REEVALUATING TEACHING STRATEGIES IN MATHEMATICS AND STATISTICS IN SECONDARY SCHOOLS

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Abstract

Numerous studies had shown that rural students are lagged behind in mathematical subjects compared to their urban counterparts, particularly in developing countries. This argument is normally characterized and expounded by exposing the negative factors such as students' attitude, cultural background, poor environment and facilities, command of language, lack of graduate teachers as well as poor mode of teaching methodologies. It has also been known that the single factor of "attitudinal problem" has chain-effects in their poor performance in schools.

This paper attempts to highlight some of the ways to arouse students' interest in learning Mathematics and Statistics. Various teaching methodologies suitable for rural students are discussed. Furthermore, the application of "contextual-based" teaching approach rather than the "content-based" teaching approach is found to be more beneficial for rural students in the teaching of mathematical subjects.

Keywords: attitudinal problems, anxiety cycle, good mathematics lesson, contextual based teaching, content-based teaching, examination-oriented teaching, proactive modeling, group tessellation.

1. Introduction

Normally members of the public agree that higher percentage passes in public examinations implies a higher performance for a school compared to the one with lower percentage passes. This does not exclude achievements in Mathematics or Statistics. So much so, the teachers desire to promote maximum percentage in examination results has become a standard norm. The ultimate aim is to ensure high credibility for the teachers as well as the schools.

The above objective is indeed a noble one. However, some university teachers had complained (at least in our university) that even students who scored good grade in secondary mathematics, large proportion of them find difficulties in understanding mathematics. The one that we are more concerned are those who only faired average or poor in their achievements of secondary schools mathematics. As mentioned earlier, the aim of this paper is to give some light in strategizing for a better learning environment to this group of students, particularly those from the rural background.

2. Reasons for Poor Achievements

Numerous studies had been carried out why some groups of students had poor performance compared to the other groups. Some (if not all) factors that contribute to the poor attainment in schools mathematics are attitudes, cultural background, poor command of language, lack of infrastructure, schools' environment and the pedagogical approaches (see e.g. [2]). These are particularly true for students coming from rural background in developing countries.

Some authors considered the negative attitudes reflected by the students towards mathematics is caused by an "anxiety cycle" (see e.g [14]) The negative experience involving mathematical subjects caused the student/pupil/trainee to think by himself that he is in fact "poor" in mathematics. This causes fear, panic, anxiety and worry which resulted that he or she is unable to perform. His self-image, feelings and perception towards mathematics inhibit his behavioral misconception towards mathematics. To avoid or remedy this type of "mathematical anxiety" cognitive restructuring is needed. (See e.g [12]).

For cultural background, many authors perceived the lack of learning facilities and language problems are the contributing factors to distract students from learning dynamically. But what is worrying is the parental beliefs that his children is not good in mathematics is because that he is born of a specific race, see for instance [15].

However, if these students are given the same treatment of educational environment and infrastructural back-up, we should realize that the only single factor which contributes to the students performance in learning, particularly mathematics, is basically attitudes. Other factors are actually the chain-reactions from the attitudinal aspect. For instance, the poor command in language and communication could be a result of lack of interest and exercises which in fact inhibit the attitudes of the person. Taking into account the philosophy of one of the universities in Malaysia, it is still possible that such an individual can be trained to a useful being and contributes to the development of the individual himself as well as the society and nation (see e.g [5]). The only condition is the individual is "aware" of the situation and willing to learn.

3. Learning Perspectives

In an active learning situation, the three components of teacher, process as well as the students must be present. To be meaningful, there should be interaction between/amongst

them. As far as teacher is concerned, he or she should conduct a lesson that is considered as "good lesson." A good lesson is conceived as the one which keeps in balance the four aspects of achievement: affect, function, knowledge and behaviour. These four aspects according to Osamu (2000) (see [13]) relate to the following conditions of good lesson:

(i) children motivation in learning is prompted and maintained
(ii) the purpose of the lesson is clear
(iii) flexible teaching is conducted
(iv) individual difference among students is taken into account
(v) autonomy is emphasized
(vi) students learn from each other
(vii) major concern is the product of learning
(viii) what is learned is further applied
(ix) product of learning is emphasized
(x) fostering students' attitude.

All these are identified according to the teacher's perspective. In the case of process, the instructional delivery is of prime importance. Thus, the teaching methodologies become the backbone of effective learning.

However, we also have to take into consideration of the students' perspective in learning mathematics. These include their interest and motivation to study, experience enjoyable learning and thinking as well as enhancing their ability to create, express and reason out. What is important they have achieved the required skills and knowledge after attending a "Good Mathematics Lesson."

