

BBC raw numbers

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BBC raw numbers is a new online informal learning resource aimed at inspiring and supporting adults to increase their confidence and fluency with numbers. The resources are aimed at adults who are not and may never be in formal education – the focus is on enriching everyday life rather than achieving a qualification, and on users' personal interests and points of need in their everyday lives rather than a curriculum framework. The resources are planned to launch on bbc.co.uk/raw/numbers in Autumn 2009. This hands-on workshop is focused on some of the resources for mobile phones being developed for raw numbers, in particular tools for creating and sharing solutions to everyday numerical problems, and for creating and sharing simple mathematical games. For part of the session we will follow the pattern of a recent workshop carried out with bus-drivers at Holloway bus garage in north London to make mathematical games for passengers to play on their phones during the journey.

Introduction

This workshop was aimed at demonstrating some of the resources in development for BBC raw numbers and inviting feedback from participants.

The resources were work-in-progress at the time of the session – so this paper is essentially a snapshot of a process of developing numeracy resources for mobile phones, with the caveat that mobile phone technology is rapidly evolving so some of the technical platforms and processes mentioned are likely to be outdated soon.

After an initial presentation of the background to the project and its pedagogical basis, the session consisted of two parts:

- an introduction to and demo of the prototype mobile phone tools and video-clips in development, beamed via a Bluetooth transmitter to participants' mobile phones
- a review of a pilot project conducted in collaboration with the union learning representatives and the Learning Centre at Holloway bus garage in North London, in which bus drivers built mathematical maze games for mobile phones which were then broadcast via a Bluetooth transmitter on the bus to passengers to play on the journey.

Background and pedagogical basis of raw numbers resources

The BBC's online adult numeracy offering currently consists of two websites, Skillswise: <http://bbc.co.uk/skillswise/numbers> aimed at tutors in formal education, and raw: <http://bbc.co.uk/raw/numbers/> aimed at independent adult learners outside formal education.

Raw numbers is a two-year project aimed at producing online resources for the estimated 7 million UK adults with numeracy levels below those expected of an 11-year old, who are not and may never be in formal education, to inspire and support them to increase their confidence and fluency with numbers.

Research evidence from the NRDC and others indicates that this target audience often has had negative experiences with school maths lessons and formal education in general and is reluctant to enroll in a formal structured maths course, in particular any course involving tests, which have associations with failure and low self-esteem at school.

This suggested an informal, non-curricular approach. We therefore conducted audience research into when this audience came across any use for numeracy skills in their everyday lives and their strategies in these situations through gathering numeracy 'diaries' of a sample group:

The figure shows two pages of a spiral-bound notebook with handwritten entries. Each page has four sections with labels: 'Date: [handwritten]', 'Time: [handwritten]', 'Location: [handwritten]', 'What happened?', 'How did you feel?', and 'How did you deal with it?'. The left page entry is dated 26th February 2009, 9:00 pm, at a cafe, about a 10% tip. The right page entry is dated 6-3-09, 4 AM, at home, about a son's math homework.

Fig. 1 Example diary entries

The audience research highlighted eight broad types of situation where users identified a need for or interest in using numbers:

Calculating a discount

Percentages seem to be encountered most when people are out shopping during the day. Basic percentages are better understood (50% understood as half, 10% understood as losing a nought, or £1 in £10). More complex percentages are extrapolated or guessed from these. However, some people do not work out discounts at all, and instead simply decide whether the initial price is reasonable. The discount then makes the item more attractive.

Converting currency

On holiday or at the airport, people use guesswork, special conversion rate cards, or ask currency exchange staff to indicate approximate equivalence between British and foreign currency denominations. However, some simply accept that their holiday is going to be very expensive, and ignore the issue of conversion entirely.

Helping children with homework

At home, in the evening, parents of school-age children sometimes find themselves asked to help with maths homework. At the moment, parents will ask each other for support (calling friends), or use trial and error to try to get the right answer. For many, the thought that their children's maths needs may soon surpass their ability to help is key in bringing innumeracy forward in their minds.

Working out a tip, splitting a bill

After an evening in a restaurant or pub, many people pass the buck, and hope someone else will do the maths for them. Others hazard a guess, or (rather than split the bill as such) each put a banknote in a pot as a crude approximation. The remainder is left as the tip.

Converting weights and measures

People may find themselves in situations where they need to convert metric measures into more familiar imperial measurements, perhaps when being weighed as part of a doctor's appointment, or during the day at work. Some guess conversions, or very crudely approximate based on what they know from other elements of their lives. Others are left confused.

