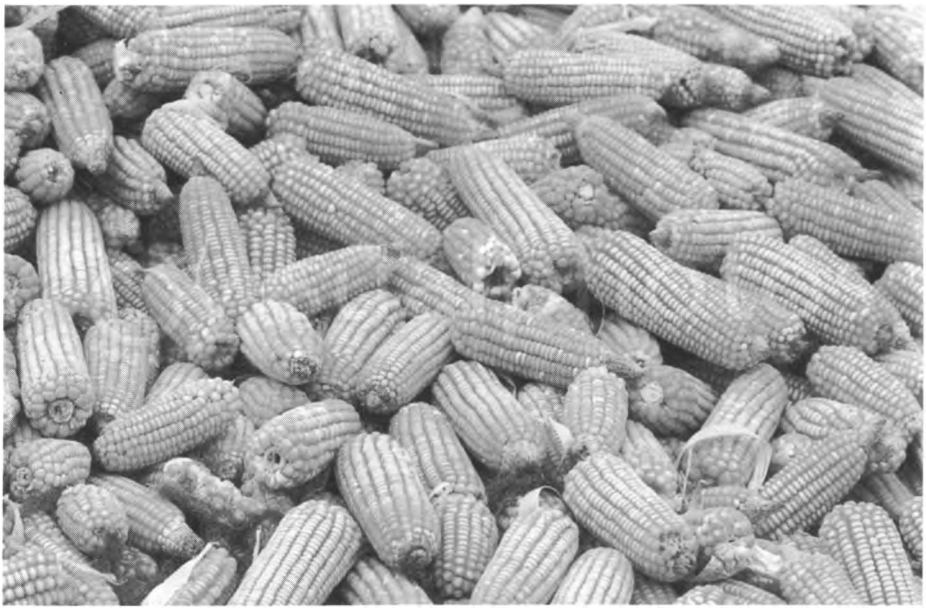
Most of the learners (26) found it fun and amazing to learn using everyday things they were familiar with. The lessons were clear and easy to follow. They also concurred on the fact that they could actually see mathematics in action and had chance to prove and repeat points they were in doubt with as much as they could. However, there were some learners (2) who had found the lessons difficult as their estimates were always off the mark.

Question 2: ***How did you find learning mathematics in the maize field compared to classroom learning?***

Most learners (17) find the classroom environment a bit intimidating and imposing which makes it hard for them to understand as they would not be relaxed. Some (3) indicated that mathematics was far too subjective and they would have to use their imagination to try to make head or tail of what the teacher would be talking about. The general feeling was that this type of learning brought the school home and made mathematics fascinating.

Project

In most rural areas in Zimbabwe harvest is normally given a numerical value in terms of scotch carts (*ngoro* in ChiShona language). According to our research, we were in a way trying to encourage farmers to use better farming methods in terms of yield count, speed in harvesting and storage. Maize is mostly put in reserves called *dara* (in ChiShona language) before being shelled and eventually put into all sorts of containers where it is attacked by moist and insects.



After the lesson, the class met again the following week for interviews and orientation on the next activity which was a project. Each learner had to go to his or her family's field and estimate what the harvest would be in terms of kilogrammes or tonnage. The learner would count the number of lines in an acre and multiply by the number of plants along it to get the number of plants. An average size of maize cob would be obtained by getting the average between the biggest and the smallest one. The information was recorded. We had to wait until the 5th of May, the harvest deadline, and that the maize be shelled, a process that ends around June.

Project results: June 30

It was rather unfortunate that the yield this year was very thin due to drought. However, the learners did not find it very cumbersome to estimate it as none had a harvest more than 200kg. It could have proven to be an uphill task otherwise.

Table 1
Cognitive Skills

Cognitive Level	Project
Knowledge	✓
Comprehension	✓
Application	✓
Analysis	
Synthesis	✓
Evaluation	

Table 2
Estimation Results

Accurate (more or less than 10 kg)	**14 learners (9 Grade 6 and 5 Grade 5)**
More by around 20 kg	**8 learners (5 Grade 6 and 3 Grade 5)**
More by more than 20 kg	**1 learner (Grade 5)**
Less by around 20 kg	**3 learners (2 Grade 6 and 1 Grade 5)**
Less by more than 20kg	**0 learners**

Analysis of results

Slightly above 69.23% (14 out of 26) had accurate results. Considering the ages of the participants the result is quite satisfactory. This shows that they had understood the concept and would perform a lot better when they go back to the classroom. Those whose estimation missed the mark by around 20 kg were 30.77% (8 out of 26). They professed that their results had been affected by the fact that some of the lines in the field were not complete as the crop had withered before maturing. Some had upped the figures as emotion could have come into

play considering that the harvest was very thin. Only one Grade 5 learner (0.04%) missed it by more than 20 kg. Upon being probed the learner confessed that the estimate got after calculations was beyond belief and somehow the method we were using did not work. A random figure had been put, a figure that made more sense as compared to the size of the field, obviously the work and effort put in. Those whose estimates were less by more than 20 kg were 0.12% (3 out of 26). They had used shorter lines as their base lines as they had assumed that every line had been affected by drought.

Recommendations

To incorporate contextualization as a teaching and learning method into our classrooms, the following should be conducted:

- Seminars;
- Task-focused teaching methods;
- Context-based text books should be encouraged;
- Micro-teaching.

Educationists should focus on motivating the learners in mathematics and science. For motivation it is necessary to:

- Bring school work closer to practical daily life;
- Contextualise school work;
- Publish ... ol materials that are contextual;

Educationists should also introduce hands-on teaching and learning methods, mobile phone-based teaching and learning methods, game-based, problem-based learning, project-based learning, e-learning techniques, and motivation by adventure in pedagogy, computer-based instruction and experiments.

Even some of our AREX officers could take advantage of results of such studies and propagate better farming skills to the general populace.

Conclusion

There are a lot of advantages and disadvantages of contextualizing the teaching and learning of mathematics. Our finding is that teaching and learning using what learners know and are used to moves lesson delivery from whole-class to personalized instruction, from lecture and recitation to discovery (Majengwa, 2015). Everyone in class participated with a lot of enthusiasm thereby stimulating constructive discussion with a cooperative social structure. Since the lesson was done at home, in a maize field, it was more or less like bringing the school home. All students had an opportunity to learn using what they are familiar with. This type of teaching and learning method gives learners a lot of confidence both in mathematics as a subject as it somehow demystifies it; from subjective to concrete and in schooling in general as it proves relevance of education in real life (Gillies, 2007). The learners learn to trust the subject as something that is usable in life after school. 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 fraternity (Majengwa, 2015). Parents and relatives at home were also given a chance to see mathematics at work and can start to make direct contributions in the teaching and learning of the subject and the learners' education in general.

There were some disadvantages too as some learners dislike working in the fields and may find such activities tedious. There are teachers who prefer to work in the comfort of their classrooms and might not have the audacity to go into the fields for a lesson, let alone under the blazing sun.

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