

## **AN INVESTIGATION INTO MY PRACTICE OF TRAINING TEACHERS IN USE OF TEACHING AIDS IN MATHEMATICS TEACHING AND WAYS TO IMPROVE IT**

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### ***Abstract***

*In this paper I report the procedure I followed to investigate my practice of training teachers in use of cultural objects as teaching aids in mathematics teaching and also ways I ought to improve this teaching. Two cohorts of student teachers and two practising teachers were involved. So far two cycles of action research have been completed and the results indicate that my practice is and has been open to improvement.*

### **Introduction**

One of my former students told me: "I have tried to do those things (referring to teaching mathematics using aids) but it has proved to be lengthy." "When I finish my present research," I promised, "I am going to come out to schools and work with the teachers. I want to get a class and teach it to show that these ideas can be put into practice and can work".

The issue of teachers' non-use of teaching aids has bothered me over the past ten years. I got more and more concerned each year as I trained teachers in their use and still found no evidence of their use in schools. This was despite the improvements in my training that I tried to make each year.

I have a strong desire to see that all Ugandan children successfully learn mathematics. It is a core subject at primary and lower secondary levels and the grading of certificates at these levels is based upon success in it. I believe that if teaching aids were used adequately by all teachers, students would love and learn mathematics, which would empower them as citizens (D'Ambrosio, 1990). Mwanamoiza (1992) found that students in Ugandan classrooms are treated as passive receivers of knowledge. Many simply cram formulae and methods of solving specific problems in mathematics. The use of aids may encourage other approaches.

### **The Problem**

Despite the training in use of teaching aids in mathematics teaching that Ugandan teachers get in pre-service programs, they hardly use them. This made me question the training they get. Was it adequate? Was it appropriate? If not, how could I improve on the training I was giving them?

How would I train teachers so that they could adequately use teaching aids in mathematics teaching?

### **Theoretical framework**

A major theoretical framework underlying this study is constructivism. The view that knowledge is actively constructed and not passively received (Noddings, 1990). The belief that all knowledge is a product of our own cognitive acts (Confrey, 1990), implying that knowledge is constructed in the human mind and that understanding is constructed through experiences.

The learners have a knowledge base /structure on which they compare incoming knowledge. Then either the new knowledge is modified for taking in, or the knowledge base is modified to allow it to fit in. This is to say that the teachers come to training with some knowledge and beliefs about teaching and use of aids (Ball (1990) to which they compare new knowledge. A series of experiences facilitate this knowledge acquisition and the learner ought to be provided with such an environment. (Piaget, 1969 cited by Von Glasers 1990; Noddings 1990; Confrey, 1990). Freedom to express oneself must be part and parcel of this environment (Vygotsky, 1978). In the training that I give teachers I try to give practical, hands on experiences. The knowledge structure is continuously revised using active knowing (Noddings, 1990). In the intervention phase of this study, students were put in groups, in which they worked and were able to talk freely. Vygotsky (1978) and Bruner (1985) explain that some kind of mulling over takes place in the learner's mind as he/she interacts in the environment. In the intervention phase I attempted to involve students in reflection by requesting them to keep diaries.

Thus the teacher should endeavor to ascertain what knowledge base the learner has and then plan to offer the right environment. A questionnaire and interviews after sessions served this purpose in my study. The teacher's prompting, questioning etc. which Vygotsky calls scaffolding, is integral to this kind of environment. It should be an environment that is social, that is full of sharing ideas, challenging, questioning and explaining and negotiations of meanings (Jaworski, 1994) between teacher and learners and between learners and learners (the peers according to Vygotsky (1978)).

Sometimes such an environment can be created through bringing experts to the classroom (Davidson & Miller (1998), Lave (1988), Lave and Wenger(1991)). Such an approach would be an eclectic one and in my view profitable to learners. This is what justifies my bringing in of an experienced teacher to teach with student teachers acting as students in cycle 2. Jawoski

(1994) refers to this as socio – constructivist nature of learning. Of course, the teacher knows more than the learners do. So by planning in a purposeful way for them the teacher may be able to offer situations that are profitable to learners. The experiences could be through observing and questioning experts who might be other (more capable) students or the teacher.

