

THE CALCULATING COOLNESS OF DR MATH

CHAPTER EIGHT

*Born in a communications
breakdown, Dr Math is the
unseen avatar who helps
to lead school-goers on the
pathway from befuddlement
to enlightenment, via Mxit.*

IN THE MILLIONS of messages that flit through the ether on Mxit every day, a call for help breaks through, thumbed in a rat-tat-tat of half-formed words and digits adrift at sea.

‘Okay,’ runs the message from a scholar we’ll call Pupil, ‘a certain numba is increasd by 7, it will be equal 2 13 decreased by dat numba, wat is the numba? so my equation is $x + 7 = 13 - x$ wher did i go wrong?’

In seconds, on the other side of the equation, the SOS is reeled in, decrypted and held up to the light by a contact of the most calculating variety. Dr Math.

‘Hmmm,’ types the doc, sitting at a distant computer terminal. ‘Let me c.’

Rat-tat-tat. Tap-tap-tap.

Dr Math: It’s correct, now take the $-x$ to the other side

Pupil: Ohkay so it become $x + x = 13 - 7$? Ryt?

Dr Math: Yip

Pupil: $2x = 6$

Dr Math: Therefore $x = \dots$

Pupil: Oh ... Thanx $x = 3$ lol yeah thanx

Dr Math: :)

Sealed with a smiley, the consultation reaches a crescendo in a blaze of revelation as Dr Math chalks up another victory for basic numeracy and the joys of mobile learning.

Except here, there is no chalk. Just fingers touching keys, and minds meeting minds across the neural pathways of a system that owes its very being to the beauty of numbers.

Not everyone can grasp them. Not everyone can follow the steps that lead logically to the unmasking of x . But Dr Math is here to help.

Every day, when the final school bell has rung, Dr Math goes online, ready to help with homework and answer queries for the more than 30 000 Mxit users who have registered for the free service at primary and high schools across South Africa.

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To avoid interfering with class or being sneakily consulted during an exam, the live-chat service is only available after school hours. During school hours, users can play math-based games, answer quizzes or find definitions for formulae.

But who, you may ask, is the mysterious Dr Math, solver of problems, prover of theorems, elucidator of Euclidean conundrums?

Invisible, voiceless, genderless, ageless, the Mxit mathematician is an enigma about whom only two things are known for certain. Dr Math knows math. And Dr Math is human. A multiplicity of humans, in fact, in the form of a corps of Pretoria University undergraduates from the Faculty of Engineering,

Built Environment and Information Technology, who volunteer to act as online math tutors as part of their community-service obligations.

Sitting at their laptops or desktop workstations, on campus, at home, in internet cafés, they individually assume the persona of the friendly, wise and helpful Dr Math, an avatar of enlightenment, who speaks not just the language of numbers, but the language of Mxit.

Pupil: EloW

Dr Math: Helo! How can I help u 2day?

Pupil: Hw can i find beta if $\cos 2\beta = -0.5$

Dr Math: What?

It isn't always easy. But Dr Math perseveres, learning through teaching, cracking the code, following in the footsteps of the archetype, the role model, the first to wear the mantle and facilitate a marriage between Mxit and mathematics.

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Yes, there is an original Dr Math, whose story of serendipity and connection begins, as many do, with an everyday breakdown in communication.

Just off Lynwood Drive, east of Pretoria, lies the Council for Scientific and Industrial Research (CSIR), a world away from the heartland of personal computing in Silicon Valley, California, USA.

But in 1978, a young mathematics graduate and computer programmer named Laurie Butgereit made that leap of faith, venturing across the oceans to take up a six-month contract with the South African state electricity supplier, Eskom. She saw the light of opportunity in Africa, and she stayed.

Today, her California accent intact, her sunny disposition undimmed, she works as a senior technologist at the Meraka Institute of the CSIR, where she runs the programme that adds new dimensions and angles to mobile education.

Laurie's eureka moment came one day in 2007, when her son, Chris, in matric at Hartebeespoort High School in the North West province, needed a little help with his homework.

'Have you ever tried to help a teenager?' says Laurie. 'My son and I could not sit at the kitchen table and discuss mathematics. It was just impossible.'

Laurie cannot now remember whether she or Chris first came up with the idea, but the solution lay close to hand, in a proxy device that is capable of filtering the emotion from a conversation and cutting straight to the numbers: a mobile phone, running Mxit.

