

## **Accreditation not Aggravation**

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### **Abstract**

This paper describes an action research project that investigated a range of activities to improve learners' mathematical communication skills. It also gives details of a subsequent case study that illustrates how technology can provide a means of overcoming some of the difficulties learners and tutors face in communicating about numeracy, while developing confidence and enhancing skills in a rapidly changing learning environment.

Key words: accreditation, communication, confidence, evidence, and technology

### **Background**

For many, especially older, adult learners, the experience of mathematics is that of rote learning and being asked to complete pages of 'sums' independently of one another. In recent years the shift in accreditation of numeracy skills towards communicating ideas and meaning has been an awkward one for both learners and assessors and Chinn suggests that 'problems and confusions are both with the vocabulary of maths and with the language (semantics) of maths' and that difficulties are a 'consequence of the way word problems are written and constructed' (Chinn, 2012).

Improving communication skills within the context of, and with specific application to, numeracy is a key part of adult numeracy learning and tutors of adult learners are faced with the challenge of providing evidence of learners' descriptions and explanations of mathematical processes and outcomes for accreditation or other purposes. This paper describes an action research project that investigated a range of activities to improve learners' mathematical communication skills. It also gives details of a subsequent case study that illustrates how technology can provide a means of overcoming some of the difficulties learners and tutors face in communicating about numeracy, while developing confidence and enhancing skills in a rapidly changing learning environment.

## Action Research

Learners within Monmouthshire Adult & Community Education took part in an action research project between October 2012 and February 2013. The purpose of the project was to investigate ways of developing the communication skills of adult numeracy learners, with specific relevance to fulfilling the Essential Skills Wales (ESW) qualification requirements at Level 1 and 2 of ‘describing a practical problem or task’ and ‘describing and explaining the results of calculations’.

At the start of the action research, learners from two small adult numeracy classes assessed their own confidence in four key communication skills: identifying facts and ideas; choosing appropriate vocabulary; verbal presentation skills and writing skills. A range of interventions was trialled over a three-month period. These included: peer review of work completed by previous learners; use of writing scaffolding sheets and mini practice tasks. The learners as a group and, following the trial then discussed the interventions; they were required to repeat a self-assessment of confidence in these skill areas. (Fig. 1 shows an example of the results collated from the skill ‘choosing appropriate vocabulary’)

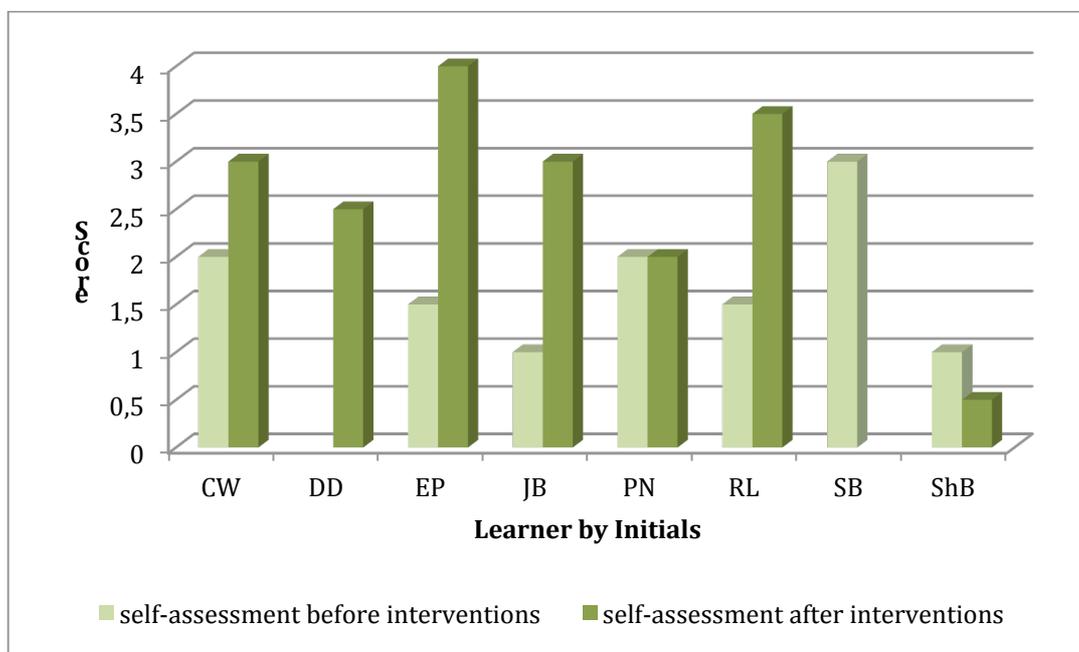


Figure 1. Finding words to describe what I mean.