In my study I used cultural objects as a sample of teaching aids. I claim like D' Ambrasio, (1990) ;Gerdes, (1998) ; Zaslavsky (1994) and others that there exists mathematics in every culture which can be explored through artefacts. While D'Ambrasio refers to it as ethnomathematics or mathematics in specific cultures, I wish to claim that ethnomathematics is mathematics, no different from European mathematics. I agree with Gerdes (1994) that mathematics is preserved in cultural objects. It is ingrained in the cultural activities. Thus aspects of culture can be used to teach mathematics. Using cultural objects in this way allows the learner to work on mathematics as both an unintentional and natural process (Lave 1988) and also through reflective abstraction from purposefully arranged activities (Noddings, 1990).

Vygotsky's theory of social development through the idea of Zone of proximal Development (ZPD) also suggests an area where culture can be used for learning. Teachers or peers tutor the learner until he/she gains mastery of his /her own actions through activities which allow the learner to make a leap. The context could be the use of cultural objects. The use of such objects allows mathematics to take place within. Cultural settings and activities that go on daily and in which learners participate naturally as members of the communities to which they belong (Lave, 1988).

### **Methodology**

The objectives of the study were to:

(i) Document, (ii) observe and critically analyze, (iii) innovatively explore ways of improving my current practice of training teachers in use of teaching aids particularly cultural objects. I chose them because they are in every home and therefore familiar to teachers and pupils. Being in homes they are affordable and they also offer pupils a good opportunity to explore mathematics at home.

### *Subjects*

I used two categories of teachers; (i) 3<sup>rd</sup> year mathematics' student teachers of academic years 2000/2001 and 2001/2002; (ii) two practising mathematics teachers. The study was organized in two action cycles. Cycle 1

was a pilot phase and involved student teachers of academic year 2000/2001 and two teachers while cycle two was an intervention phase and involved student teachers of academic year 2001/2002 and one experienced teacher from cycle 1.

### *Instruments*

I used video recordings, classroom observations, interviews (audiotaped) and questionnaires. An action research approach was used and it enabled me to (i) document my current practice, (ii) observe it, (iii) discover problem areas through critical analysis alone and with friends, (iv) imagine a solution, (v) try it out and (vi) evaluate my actions. Two action cycles were possible in the given time. Documentation of remembered action in my usual practice enabled me in cycle 1, to act out systematically and purposefully what I usually do as routine. I taught both sets of teachers on the use of cultural objects as teaching aids in mathematics while being recorded on video. After each session with the pre-service teachers I interviewed five of them asking them what new ideas they had got out of the session concerning cultural objects as a resource for teaching mathematics.

With the two practicing teachers I did a two-hour session. Two weeks later I had another two-hour session with them in which we discussed the activities they had prepared exhibiting the knowledge they had obtained in the first session. Two weeks later they used these to teach while I observed the lessons and taped them on video. Throughout, these teachers were free to consult me at any time for clarification on the things we were doing.

Work with these teachers gave me a comparison between in-service and pre-service training.

Eight months later I observed four student teachers teach during school practice. I interviewed each of them concerning what they had learnt from my sessions with them vis a vis their practice in class. I also asked them how other students viewed my sessions and whether they could suggest some improvements.

### **Analysis of cycle 1**

I watched the videotapes repeatedly noting down my actions and trying to analyze why I did what I did. On separate occasions I watched excerpts of the tapes with five critical others (three individually and two together) and taped their comments which were sometimes prompted by my questions. I transcribed the comments and read through them comparing comments of different viewers with my own observations. I compared the comments from

different sources, (the critical others, the student teachers, the teachers, and my own comments). I triangulated these and came up with some discoveries about my practice, which I termed shortcomings.

This work was supported by my reviews of the literature on culture, teachers, teacher educators and learning theories. These reviews also informed my actions in cycle 2.

Thus, from: (i) observations on video tapes and in the classrooms, (ii) interviews with 10 student teachers and the two teachers, (iii) interviews with critical friends, and (iv) critical literature review, I was able to critically analyze my current practice, establish what it is and identify areas of strengths and weaknesses. I worked out a possible course of action that might improve my practice and tried the ideas out in cycle 2.

### **Findings from cycle 1**

The following were the findings:

(i) I talked a lot; i. e. I used the telling mode a lot, although I believe in learners constructing knowledge. The planned activities for the learners to do in the sessions were rather superficial. The time I allowed for each activity was short. (ii) Throughout my presentations I was worried about time and kept mentioning time being short. (iii) Although it was felt that I was clear in my exposition and presentation, the student teachers' hearts did not appear to have been touched. (iv) None of the student teachers were observed using cultural objects as teaching aids in their teaching. v) Although the student teachers would not agree, they did not seem understand what cultural objects are and how to use them. Neither did they appear to conceptualize the possible benefits of using them. (vi) The literature highlights how prospective teachers come into training with their own views about mathematics, its teaching and learning. In the student teachers could be observed (even in their own words) a strong belief that cultural objects are not easy to obtain and that if teaching aids were used the syllabus would not be covered.