Chris would tap out mathematical queries and dispatch them over the network to Laurie, who would process them online while logged in to a Google Talk account on her PC.

The technical term for this is peer-to-peer networking, allowing different devices to communicate with each other on a basis of equal bandwidth. Back and forth, step by step, the construct of conversation builds a pathway to understanding, even between different generations who are sitting under the same roof, within shouting distance of each other.

It was too good a solution not to share.

Chris told his classmates about mathematics-by-Mxit, and not long after a small group of them were also adding dr.math.help.me@jabber.org to their list of contacts and checking in for help with homework between 3 pm and 4 pm after school.

Math homework, concedes Laurie, is a necessary evil. You can't learn mathematics without it. Attempts to cast the chore in a glow of cool, to game it into fun, are well intentioned but doomed, because at the end of the equation, you still have to do the math.

But in the character of a pseudonymous contact on Mxit, patient, easygoing, non-judgemental – a peer among peers – Laurie saw an opportunity to lighten the load, to make the chore at least a little less difficult and boring.

From the start, she wanted it to be a complement, not a substitute, for conventional in-class education. She sought approval from the principal of her son's school and she printed posters and business cards inviting Mxit users to connect with Dr Math.

The idea was not to give answers, but to help with steps to finding answers, because the real joy of learning lies in figuring it out for yourself. Then it all got a little too big for one Dr Math to handle.

Fluent in the Java programming language on which many mobile applications are based, Laurie wrote a program to communicate with the Mxit server in Stellenbosch and to provide a graphic user interface for the tutors.

Then she presented her project to the Meraka Institute of the CSIR as a subject for further research.

Today Dr Math is the flagship of the institute's mobile-education initiative, a model for distance learning and a vehicle for the redistribution of knowledge by university students engaging in community service.

But on a platform designed primarily for personal chat, the boundaries of engagement by Dr Math have had to be strictly defined.

'We were thinking: male University of Pretoria engineering students and poor little teenage girls – do the math,' says Laurie. 'We were well aware from the outset that we were dealing with minor children, without parental permission. So we went to the Ethics Committee of the Tshwane University of Technology and we drew up some guidelines.'

The first was the very bedrock of the Mxit platform: anonymity. The tutors are identified only as Dr Math and they do not give out any details of ASLR, the standard opening conversational gambit of age, sex, location and race on an instant-messaging platform.

Likewise, the learners who chat with Dr Math are obliged to use nicknames, or 'handles', and the system has a software algorithm that hides or overrides their cellphone numbers.

All conversations are recorded and logged for 'quality, research and safety purposes', and the tutors' identity details are kept on file. Then there is the Math on Mxit Code of Conduct, which all tutors are required to sign. This binds them to limit topics of conversation to math, science and schoolwork, and all personal questions are barred, except for 'what grade are u in?'

Tutors specifically pledge not to discuss sex, drugs or illegal activities with any of the participants, although they are given the go-ahead to encourage further study in math-related subjects and the use of cellphones as research tools and calculators.

From an ethical perspective, Dr Math has proved to be beyond reproach, with many tutors referring to their personas in the third person, to add another level of discretion and disengagement to their online interactions.

Single-minded in their pursuit of truth in mathematics, the tutors quickly become adroit at steering stray threads of conversation back on track.

What Laurie didn't reckon with, however, was that in these conversations the tables might be turned. 'We've been shocked,' she says, 'to see that the kids have often tried to proposition our tutors. They will push their phone numbers to the tutors, and we have tried to intercept that with software, but the problem is, we're math tutoring ... we can't just block all numbers on the system. And then they try to send their phone numbers as words: "Oh, eight, three ..."'

Single-minded in their pursuit of truth in mathematics, the tutors quickly become adroit at steering stray threads of conversation back on track:

Speedy: Hay do you know any one that can help me wit relationships?

Dr Math: Unfortunately, Dr Math doesn't know anything about relationships except the relations between an x and a y on a graph – LOL

Speedy: Ok :-(thanks because i really need help but thanks anyway

Still, the conversations can get personal, very personal, says Laurie. To the extent that social-welfare organisations sometimes need to be consulted, as learners, ostensibly seeking help with math, seize the opportunity to confess and unburden.