Adding up shopping

In supermarkets, perhaps mid-morning or at the weekend, budget-conscious shoppers sometimes use phone calculators or very crude approximation to establish how much their shopping costs before reaching the checkout. However, others take a different approach, ordering their basket so the most important items are paid for first, and anything that they cannot afford can be put back on the shelves.

Work related tasks

Many people have to deal with numbers as part of their working day. Even non office-based jobs can involve quite specific mathematical operations. Recent research came across gardeners calculating the dilution of concentrated weedkiller, and builders establishing quantities of concrete to be poured into holes. Currently, those engaged with these kinds of tasks learn by the example of others, use trial and error, or ask for help from a more experienced colleague.

Personal finance

When seeing a mortgage advisor at the weekend, or looking online for a loan in the evening, people come across not just unfamiliar terminology, but numbers. These might be interest rates, payment periods, or specific amounts. Understanding these is predicated on an element of numeracy. At the moment, less numerate people have to rely entirely on professionals to

inform and even make decisions for them – putting their financial matters in someone else’s hands.”

Pedagogically, research pointed to the importance of flexible visual-concrete models of number, sometimes known as ‘manipulatives’, which can be physically manipulated as an aid to thinking and communicating ideas. Two of the most flexible models are the number line (eg jumps showing addition), and the rectangular array of unit squares (eg for multiplication).

There was also evidence of the importance of dialogue in constructing and reconstructing thoughts and internal conceptual models.

Research into the use of tools as ‘boundary objects’ which facilitate communication also suggested that visual models might be useful in stimulating dialogue and learning.

From a technical platform perspective, surveys showed that this audience had a relatively low level of internet usage and preferred using mobile phones to desktop computers.

We therefore decided to focus on creating simple visual models of number which could be manipulated on mobile phones to solve the eight broad types of situation requiring number skills commonly encountered in everyday life.

The mobile phone tools: user-centred design process

We developed prototypes in Flashlite (a simplified version of ‘Flash’ animation package for mobiles): versions of a grid of blocks that could be incremented or decremented in rows and columns, and a number line that could be jumped along.

It quickly became apparent from user-testing that usability on a small mobile phone screen was a key issue – in particular multiple jumps on the number line quickly became a jumble of lines and numbers so we restricted the tool to a single jump visible at any one time. To express percentage increases and decreases we added a second parallel number line, so there was one line for the price and another for the percent. The mobile screen also tended to be ‘portrait’ on most phones so we made the number line vertical rather than horizontal:

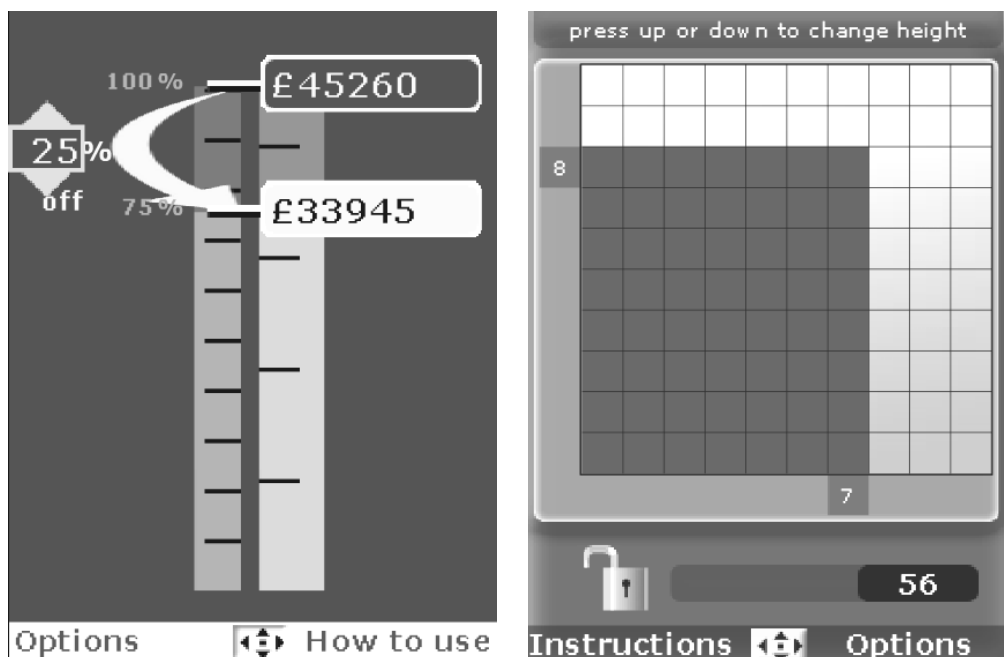


Fig. 2: Flashlite prototypes from <http://www.bbc.co.uk/mobile/learning/raw/numbers/>

These prototypes were then trialled with a sample audience who again kept diaries of how they used the tools in situations involving numbers in everyday life.