4. Past Surveys

Sometime in the year 2002, I have done two surveys in the Segamat District, Malaysia. The first study involved 84 teachers and was concerned with the utilization of mathematics curriculum [see 17]. The second one, on the other hand, involved 45 teachers who constitute 24 teachers from urban schools and 21 teachers from rural schools. All the teachers are teaching Form IV and Form V levels Mathematics and Additional Mathematics. The latter study is more concerned with the perception of teachers towards their students as well as their teaching approaches, and therefore more relevant to this paper [see 16]. Some portion of the issues or results are reflected in the following sections:

4.1 Teachers' Comments

Some of the teachers' comments resulting from the open-ended questions in the survey concerning their overall experience in teaching mathematics and statistics were reported as follows:

1. I need a "teaching method" that is effective for both rural and urban students.
2. Two distinct methodologies in teaching the poor achievers and the normal students should be used.

3. I am happy teaching mathematics even though is not my optional subject.
4. I am very happy when students who always fail in my tests, make through in public examination.
5. I find that students find difficulties to grasp mathematical concept because it cannot be used in everyday life, especially in Additional Mathematics.
6. Students who take Additional Mathematics must have a strong basic, especially good results in PMR (Penilaian Menengah Rendah) Examination.
7. The poor performers are usually those who are not interested in doing exercises and homework.
8. I am very happy if the percentage passes in Mathematics in school is very high even though with grades 7 or 8.
9. To do well in mathematical subjects, commitment by parents is also important (not totally rest on the teachers)
10. Whether students like the way I teach or not, I still like to teach mathematics.

The above comments are interesting and useful and could bring better insight for us or mathematics teachers in improvisation of teaching approaches, development of teaching materials as well as the adaptation of the curriculum in the community.

4.2 Content-based and Contextual- based Teaching.

In this regards, "content-based teaching" is basically teaching according to the given syllabus or curriculum. The main aim is to fully complete the whole syllabus at the end of the year or semester. The emphasis is more on the mastery of concepts as well as the theoretical foundation of a given topic. It gives a detailed coverage as it stresses on content. Hence, the responsibility of a teacher is to deliver the whole curriculum with minimum modification. On
the other hand, "contextual-based" teaching is teaching through focusing on a selected topic and resorting to environmental orientations. This means that in the "contextual-based" teaching, the teacher does not necessarily complete the whole syllabus, but he has the flexibility in choosing relevant topics for his class. The main objective is to generate more understanding about a given problem. Hence, in this form of teaching application of concepts rather than theory is more dominant.

With respect to the above study, it was found that there is no difference in preference for the use of content-based teaching for teachers teaching in the rural schools and urban schools. However, there is a difference in preference of teachers concerning the use of contextual-based teaching for urban and rural teachers.[see 16] . Testing using a one-sided t-test, it is revealed that teachers prefer contextual-based teaching compared to content based teaching at 5% significant level.

5. Learning Strategies

5.1 The experience of RME in Netherlands and Indonesia.

RME (Realistic Mathematics Education) is an approach in which mathematics education is conceived as human activity [see 7,8,9]. In RME, learning mathematics means doing mathematics of which solving everyday life problems as an essential part. The key principles are that students are given the opportunity to reinvent mathematical concepts, and the teaching –learning process is highly interactive. One of the objectives of RME is to create active learning environment where pupils can share to discuss certain concepts, problems and results which can enhance better and conducive learning climate.

The RME approach has been developed in Netherlands and experimented in Surabaya Indonesia. Even though, the experiments were done in primary schools, it gave promising results [see 6].

5.2 South African Experience

After the fall of apartheid, the Department of Education in South Africa had embarked in changing the Old Approach of teaching to a New Approach in all curricula, including mathematics. The characteristics of the New Approach reflect the following situations:

1. Active learners as oppose to passive learners.
2. Critical thinking, reasoning, reflection and action as oppose to rote-learning.
3. An integration of knowledge, learning relevant to real life situations as oppose to content-based syllabus.
4. Learner centered, teacher as facilitator as compared to textbooks bound and teacher-centered.
5. Learners take responsibility for their learning compared teachers responsible for the students learning.
6. Flexible time frame as compared to rigid time frame. [see 4].
7.

This New Approach in the delivery system had been developed in 1997 and is to be fully operational in 2005. It was understood that the change from the old approach to the new one would not be easy as teachers were normally influenced by the methodology of the past. Nonetheless, a 3 years observation/experiment on Grade 7 mathematics teachers by Brodie [see 15], there was a major shift in the ways that the teacher taught mathematics.