Even when the off-topic chat is just idle banter, a sharp-eyed tutor can quickly sense where it's heading:

Dr Math: Hi. what's your nickname?

unknown_3@mxit.co.za: Sexy

Dr Math: No, I want a more appropriate nickname please ;-)

unknown_3@mxit.co.za: Creamy

Dr Math: Still pushing your luck :-(one more try

unknown_3@mxit.co.za: Beauty

Dr Math: OK, Beauty, that's better. I need to tell you that I
record these conversations, is that ok with you?

Beauty: Yes

Dr Math: So, Beauty, how's math class going?

Beauty: Nt gud

Such admissions only reinforce the need for Dr Math to be on call, in a society where more than 90 per cent of first-year university students lack the basic skills to cope with first-year mathematics.

That statistic, referenced in a study by Laurie, is weighed against a figure for cellphone usage by teenagers in South Africa: 97 per cent.

What Dr Math hopes to do, then, is use all that technology to tip the scales of learning. Is it working? It's a little difficult to say because the anonymity built into the system precludes the gathering of empirical evidence and the tracking of marks.

There are users who themselves have good news to report:

Lock: I passed math!

Dr Math: WONDERFUL! that's great

Lock: Lol well i knew i'd pass. mark isn't up to standard
but i'll live

Dr Math: Good

And there is also evidence to suggest that Dr Math has the power to change more than just hearts and minds.

Laurie tells the tale of a learner with the less than flattering handle of PIMP(*)STAR, who took part in a polynomial factoring competition during a Christmas school break.

After hours of intensive polynomial factoring – sample question: what are the factors of $x^2 - 7x - 44$, written in the form $.zx + 3x - 7$? – PIMP(*)STAR emerges as the new top-score winner.

In the afterglow of this victory, the user submits a ‘dot n’ command, or `.n`, to request a change of alias on the system. The new handle: Qun of maths, presumably meaning Queen of Maths.

Then, a little later, another change of name, and Qun of maths officially becomes smartyCAT. This, suggests Laurie, is an interesting example of the way mathematics can be used as ‘a tool for social upliftment’.

Laurie has also been struck, for all her initial concerns about possible impropriety, by the generally cordial and respectful tone of discourse on Dr Math.

‘Learners showed a real eagerness to engage in conversation with an adult,’ she concludes in a research study, based partly on her own experience as the advice-dispensing doc. ‘Despite the fact that we made a concerted effort not to reveal any personal data about the tutors, learners rightly assumed that the tutors were adults and treated us as such. Once we made it clear in the ground rules that we would not tolerate foul language and sexual content, most participants were extremely polite when dealing with us.’

A typical consultation on the Dr Math platform is short, sharp and to the point, with between five and ten back-and-forth rallies on the pathway from befuddlement to enlightenment. With each tutor multitasking on up to 30 individual

queries at a time, there is little room for lingering, small talk or going off at a tangent.

But it's a sign of the success of Dr Math that tutors report many requests for help with other tough school subjects, such as physics, science and accounting.

There seems to be no reason why the model of mobile learning on Mxit would not work equally well with those. Already, there are more advanced versions of Dr Math for university students – Mathlete and Professor Math – and the program has been translated into other South African languages.

In the guise of Dr LOLS (Life Orientation and Life Skills), the platform has also been used to help primary- and high-school learners cope with the challenges of growing up in a fast-changing society.

However, says Laurie, there are limits to what can be achieved. 'The technique would not work for any language-based courses, such as English, Afrikaans or Zulu. This is because of the abbreviated language used on Mxit and the terrible spelling employed.' Elsewhere in her Dr Math research, she is more diplomatic, referring to the spelling on the network as 'creative'. Either way, Mxit lingo, or 'Mxlish', can be a litmus test of tolerance and literacy for those who stand outside the social circle.

Try this: 'Hey! wud da circumference of a circle with a radius 2 b pie2? or if nt wt is da answer nd y'

Mxit lingo lives and breathes by the hacker's creed, which assumes that no system cannot be made more usable with the help of a little friendly splicing and rewiring.

Any twelve-year-old with opposable thumbs and a mobile should be able to parse that swiftly into formal adult English: ‘Excuse me. Would the circumference of a circle with a radius of 2 be pi 2? Or if not, what is the answer and why?’

To complicate the matter for formal adults, ‘wud’ is also a ubiquitous acronym on Mxit, typically used as a conversational opener: ‘What you doing?’ But here, the clue is in the context.

