Using a blog to bridge the mathematical knowledge at the tertiary level

FARIEL MOHAN
Department of Information Communication Technology
University of Trinidad & Tobago
Point Lisas
Trinidad & Tobago

Professor Bhatt
Department of Mathematics and Computer Science
University of the West Indies
St. Augustine
Trinidad & Tobago

Abstract: - Over the decades, the imparting of knowledge by teachers have always been proven challenging. Research in teaching has contributed to some improvement in teaching. In the Caribbean, financial assistance for research in teaching is very limited. This paper looks at the challenges faced with the teaching of Mathematics at the tertiary level based on the shortcomings of the teaching of mathematics at the secondary level. The paper illustrates a cost effective approach based on the social constructivism in creating a community learning scenario by using a virtual classroom to teach Mathematics. The paper highlights the benefits of collaborative learning by the student academic success, self confidence improvement and togetherness resulting from the first phase of the project.

Key-Words: - mathematics teaching, community learning, collaborative learning, social constructivism, blog, web logs, virtual classroom, cooperative learning

1 Introduction
In the Caribbean, students do not like mathematics because it is hard (George, 2005). The teachers often complain that the syllabus is too large hence the delivery of material is directed by the allocated teaching time. The method of delivery used is the traditional approach of ‘chalk and talk’. The structured approach to teaching mathematics often leads to less student learning. A study (Clarke, 2007) carried out in the Caribbean highlighted computer technology use in secondary schools is needed because of its benefits for both students and teachers and to stimulate interest, motivation and improvement in their student’s performance. With finance a major issue in the Caribbean, the education sector is the most vulnerable to cut. At the tertiary level administration and non-academic costs consume most of the budget (Carrington, 1993).

2 Problem Formulation
One set of first year diploma ICT students at UTT had performed very shockingly in a very basic mathematics quiz. This quiz was based on variables expressions and straight line graphs. The result was less than 20% of the students passed the quiz. The problems encountered by these students were so different, that it was very difficult to identify what was the common problem in these students mind. Every student can state that the equation of a straight line is \( y = mx + c \). Using a straight line graph to read off given values on the graph posed difficulty. On the algebra side, a question on an amusement park, involving adult and children cost, providing the total number of people and the total charges received. The students were not able to determine how many persons admitted were children. A study undertaken by Cai(1995) has...
shown that most students know the mechanism of “adding all together and dividing” which constitutes the simple average calculation algorithm. However, only some of them were able to find an unknown value in a series of data where the average is known. Children often have different strategies, concepts, attitudes and beliefs due to different biographical or cultural background or simply due to different ways of thinking. (Prediger, 2005).

2.1 Teaching Approach
In teaching any class the biggest challenge is to ensure that the students understand. Over the decades, it has been said that when teaching a class, the first step is to find a common base or starting point among the students. That line where is this common base has posed the biggest challenge in teaching over the decades. It is debatable that it is easier to teach a class of extremely weak students or extremely bright students than it is to teach a class of mixed levels. The teaching of Mathematics has added another angle to this problem. In the latter part of the 20th Century, there have been intense efforts to improve mathematics education in schools but after more than a quarter century of attempted reforms, there appears to have been little improvement (Chilakamarri, 1998). Chilakamarri proposed that the mathematical culture that is adapted may be one of the causes and mathematical enculturation is one of the solutions.

2.2 Teaching in the Caribbean
In the Caribbean, the teaching of mathematics in secondary schools also poses this great challenge. In Trinidad & Tobago, a recent survey done in 2006 of Mathematics in secondary schools was published by NIHHEREST. One major point highlighted in this report is that 28% of the mathematics teachers held a first degree in Mathematics. The continuation of the traditional ‘chalk and talk’ method of teaching was used. 93% of the students indicated that teachers frequently showed them how to do mathematics problems. The highest percentage of teaching time was spent on algebra which was identified as the most difficult area of the mathematics syllabus. 93% of the teachers used textbooks to teach mathematics. Almost all of the students, 97%, agreed that lots of hard work and studying at home was necessary to do well in mathematics.