Although the results of the action research showed that the interventions had developed communication skills overall, it was noted that it would be beneficial to investigate alternative methods of supporting and developing skills, which may be particularly important to learners with specific learning difficulties such as dyslexia.

Following the action research project and through discussion it became apparent that one form of intervention that had not already been explored was the use of technology. Although learners in both of the classes involved in the research have regular access to computers and word processing software and use these when writing about mathematics, the process of typing a word processed document is much the same as hand-writing onto a page with no inherent support for the organisation of the writing.

The availability of Apple iPads for use within numeracy classes in Monmouthshire Adult & Community Education led to the discovery of the application ‘Story Creator’, an education tool that allows iPad users to create simple e-books using video, photos, text and audio.

## Accreditation

The question that could be asked by both teachers and learners is why, when learners are being assessed for their numeracy/mathematics skills, are they being asked to provide explanations of their choice of methods and results? The reason for this requirement is that in real life, mathematical thinking and processes do not begin and end with manipulation of numbers (Ball, 2007; Schoenfeld, 1992). If learners are to apply their learning then they need to be able to consider how they are going to address problems, where they will find the data necessary to solve problems, which computational methods should be employed and how to evaluate obtained results. If accreditation is to reflect a learner’s ability to use mathematics purposefully then this whole process needs to be assessed.

While computational expertise can be easily evidenced without the need for any words, explanations and evaluations often need to be verbalised. Assessment of these skills may take place in the classroom during discussions or by integration within other projects or activities but evidence that the learner has achieved these skills needs to be recorded in some way to ensure the rigour of outcomes. Traditionally the learner providing written accounts, accompanied by documentation of teacher assessment, records explanations and evaluations; however, the exclusive use of this method of evidence needs to be challenged with regard to its validity (Scottish Qualifications Authority, 2009). This is particularly so where the learners have little or no literacy, even though their cognitive skills mean that they are able to use numbers within everyday applications and may be developing appropriate evaluative skills. We need to make clear distinctions between assessment of skills and means of providing evidence.

Unless awarding organisations specify an assessment method it is up to the teacher/assessor to select how that is to be achieved. Internal quality processes need to be in place to ensure that the method chosen meets the usual assessment requirements of reliability, authenticity, validity etc. Where learners have literacy difficulties, it could be argued that the validity of the assessment may be compromised if learners are asked to record their ideas in writing. Are we assessing the learner’s ability to write or their ability to evaluate?

Endeavouring to minimise assessment issues which arise as a result of a learner’s ability (or inability) to write does not mean that communication skills should not be addressed in our mathematical teaching. This project does not aim to put writing skills to one side but to look at how the development of communication skills can be embedded within mathematical teaching.

In this project the accreditation chosen was a credit-based qualification (Agored Cymru, 2013). This type of qualification enables learners to target specific skills determined by their personal, academic and vocational needs and allows them to combine units of communication, maths and ICT within a qualification. Even though the units chosen address specific skills, these skills are not taught or used in isolation. In this instance the focus of the unit was on measure but it also required the learner to use the four rules of number, ratios, estimation, 3D shapes, knowledge and use of mathematical language, problem solving and interpreting the results of calculations. In addition to this the learners were developing their communication and ICT skills.

## The Learners

The 'Story Creator' application was used with a group of three adult learners. Two of the learners, both female, had progressed to the class having previously attended local Family Learning provision and the third was a new learner, male, wishing to work towards achieving a level two numeracy qualification in order to access further education. All three learners were assessed as currently working at level one of the Essential Skills Wales standards (*Essential Skills Wales*, 2009). Both female learners had engaged in Family Learning as a means of improving their own skills whilst also being able to support their children. It was acknowledged early in the course that all three had recollections of negative mathematical experiences in school but that, for the two women, the Family Learning class had provided an opportunity to begin to change their perceptions of, and build confidence in, their own mathematical abilities.

Since this class commenced quite late in the academic year, it was considered more appropriate to offer a short numeracy course using Agored Cymru accreditation. This gave the learners the opportunity to demonstrate the skills required for measure within the context of a garden design project. The specific assessment criteria include 'outline problems to be tackled' and 'present and explain the results of calculations using measurements' giving the learners an opportunity to use their numeracy communication skills.

## Issues surrounding the use of mobile technology for evidencing the assessment of skills

Whilst the education centre used for the study was in the fortunate position of having the use of iPads within the classroom, it did not have access to Wi-Fi which meant that learners were not able to download the graphics which could have further enhanced the presentation of their work. In this instance the problem was overcome by the learners taking photographs or drawing. In effect they were creating their own graphics.