As the Canadian media theorist Marshall McLuhan put it, the medium is the message. The way we communicate is shaped by the tools we use to communicate, and on Mxit, the rapid thumbing of small keys to transmit data on a small screen can lead naturally to misspellings, compressions, acronyms, omissions and disemvowelings – typically rendered in lower case to bypass the tyranny of the shift key.

But it would be wrong to suggest that Mxit lingo is born simply out of a disrespect for convention. Rather, the language lives and breathes by the hacker’s creed, which assumes that no system cannot be made more usable with the help of a little friendly splicing and rewiring.

So Mxlish, with its modern roots in SMS-speak and IM-chat, holds the English language up to the light, sees through its quirks and inconsistencies, and gets down to work. Snip-snip.

Why use two consonants when one will do?

‘Borrow’ becomes ‘borow’ and ‘smaller’ becomes ‘smalr’.

Why use vowels when you can easily understand words without them?

‘Equation’ becomes ‘eqtn’ and ‘fine’ becomes ‘fn’.

Why use ambiguous spelling when phonetic spelling is so much clearer?

‘Addition’ becomes ‘adishun’ and ‘circle’ becomes ‘sircle’.

Why use letters at all, when numbers and symbols can be called on to do double duty?

'What' becomes 'w@' and 'between' becomes 'b2wn'.

The point is, Mxlish defines and applies a set of semantic principles that are just as rigid as those of the mother language, and with a bit of perseverance, even a math tutor two generations removed should be able to figure it out:

*i need help wit my mathz i can subtrct fwm 180 dgrez 4 da
anonymas anglz
wtz de difarenc b2wn de perimita nd de area?k nw dats de
1 dat i dnt undrstand plz explyn it in anothr wy plz*

But the roots of the lingo go back a lot further than the advent of the mobile phone. Courses for Emma Dearborn's Speed-writing, once considered an essential skill for journalists and secretaries, were advertised in the 1960s with the following tantalising phrase: 'f u cn rd ths, u cn gt a gd jb.'

The convention of 'da' or 'de' as a shortening for 'the' harks back to the *ye* of Middle English, a typographic quirk that signified the definite article and was always meant to be pronounced 'the'.

Likewise, for the puritanical speller of today, reading the fourteenth-century poet Chaucer can be a chore, as he spices his bawdy literature with words that cry out to be wavily underlined in red: *agast, blisful, bloody, contree, cotage, erly, fether, fyn, fyr, lyf, malencolye, merier, peple, resonable, sleping, smal, somtyme, therfor, vois, wyf, wyn, whyt, slayne, layd, woe begon*.

Somehow, we plough through, and somehow, we understand. But when the meaning of the message is crystallised in numbers, clarity must reign paramount.

There is a science to this, in the form of a model of information processing that seeks, once again, to strip the math in a

In everyday English, these stop words would be commonly recurring articles of speech such as ‘a’ and ‘the’. In Mxit lingo, the lexicon grows to include slang terms such as ‘howzit’, ‘sup’ and ‘aweh’ ...

conversation from the layers of chatter that surround it. It is a software system called the Mxit Understander, and it is designed to sift through questions from learners, casting aside what are known as ‘stop words’ to identify the math-

ematical topic as swiftly and clearly as possible.

In everyday English, these stop words would be commonly recurring articles of speech such as ‘a’ and ‘the’. In Mxit lingo, the lexicon grows to include slang terms such as ‘howzit’, ‘sup’ and ‘aweh’, as well as bursts of exclamation that have little apparent bearing on mathematics:

hahaha

mwaaa

aaarrggghhh

helooo

xoxoxo

The Mxit Understander slices through the layers as the questions come in, presenting the tutor with a neat package of hyperlinked keywords that make it easier for Dr Math to answer and explain.

The quest to hone in on relevant mathematical topics is made more difficult by the free-form spelling that is characteristic of

Mxit lingo, with variations such as 'arithmetic', 'quadraletic' and 'hypothenusa' testing the tutors to their limit.

But this is at heart a human system, engineered to accommodate people's desire to learn and know, from the child travelling home in a taxi, to the scholar scrawling notes at home, to the learner sitting under a tree in a rural village where there is no teacher to teach mathematics.

There is just a mobile phone, a signal shooting into the sky, and on the other side, an unseen figure waiting to show the way. Rat-tat-tat, tap-tap-tap. Dr Math, on Mxit.