5.3 Proactive Modeling and Practices.

Generally, teachers and instructors tend to pinpoint others as to why their students cannot achieve much in school mathematics. The secondary school teachers tend to blame the primary school teachers, while college or university teachers blame the secondary school teachers. Steps should be taken to overcome if not neutralize this negative feelings. This

section provides the proactive approach that mathematics teachers and instructors are the key players in the contribution of students' achievements.

In this respect, we have to look at the pedagogical aspect in classroom teaching. We have to consider that our traditional approach of "chalk and talk" teacher-centered teaching can best be shifted to a new dimension of classroom teaching which focuses on students-centered learning.

5.3.1 Teacher's Modeling

The framework of teacher's modeling is based around the concept of didactical system [see 10]. A didactical system is a set-up when the intention of teaching and learning exist. Teaching is monitored like a project (mini-project) where there exists the objective of a study, the persons who want to study and the persons who helps in the study. This means, in the system, the organization in the encounter for knowledge deals both the teacher as well as the students. The teacher is not the central actor in the system but there is interaction between students and knowledge and the teacher becomes the feedback. The importance of the teacher is stressed into two complimentary processes, namely devolution and institutionalization.

Devolution is a process in which the teacher delegates the power to solve the problem to the students. The teacher explains the tasks to the students without providing any indication about the possible ways of solving it, but encourages the students to enter into the solving process. However, instituitionalization refers to the process where the teacher helps to decontextualize and formalize the knowledge learned in the previous stage.

A case in point is a "kajian tindakan" (action study) done by the Selangor Education Department recently [see 1}, where teachers engage in a short-term project/study for his class.

The teachers concerned then evaluate the performance and effectiveness of his new creative method of teaching a given topic. If it is effective, it can be repeated for different classes or different topics.

5.3.2 Role Play and Dramatization.

This form of teaching is based on the notion of constructivist teaching [see e.g 18]. Teachers monitor the class such that the knowledge imparted is based on real-life situation. In mathematics class, for instance, the use of money and coins can be taught trough transaction based on the "dramatization at the market place."

Similarly, in a probability or statistics class the teacher uses real common objects like balls or bricks rather than using traditional examples of dice and playing cards which are unfamiliar to most of the students.

5.3.2 Variations Mode

One method of teaching mode may not be conducive in the modern learning environment. In fact, it causes boredom, particularly to rural folks. It is therefore envisaged that variation becomes a necessary strategy in the classroom delivery. Again, real-life situation is to be emphasized. Variations in mode should include visits, drama, sports, jamboree, Olympiad competition and outside experimentations.

Monotonous intonations should therefore be avoided and multiple tones be exemplified. These situations provide rooms for motivation and stimulate the dull classroom atmosphere.

5.3.4 Computer Aided Learning (CAL).

CAL is an important aspect in modern instructional delivery. The availability of such instructional facilities should be regarded as a teaching aid which would enhance effective and enjoyable learning. Though the main objective is to encourage students-teacher interactions but we should bear in mind that computers should not totally supplant the role of teachers and instructors.

A case in point on the use of CAL is the EteMS (English in the teaching of Mathematics and Science) policy in Malaysian schools. The policy commenced in 2003 involving students at Primary 1, Secondary 1 and Lower Six. It is therefore to be fully operational by the year 2008, where the policy covers all primary and secondary schools. Though there were some criticisms on the implementation of the policy, especially for the rural schools, the response from

teachers and students were promising when the government agreed to improve the method of teaching involving rural schools [see 19].

6. Concluding Remarks

This exercise reveals that there should be a better instructional delivery system for the students in learning mathematics or statistics especially those from rural schools. As we have discussed, the rural students are more prone to exhibit "mathematics anxiety" as well as inhibit "negative factors" in learning, they are supposed to be the focus group to be motivated, stimulated in their learning process. The experience in the Netherlands and Indonesia through the RME approach of teaching, the South African policy through the New Approach as well as my two studies in Segamat Malaysia suggest that all the approaches have some if not all the characteristics of contextual-based teaching. In Hong Kong quite a similar approach called TOC (Target Oriented Curriculum) teaching is suggested (see e.g [20]).

The duty of the teacher is to ensure the learning process should be suitable for his students' attainment. From our discussions in the previous section, the proactive modeling and practices should be taken as a guide to deliver good and meaningful lessons. It is also a way of cognitive restructuring as suggested by one of the authors I mentioned.
We ourselves should reevaluate whether the methodological approach in our teaching of mathematics and/or statistics suits the class under our responsibility. If indeed a contextual-based teaching is appropriate, do not hesitate to adopt it. However, if we have all above average students in front of us, then content-based teaching may be appropriate. Our duty is to maximize the students potential in learning through the integrated development, incorporating the physical, emotional, spiritual as well as intellectual development [see 11].

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