C³TO: ENABLING MATHEMATICS TEACHERS TO CREATE A PRESENCE ON MXIT AND OTHER CHAT AREAS

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To the mathematics teachers who are comfortable with expressions like Θ, φ, Σ and Δt, the terms "mxit", "chatter bot", "xmpp", and "jabber" may sound like Greek to them. Although recent research has shown that primary and secondary school pupils are more than willing to discuss mathematics on MXit and in chat rooms, it has been difficult (if not impossible) for an ordinary mathematics teacher (with limited computer and financial resources) to take advantage of this eagerness on the part of their pupils. C³TO is a platform where bona fida teachers (not just mathematics teachers) can easily set up games, quizzes, definition lists, formulae lists, and tutoring facilities which their pupils can reach using MXit on their cell phones.

A.   INTRODUCTION

It is not necessary to describe the state of mathematics education to AMESA members. Suffice it to merely refer to the (draft) report issued by Higher Education South Africa wherein the statistics show that only 7% of first year university students can cope with the mathematics required at university level (Yeld et al. 2009). There is no reason to further quote from the TIMSS 2003 report (Mullis et al. 2004) or Reddy's interpretation of that report (Reddy et al. 2007).

But there is another set of statistics which are not as commonly known. Although there are no official statistics of teenage cell phone usage, recent research in low income high schools in the Cape Flats area indicate that nearly 97% of teenagers claim to have used a cell phone to access the internet within the past 24 hours (Kreutzer 2008, Kreutzer 2009). Many pupils who do not own cell phones, do, in fact, own SIM cards and borrow cell phones from friends and insert their own SIM card.

Isn't it possible that that second set of statistics (the cell phone usage among teenagers) can somehow help in solving the problems indicated by the atrocious first set of statistics?

B.   A VERY BRIEF HISTORY OF DR MATH

In January, 2007, Meraka Institute initiated an action research project aimed to investigate whether or not secondary school pupils would use their own personal cell phones and their own personal airtime to discuss their mathematics homework with a tutor using the popular Mxit instant messaging system. From an initial expectation of approximately fifty participants, the Dr Math project has grown to over 6000 pupils regularly getting assistance from dozens of tutors from the University of Pretoria. This project has been well documented in the past few AMESA Congresses (Butgereit 2007, Butgereit 2008, Butgereit 2009).

Although this research and similar research to dispense information about drug abuse (Parker, Wills & Wills 2008, Wills, Parker & Wills 2009) and to dispense information about HIV/AIDS (de Tolly, Alexander & Cell-Life) over Mxit has consistently shown that secondary school pupils (and, in many cases, primary school pupils) will contact adults for assistance using Mxit, it has not been easy for teacher with a limit budget and limited IT resources to take advantage of this research.

C.   C³TO – CHATTER CALL CENTRE/TUTORING ONLINE

C³TO, **C**hatter **C**all **C**entre/**T**utoring **O**nline, is web application where teachers can configure a tutoring environment which can be used with cell phones using Mxit. This tutoring environment can be configured to have extra mathematical competitions, games and multiple choice quiz competitions to keep participants busy during the periods of time when a tutor is not available.

Mathematical skills competitions include:

- Addition – simple addition of two integers

- Subtraction – simple subtraction of two integers with the difference remaining positive

- Multiplication – simple multiplication of two integers

- Division – simple division of two integers with positive, natural number quotients

- Prime Factors – prime factors of a positive number

- Simultaneous Equations – finding the intersection of two straights lines where the intersection point has intreger x and y components.

The multiple choice quiz competitions allow a teacher to set of a multiple choice questionnaire. The participants can compete at answering the questions. This is ideal for testing definitions. For example, a question such as "What is an isosceles triangle" might have the following choices as answers

- A triangle with all sides of different length

- A triangle with 2 sides of equal length

- A triangle with 3 sides of equal length

The quizes or questionnaires are easily configurable using a web interface.

Sets of static lookups can easily be set up. This allows a teacher to put a set of definitions or formulae which the particiapants can easily look up.

With all of these facilities, the teachers or adults can use a full sized computer workstation to access the web interface to C³TO. The pupils continue to use Mxit on their cell phones.

Hopefully, at the presentation of this paper, additional facilities will also be available and easily configurable over the web.

D. ETHICS AND SAFETY

The original Dr Math project went through an ethics and safety procedure due to the fact that the research project involved minor children. An ethics clearance was obtained from the Tshwane University of Technology. A number of features are present in C³TO to help ensure the safety of the participants:

- All tutors must sign a code of conduct

- All conversations are recorded for quality, research and safety reasons

- Cell phone numbers are hidden from all users

- Conversations are spot checked for to ensure that no inappropriate conversations are happening

With respect to the spot checking of recorded conversations, there are a number of ongoing research projects to attempt to automatically spot topics in the conversations. This is more difficult than it may initially appear to the casual reader since the conversations are in abbreviated "sms lingo" or "mxit lingo".