Another study (George, 2005) carried out in the Caribbean concludes that there is a mismatch of purposes in the classroom. Teachers have a structured approach to teaching, students often less so to their learning. Hence, gaps were made or further widened as teachers were not necessarily always meeting students where they were. The starting points of the teaching to the learning were sometimes so different that students could not make the connection (Boaler & Greeno, 2000). Another study (Clarke, 2007) investigated the experience and perceptions of the secondary school mathematics teachers in the English-speaking Caribbean as they explored the use of computer technology (CT) in their mathematics instructional practices, and to identify factors they consider necessary for successful integration of CT in mathematics instruction. This study concluded that it is evident that the teachers’ conscious effort to move away from the traditional “chalk and talk” approach to a learner-centered approach did lend itself to genuine positive progress in using computer technology.

2.3 Tertiary Education
The secondary school students are then about to decide what is the next step to higher education debating whether to go to diploma level or BSc level? The concept of an individual self-efficacy (Warwick, 2006) to be used in helping students examine themselves in determining what programme is more suited to them (diploma or BSc). Self-efficacy uses “people’s judgements of their capabilities to organize and execute courses of action required to attain designated type of performance” (Bandura, 1986). This personal cognition has been applied within the field of educational research (Phan, 2000) and is conjectured to be oriented around four core concepts:
performance experiences, vicarious experiences, verbal feedback and physiological and effective states. The pilot study (Warwick, 2006) concluded that on average students who were admitted to the BSc courses have better previous experiences of mathematics than diploma students. It was highlighted that these experiences were not based on qualification gained. The author concluded that diploma students often lack confidence and some basic mathematics skills.

3 Problem Solution
With this extremely high failure rate, an innovative approach to teaching these students had to be experimented. The explicit confrontation of the individual way of a student thinking offer different approaches which lead to different mathematical concepts can result in interesting amplifications of perspectives (Prediger, 2005). This YMC project was to teach the students the foundational mathematics that was not understood. There were two major issues in YMC project, teaching-time constraint and student learning approach. The method employed to alleviate the teaching-time constraint was to use computer technology and create a virtual classroom. Research has shown that teachers who has a spectrum of attitudes such as fear of possible failure because of a lack of knowledge of the technology, and skepticism toward technology, gradually changed toward an appreciation through classroom experience that convinced them of the positive benefits technology has to offer as a problem-solving tool (Abramovich & Brown, 1996). In a similar manner, the assumption taken was once the student was convinced of the positive benefit, they would willing use the technology.

3.1 Constructivism approach to teaching
The constructivism approach has been around for a very long time. In recent years, a lot of research has been engaged in this approach to teaching. Ernest (1995) in his description of the many schools of thought of constructivism suggests the following implications of constructivism which derive from both the radical and social perspectives:
• sensitivity toward and attentiveness to the learner's previous constructions;
• diagnostic teaching attempting to remedy learner errors and misconceptions;
• attention to metacognition and strategic self-regulation by learners;
• the use of multiple representations of mathematical concepts;
• awareness of the importance of goals for the learner, and the dichotomy between learner and teacher goals;
• awareness of the importance of social contexts, such as the difference between folk or street mathematics and school mathematics (and an attempt to exploit the former for the latter).

In addressing the problem, the constructivism approach was considered. The students' previous mathematical knowledge was considered and the solution must be able to diagnose the misconceptions in their mathematical concepts. The solution must foster the student to express their mathematical concepts in as much ways as needed using his own manner of communicating. The importance goal was the student must understand the correct mathematical concepts.

3.2 The Virtual Classroom
Consideration to the pilot study (Warwick, 2006) which concludes that diploma students often lack confidence and some basic mathematics skills should be taken into consideration. YMC attempted to resolve this problem by making the student become the teacher for a virtual classroom. This approach could actually build the confidence of the student in his learning of mathematical concepts as well as build confidence in himself. Learning is described as a dynamic, active, problem-solving process in which existing knowledge is modified, added to, or reconstructed.

This YMC pilot project used a blog to create the virtual classroom. A number of blogs have been used in assisting teaching. Most of these approaches using blogs for teaching involve...
each student setting up a personal blog and using it as an online diary to express course content. Every student normally is instructed to make some entries to each other blog. The YMC pilot project used the blog in a different manner.

### 3.3 Web logs in the Teaching Approach
The use of web logs (blogs) in teaching is the recent years are being researched. The ability of students to easily maintain online diaries can enhance discussion. In addition, blogs can promote collaboration (Flatley, 2002). Blogs also encourage students to write and knowing a larger audience can be reading further develops critical thinking skills (Beeson, 2005). The benefits of using blogs in teaching carried out by (Davi et al, 2006) concluded that using blogs across disciplines can enhance liberal learning and providing course materials before class fostered a sense of active learning classroom. In these approaches of using blogs, each student maintained his own blog.

