Mathematical learning opportunities for young learners with touch screen technology

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I am certainly no 'technological fundi' and tend to have to pick up the phone or refer to LTM techno tips or math_fet@yahoo.com e-mails for guidance. I also tend not to get excited about technology company new releases of the latest computer or processing packages. However, when my husband came home with an i-phone and I was able to download a whole lot of maths games 'apps' (mostly for free) and both my children were able to play these with minimal adult supervision I suddenly began to understand the powerful learning tool that intuitive touch screen technology can provide.

From a mathematics educator and a parent perspective I now wanted to explore this technology myself and so I requested that my husband bring me an i-pad when returning from his overseas trip (rather than the usual chocolates, perfume or wallet). Having the i-pad suddenly took me from my usual 'lagging behind with technology' position to leapfrogging to cutting-edge technology. While my focus in this paper will be on my experience of mathematical learning opportunities with the i-pad, almost all of the 'apps' and learning opportunities that I refer to are also available on the i-phone. And of course as other touch screen phones and 'pads' become available so too will a range of new mathematical learning opportunities be available for those. One simply needs to explore these learning opportunities by typing into the search facility the keywords "mathematics" or "math games", "fun maths", "math challenges" and so on.

I have found the learning opportunities especially fantastic for young learners who have tended in the past to need relatively intensive adult supervision to work with computers and mathematics software. Not only are my four and six year-olds able to navigate the i-pad by themselves but **I too** have been able to do this without needing to ask someone which key combination to press ("Is it control F2? Shift F6?"). The intuitive touch screen nature of this tool makes it a truly stress-free and enjoyable experience. This contrasts my children's earlier experience of their kiddie 'learning computers' which tended to result in frustration when they couldn't figure out what they needed to do.

In particular I have enjoyed watching children's use of this touch screen technology to explore basic numeracy concepts. I have 'trialled' some of the games with a grade 0 class of learners and with a couple of Grade 1 and Grade 2 learners in a maths club as well as with my own 3 and 6 year old. On each occasion the i-pad was a big hit and not just because it was cool but because the games are educationally interactive and the touch screen made it easy for these young learners to make sense of what to do without adult instruction.

So what learning opportunities in the form of "apps" have I found particularly useful for mathematical learning? I include a range below:

Math number recognition and writing
There is an incredible range of apps relating to pre and early school number sense development (e.g. counting, recognising and writing numbers). Here learners as young as three can learn to draw the numbers following the touch screen prompts, they can play games that match numbers, they can count various objects shown to them and then select the correct number. The 123 counting is particularly lovely for preschool learners beginning to learn how to count as it shows them a collection of, for example, bears and if children touch the screen it will count with them. The 123 Colour HD is also a lovely app for early or preschoolers as they get to colour 3-dimensional objects (cubes, rectangular prisms etc.) by touch screen 'paint by number'. The colours are chosen in such a way that emphasizes the 3-dimensional view of the drawings. This is fantastic for both number and shape/object recognition and a lovely jingle plays once

the objects are coloured. From here one can move to basic addition and subtraction where applications show the objects being added or subtracted and so 5 apples – 3 apples is shown as 5 apples and then 5 apples with three of them being crossed out. My favourite app that explores very early number sense is called Kids Maths Ace.

Mathematically related games

Chinese checkers, master mind, chess, solitaire, one peg, noughts-and-crosses and various card games are (mostly) freely available and while one can play most of these games on a computer the packaging of these games as 'apps' simplifies the experience and makes the games available at the touch of an icon. Once again the ability to play these games on a touch screen has greatly enhanced my and the children's enjoyment of these games and has also meant that my four year old who struggles with using a mouse can play too.

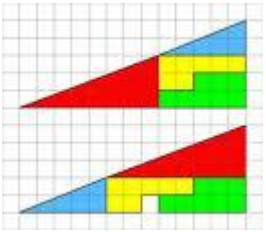
Spatial and number mathematics puzzles

There are numerous mathematical puzzles available which include spatial puzzles, moving through mazes and so forth. My favourite here is the 'traffic jam' equivalent called 'Crazy valet'. A range of cars and trucks are parked on a square grid and your job is to shift the cars backwards and forwards until you can get the yellow car out of the designated exit. This might sound simple but it can get much more challenging as one moves up the levels. I have the Think Toy version of this game at home and I must admit that since many of the cars have gone missing this electronic version which does not require careful packing up is a pleasure.