E. OPEN SOURCE SOFTWARE

C³TO was written using all open source products. As such it is released under an open source license. Teachers who wish to have a copy of the software are invited to contact the author.

C³TO is also hosted on a server and teachers can use the service which is hosted elsewhere.

F.   PILOTS

Prior to migrating all of the existing Dr Math participants to the new C³TO platform, two pilots were executed to ensure that the platform could handle the volume.

The first pilot was at a private English speaking joint primary-secondary school. The pilot was an attempt to build school spirit and encourage pupils to learn more about their school. A multiple choice quiz was set up to test pupils' knowledge about their school. Questions such as "Who is the head of the music department?" and "Who is the grade R teacher?" encourage pupils to wander around their school and ask questions.

The second pilot was in support of a conference. Static lookups were used to direct visitors to the exhibition area to various stands. Quiz competitions were used to encourage visitors to actually visit all the stands.

The migration of Dr Math participants to the C³TO platform happened in November, 2009, with Dr Math now being fully implemented on the new C³TO platform. Using the new web interface for tutoring, volunteer tutors from three South African tertiary institutes are currently assisting the pupils with their mathematics homework.

EXAMPLES OF CONVERSATIONS

Here are some examples of typical conversations between tutors and pupils:

Wise: (x-5)(x-2)=0

Dr Math: what must you do, mulltiply them together? Do you know the FOIL rule?

Wise: Multiply

Wise: i know FOIL method,jah.

Dr Math: ok so multiply the First terms, then the Outer terms, then the Inner terms, then the Last terms. add them up and combine common terms.

Wise: X^2 + 2x - 5x + 10 = 0

Dr Math: close but it should be -2x -5x not plus. now combine terms.

Wise: x^2 - 7x + 10 = 0

Dr Math: have u got a maths question?

juliet786: How do you calculate scientific notation

Dr Math: that's about v big numbers and v small numbers - say 1 million is 1 x 10^6

Dr Math: then 10 times 1 million is 1x 10^7

Dr Math: Does that make sense to you ? if not I'll try again

juliet786: Yes it does:D

juliet786: Aww u're so helpful

Dr Math: OK 0,0003 is 3 x 10^-4 . Do you understansd how that works for small numbers and negative powers?

juliet786: Yup yup

juliet786: Aww man thats so easy

Dr Math: for u perhaps but how do I know u are so clever? now what about (3 x 10^7) + (4 x 10^6)

juliet786: 0,0000003

juliet786: N 0,000004

juliet786: :D

Dr Math: 30 000 000 + 4 000 000

Dr Math: 3,4 x 10^7 get it?

juliet786: Why d 4 only got 6 0's?

Dr Math: cos it's 4 x 10^6

juliet786: Oh oki

Dr Math: u getting the picture?

Dr Math: hi, got any math problems for me today?

Kay: I need the formula 4 number patterns

Dr Math: well each pattern is differet. do you have a pattern

Kay: Linear

Dr Math: you must give me an example, i don't have your textbook.

Kay: 9, 14, 19, 24

Dr Math: ok so what is the difference between 14 and 9?

Kay: 5

Dr Math: and between 19 and 14?

Kay: 5

Dr Math: and between 24 and 19?

Kay: 5

Kay: Dat de common difference ryt?

Dr Math: exactly, so what is the next term in the sequence

Kay: 29

Dr Math: now must you find the general formula of this? is this math or mathlit?

Kay: Math

Dr Math: so this is known as an arithmetic sequence. it has a starting point (9) and a common difference (5)

Kay: Oh k and they say I mst find Tn

Dr Math: exactly. so the formula is Tn = 9 + (n-1) * 5

Kay: So this is the gf, so I cn use it in any arithmetic sequence?

Dr Math: for any arithmetic sequcen the formula is Tn = a +(n-1) d where a is the starting point, d is the difference, and n is ther term

Kay: Tanx

AngGeL EyEz: Do u help with MATHS LITERACY

Dr Math: sure whats the quest

AngGeL EyEz: The simple interest on R12 500 After 3 years at 4% p.a.

Dr Math: firstly after you learn this, we have a competition in simple interst just type in .si but the formula is si = principal times rate times time

AngGeL EyEz: Wats the answer?

Dr Math: oh, but i don't do the actual calculations. you need to do 12500 * 3 * .04 where * is multiply

AngGeL EyEz: So you'l get 15000 ryt?

Dr Math: i think you forgot to move the decimal. that is very high interest

AngGeL EyEz: So u r gona get 1500

Dr Math: yep, that's what i get also. now try our competition .si

CONCLUSION

Past research has shown that primary and secondary school pupils will voluntarily use their own personal cell phones with their own personal air time in order to obtain help with their mathematics homework. C³TO is an open source platform which easily allows teachers to take advantage of this fact and start using Mxit and other chat protocols for educational purposes in a low cost manner.

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