Example quotes from user testing prototype tools

Participant 1, male, London:

“I mean, I think even from my calculator - I found it easier to use than my calculator would be.

Because times when I’m supposed to calculate a percentage I don’t know which one is to multiply what, and divide... and I think it’s a lot easier for me to find out which is a plus or a minus, because before the 50% up or 50% back I know if it’s positive or negative...

It’s very visual and I can relate to it directly without worrying about. I think I prefer it anyway that way because I can see what I’m doubling with, rather than trying to ask the calculator - why? As a matter of fact if I was doing percentages I would probably ask the [calculator] again, if it were possible, ‘Are you sure you got it right?’, because it always goes like gives point zero nine, brr.. “

Participant 2, male, London:

“Argos. £129 wardrobe, 20% off, found it very useful, instant results and very handy.

The other one was the times table one I was mucking about with my daughter, play a little quiz with her.

[So you were doing the quiz?]

Yeah – hide the answer!

And for the restaurant worked out the tip with it – just for the sake of this I give him a tip..

Yeah, it was just fun with the kids. Just from being, the point of view where I’m not very confident with maths, it’s nice to look like I know what I’m doing.

[So the kids were involved with it as well?]

Yeah definitely. Well my daughter was, you know. But it’s fun to sit there you know, and obviously as time goes on the kids could play with it you know, and the times tables on it.. And its fun to watch the little boxes and how far up it’ll go and.. Well I enjoyed myself anyway.

It gives you a moment, that, you know, you probably never would have sat there doing times tables.”

In addition we showed video-clips at the session which we were shooting designed to bring to life situations when number skills were used by people who encountered similar situations to those identified by the respondents, e.g. an apprentice chef weighing out ingredients, shoppers calculating discounts. For examples of these videos please see the raw numbers preview website: <http://bbc.co.uk/raw/numbers> (NB some clips are restricted to UK-only access).

Bluetooth bus project in collaboration with Holloway bus garage in North London

This project was a collaboration with the BBC Learning Development team for the BBC To Go project, a two week trial to put stories and games on a Bluetooth hub on the number 4 bus, so that passengers who turned on Bluetooth on their mobile phones could download video and audio stories and mathematical games.

The mathematical games were created by bus drivers during a session at the learning Centre at Holloway bus garage, facilitated by the union learning representatives.

Below is a step-by-step overview of the project demonstrated at the session.



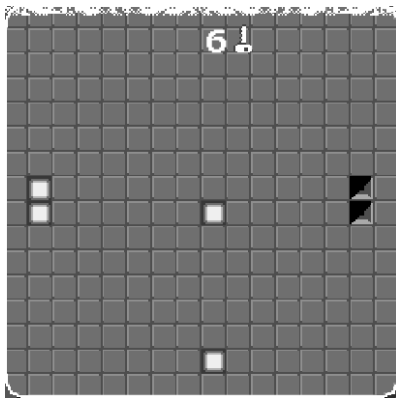
1. The BBC sets up the project with the bus company and the drivers' unions, working with union learning representatives at the learning centre in Holloway bus garage, the biggest bus garage in Western Europe.



2. Four drivers volunteer to create game levels – mathematical ‘mazes’ - on paper and on computers during a lunch-break session at the learning centre. Several say they are motivated by the idea of playing the games with their children or grandchildren.



3. Finally drivers choose a favourite landmark from photos taken along the route for the end screen, and have their own picture taken for the intro screen.



4. The BBC programs the games in Flash lite 1, a version of Flash, so they can be downloaded as standalone files and played on any mobile phone handsets with Flash lite installed. To see the final landmark picture, the player has to navigate the maze created by the driver by adding, subtracting, doubling or halving the blocks to make them the right size.



5. Technicians at the garage install a small Bluetooth hub, about the size of a lunch box, in the space under the stairs on three Number 4 buses, and connect it to the bus power supply. This

hub can then automatically beam games and video-clips to any passengers on the bus who have switched on Bluetooth on their mobile phones.



6. Posters on the buses inform passengers about the project and encourage them to switch on Bluetooth on their mobile phones. The trial is set to run for 2 weeks in April 2009



7. If they have turned on Bluetooth on their phone, passengers receive a message from the hub every 2-3 minutes during their journey offering a free game or video-clip for them to download and play.



8. If passengers complete the game successfully, they see the picture chosen by the driver who made the game, identifying a favourite landmark the passenger might see from the window. At the end of the trial the Bluetooth hubs are taken out of the buses and the usage data analysed. Future trials are planned with similar Bluetooth hubs in schools.

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