There are also many mathematical pattern applications that get learners to complete the pattern by dragging the correct numbers into the pattern, as well as some wonderful spatial patterns where learners must choose the next shape and the colour of that shape in the pattern. Also there are many mathematical puzzles and challenges that encourage out-the-box thinking (for all ages) or in some cases, as I found myself doing, investigating solutions by googling about the topic. The visual Sudoku available in the 'Little Games' app is another favourite of mine for young learners.

Math illusions

I have loved this app which has a range of well-known and some less well known illusions. Many of these appear to move as you watch them. My favourite however was this triangular 'missing square' puzzle that had me 'befuddled' for a while until I finally realised… (I don't want to give it away but the hint is in the fact that it is included as a mathematical **illusion**).



Same area?

Math jokes

I found some fun stuff here that was worthy of printing and putting up in a maths classroom. Some examples include: "The mobius strippers always show their backside' and the well-known "What do you say when you see an empty parrot cage? – 'Poly gone'. And when asked how he died? – 'Poly no meal'!

Mathemagic and Math fun facts

These apps show some wonderful 'tricks' for young learners where they challenge others to 'think of a number' and at the end of performing some operations on the numbers they can say what the number was. (Algebraic representation reveals the trick in each beautifully). The fun math facts reveal some of our favourite mathematical facts and patterns such as Pascal's triangle, multiplication by 11 and some Proofs

without words. What I love about the 'Proof without words' which we have often included in LTM is that they challenge learners to think more visually.

Math video clips

My favourite is the App 'Maths Snacks'. This includes a series of fun video clips about 5-8 minutes long each that unpack a mathematical concept such as ratio, scale factor and so on. I have been surprised at how my 6 year old daughter has been hooked on these despite my initial view that the maths would be beyond her. Her favourite is that of a teenage girl who goes on a series of dates and analyses the ratio of her words spoken to those of each of her dates. It is well done and pretty entertaining.

Math drills

There are of course a range of apps dealing with math drills, multiplication tables and so on. Here one gets pretty standard maths questions (you get to select from addition and subtraction, multiplication or division or mixed and at various levels). There are many such drills freely available e.g. Math Drills Lite and Pop Math Lite. The 'Lite' versions means that after a certain amount of playing you will be asked if you would like to purchase a version with many more problems. While this is drill type Math there is something about the touch screen that seems to draw learners in. I trialled the Pop Math Lite with some Grade 1 and 2 learners – this game involves learners popping six pairs of bubbles that float around the screen by matching the question bubbles with the correct answer bubbles – and they were clearly excited by the game.

Math tools

One can also freely download some useful tools such as a scientific calculator, graphical calculator, compass, clinometer, 3-dimensional graph generators and fantastic fractal generators (and beautiful fractal pictures that grow and change colour as you watch them). My Grade 11 nephew took my i-pad to school to show a range of 3 dimensional graphs and fractals to his class. His teacher told me that the learners were completely intrigued. For these tools, simply type the name into the search box and you will be able to choose from a range of apps.

In conclusion

It has been difficult to finish this article because every time I have left it for a few days more interesting applications have emerged and I have felt compelled to include them. The learning resources out there are changing all the time. The introduction of new Apps is exponential and existing Apps are constantly being upgraded and improved. Thus, by the time you read this article there might be many more even better mathematical learning Apps out there. My hope however is that I have shared with you the potential of this new touch screen technology in terms of providing new mathematical learning opportunities. While I have found many incredible mathematical opportunities on the world wide web – (see www.mangahigh.com; www.mathsisfun.com; www.sumdog.com) – what I have found particularly wonderful about this touch screen technology learning is the opportunity for young learners (3-10 yrs) to explore without the need for adult support and intervention.

While I am fully aware that the i-pad (and other similar touch screen pads that are about to be released) are not currently widely available for teachers, I do believe this type of touch screen technology will continue to revolutionise the education world and will be in our future. In addition almost all of what I have reviewed above is available on the i-phone and similarly I have no doubt that other touch screen phones will have similar downloadable mathematical learning apps that simply require some intentional exploration.