YMC uses blogs in a different scenario. Each student of the virtual classroom was registered to the same blog, YMC. Each student registered to this blog under an identity known only to the instructor and the given student. With the comfort of hiding behind an unknown identity, a student was able to feel free to express his views. The instructor triggered communication by placing some basic statements. The students had to add comments which could be an explanation in his own words, a question, a correction or an illustration. The student explanation in his own words were encouraged, allowing other students to teach on the correctness of the student’ understanding. This meant a student was taking the role of teaching or correcting a peer who is unknown to him. As a student reflects on his understanding of the given topic, immediate feedback can be obtained.

This approach to learning allows the student to feel competent and responsible in his teaching his peers and this will have the additional advantage of motivation and self-esteem. It has been established that intrinsic motivation is connected with the application of more effective deep level processing strategies (Schiefele, 1991). The opportunities for students to feel competent from this cooperative learning approach especially for the students who did not have positive experiences of competence. Some researchers claims the student perceptions of their competence in an area provide key ingredients to their self-concepts (Bong & Skaalvik, 2003).

### 3.4 The Result
In teaching The initial outcome of the YMC project is 92 % of the students were actively adding comments. The comments can be grouped into five broad categories, response to a statement, answering a question, asking a question, reinforcing an opinion or illustration by examples.

#### 3.4.1 Illustration of a dialog among students
An example of correspondences based on the question – Will a graph consisting of two lines intersect? The comments below demonstrate that the students are very comfortable in expressing their personal answers or thought to the question provided.

**Student 1 comment to above statement** - Once lines have equations they will intersect unless they are parallel.

**Student 2 comment to Student 1** - You can have an equation that let you plot under the positive section of the x-axis and one that lets you plot over the negative axis.

**Student 3 comment to Student 1** - If something is separated doesn’t it mean it doesn’t touch? If you have two lines on a same graph paper but separated it will not intersect.

**Student 4 comment to Student 2** - The comment on the +ve and –ve quadrant is not correct, lines can still intersect. You must consider the fact that lines can exist on a graph even though they are not parallel because it depends on how long the lines actually are.

**Student 5 comment** - An example to consider is Hooke’s law. Hooke’s law there is a straight line at the end and when you pass the elastic limit it starts to curve. Would you consider that a straight line and a curve on the same graph?
Student 6 comment to Student 5 -
I think when the line starts to bend then it is considered a curve. In Hooke’s law, if the elastic limit isn’t reached then the graph remains a straight line.

Student 7 comment to Student 5 -
In Hooke’s law, the line is considered a curve if it reached the elastic limit and starts to bend.

3.4.2 Benefits of the YMC project
This YMC pilot project has already shown great success in student learning. The students were at ease expressing their thoughts on the course material. This was reflected by the fact that on average a student added 3 comments to a given topic. The fact that the student could be learning at his convenience in the virtual classroom was reflected by the time of entry of the comments. The positive outcome of this initial phase of the project was the great enthusiasm of the students in the use of the blog. Also after 4 weeks using the blog, a similar quiz on the same topics was given and the result was the reverse. Less than 20 % of the students failed. It should be noted that the students who failed did not have more than one comment in any topic. It must be emphasized that the topics in this quiz were never taught by the instructor. The instructor directed where the students should go by placing the first statements on the topic. The background knowledge was taught without using any teaching time from the current course.

4 Conclusion
The research described in this paper involving using a blog to build a virtual classroom. This community approach provided the student with the convenience of learning when the have the time. It also broke down the barriers of being fearful to talk in class. The increase in confidence extended to an ease of talking in the normal class. It was a cost effective solution since the institution had no additional cost for this research. The ease of accessing a computer with internet access was highlighted in the frequent comment by the student and the time of these comments. The best part was the collaborative efforts by the students achieved this outcome among themselves. Every student helped in helping one another without realizing the identity of the student. The dialog that transpired among the students has demonstrated that the barriers of fear and low esteem were overcome. The virtual classroom has achieved teaching hours that is self convenient to an individual student.

The next step of the YMC is to use the virtual classroom to teach the current course content. This approach would be used in three classes out of twelve classes that teach the same course content. The final examination will be the same. If this show a better outcome then the approach should be tested on a different course.

References:
[7] Cai J. Beyond the computational algorithm. Students’ understanding of the arithmetic