### **Conclusions from cycle 1**

Teachers may have knowledge of teaching aids and their use and yet not know how to use them in their classroom teaching. The knowledge they have may only be superficial. That is, it may be of a matter of demonstrating and pointing out to pupils what concept they (the teachers) can see in a teaching aid. They, however, might not know how to engage pupils in related mathematics learning. For example they may not be able to prepare

activities that might engage pupils in constructive mathematics learning based on such objects. One possible explanation might be that the teachers are never convinced of the approaches to teaching that they get during training. Since prospective teachers come to training with their own beliefs about mathematics; those that they form over the years of mathematics learning, the limited time of training, within which they get the exposure to new ideas may not be enough to change their views. The reality of conditions in schools does not appear to help either. Teachers' attitudes are that it is impossible to find time to teach children practically using teaching aids and still manage to complete the prescribed syllabus to enable children to pass examinations.

Lesson observations showed that the in-service teacher taught with more expertise and confidence while using teaching aids than those trained in pre-service. This may be due to amount of time on training and/or the experience working in the classroom which might lead to more readiness. It suggests that training teachers at in-service level may be the answer to my question: "How can I train teachers in use of teaching aids?"

### **Cycle Two –Intervention**

Basing on the findings from pilot (cycle 1) and literature review, I carried out the following planned activities for cycle 2 as an intervention measure.

(i) To find out the views that teacher trainees came with to my sessions I administered a questionnaire at the beginning of the first session. In it I sought for their views about mathematics, mathematics learning and teaching. I also asked them to evaluate two of the lessons they had taught during the completed school practice; one they judged as their best and another they judged as their worst. Then, in groups, I asked them to discuss one successful lesson and one failure. I provided them with guidelines to follow as they did this. (ii) To create more time for the course, I gave each student teacher a file with all the materials that we would need during the six weekly one- hour sessions that we were to have. I also gave them notebooks in which to write their thoughts, reflections on the sessions and their own learning which was meant to encourage them to spend more time thinking about the work done during sessions. In order to encourage students to find time outside sessions and to impress upon them the importance of groupwork, I asked them to form groups of five to six in which they would work throughout the course. In these groups they were to discuss and complete unfinished work started during sessions. This arrangement also helped make students talk more while I talked less.

(iii) To practically demonstrate use of teaching aids in a mathematics lesson, I asked an experienced teacher from cycle 1 to come and demonstrate to them. (iv) To monitor the progress of their learning I interviewed three to five students after each session. In each interview I asked each of them what new thing they had learnt concerning mathematics teaching and learning, use of teaching aids, lesson organization, and pupil involvement. I also asked them to say something about teaching aids from culture and those from the environment. (v) To keep record of all information, I taped on video all sessions, and all lessons I observed, I taped on audio tapes all interviews with students and teachers, I kept a diary of all my actions and my thoughts on what I was doing. I requested that students hand in all the assignments and the work done during each session including the diaries and files containing all they had done. After the last session I asked them to fill in a course evaluation questionnaire.

### **Results from cycle 2**

From preliminary analysis of my diary, students' documents (diaries, files, assignments) and interviews, my own session observations I found out that:

(i) The majority of students came to my sessions not convinced that teaching aids are available and can be used. After the sessions they appeared to be convinced that there are many materials that can be used especially from the environment reflecting their culture. Students now said that the teacher only needs to be innovative and willing to look for such objects.

(ii) Students got an idea of what teaching aids are and their possible use. They also understood that cultural objects can be used to teach mathematics and were certain they could use them.

(iii) Teachers could not give a clear distinction between objects from any environment and those, which are cultural. This may be a false distinction or one, which needs more time for assimilation.

### **Conclusions**

The results of cycle 2 still have to be further investigated. However, the changes in my practice appear to have offered the pre-service teachers the opportunity for constructive learning through active group work, and mulling time (Vygotsky (1978), Bruner (1985)). My instructions offered a form of scaffolding. The experienced teacher demonstrated that teaching aids could be used. My expectations of the student teachers' out of session work were this time explicit. All this I would claim has improved students understanding of the ideas I tried to pass on.

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