Not all learners initially embraced the use of iPads, which were seen as another barrier to overcome within the learning process. The benefits of keeping up with new learning and leisure tools, particularly for those with children, were explored with the learners. Any anxieties were soon overcome as they became more adept with their iPads.

The experience of the teacher in using mobile technology was also a limiting factor. Story Creator may not be the most appropriate application and the time to trial others would be beneficial. For example, it would be desirable to use an application which included graphical backgrounds to facilitate multiplication using the lattice method or to aid the drawing of 3d shapes. In this instance, complex calculations were carried out on paper and photographed for inclusion in the Story Creator work. This was not ideal but did demonstrate the learners' problem-solving skills in overcoming the issue. (The original paper based calculations were then submitted for accreditation alongside the e-portfolios.)

Maintaining copies of learners' work also created a challenge, especially with no immediate Wi-Fi access. This was easily overcome by the tutor using standard internet storage devices once the lesson was complete. Another possible solution would be to use a tablet device that allows the attachment of USB storage devices.

## Outcomes

Apple iPads with the Story Creator application were available for the class to use in the eighth session of a ten-week course and learners created e-books to record evidence of how they had calculated the cost of soil to fill their plant tubs and how much water they needed in order to fill a circular pond. Learners studied the mathematical skills required to complete the garden design task in the preceding weeks and, during these sessions, evidence for assessment criteria concerning computational skills was collected using non-ICT based methods and presented in a traditional paper based portfolio.

The learners had no experience with the application before the session and after an initial reluctance to try it, possibly caused by a lack of confidence in using new technology, they engaged with this method of learning and collecting evidence quickly and fully. Learners expressed a strong desire to complete their e-books regardless of how much additional time it would take outside of the usual session duration.

An unexpected outcome of using the e-books as a means of recording evidence was the way in which it supported learners to organise their thoughts and calculations. Since there is a limited amount of text space available (a maximum of one line), and only one photograph or diagram per page, learners were encouraged to consider the order in which they tackle the stages of a practical numerical problem. All three learners, one of whom has been formally assessed as having dyslexia, were able to organise their e-evidence in such a way as to introduce the problem, explain the information to be collected and used, describe the calculations step-by-step and both describe and explained their results. This was in contrast to the results of the action research project, where several learners still had immense difficulty organising their numerical problems even after the interventions. Additional research using this or a similar application is needed in order to test this hypothesis. This would be of particular value to learners for whom organisation of ideas is a problem.

One of the original aims of using a multi-media storybook was to alleviate anxiety around writing down ideas and to encourage learners to make audio recordings as an alternative. In fact, all three learners refused to use the audio recording tool, feeling too self-conscious to do so and preferring to revert to writing. However the quality of the text produced was high and the structure of the e-book, allowing only one line of typed text per page, meant that learners were required to focus on the main topic of each stage of the calculation and to express this succinctly.

With the restriction in the amount of text allowed, learners were keen to fill each page with visual evidence to support their text. They did this by using photographs taken during the session and simple drawings (not to scale), which were labelled to show the measurements they needed and had taken. The photographs included learners taking measurements, showing measurements on measuring instruments, screen shots of web information, idea boards from group discussions and shots of written calculations. The combination of visual and text based evidence appeared to give the learners confidence in what they were describing and explaining.

During the final session the e-evidence books were shared with the rest of the class and learners were given an opportunity to discuss their experiences using the iPads as a tool within the classroom. All agreed that it had been a more fun way of producing evidence than simply writing on paper and that they had enjoyed the task more because of the availability of mobile technology and its multi-media approach. The global consensus was a sense of pride in the style, quality and completeness of what had been achieved in such a small space of time and a sense of excitement at the possibilities of using the tool again in learning and exploring its uses in other settings.

Since the main aim of the e- books is to provide an alternate method of presenting evidence for accreditation, it has been imperative that the e-evidence created by the learners undergo standard Agored Cymru quality processes (Agored Cymru - Quality Assurance). Reactions from internal quality assessors have been mixed – in fact there appeared to be some reluctance to internally verify

the assessment of this work. This was at odds with the excitement shown by the learners, and teacher, at the opportunity to explore and use new technology. The lack of traditional paper evidence appeared to unnerve some internal verifiers although once they were shown how to access the e-evidence they were reassured that the learners had indeed fulfilled all the criteria.

The question of authenticity arose since it could not be proven purely from the e-evidence that it was the learner's own work. It can be argued that this is the same for traditional paper based portfolios of evidence. Internal quality processes need to be in place to ensure that authenticity can be guaranteed whichever form of evidence is used. In fact, the e-book provides very personalised evidence of mathematical task organisation, implementation and evaluation. The use of photographs of written calculations meant that some assessors found it difficult to read, and therefore check, the calculations; however these could be validated by comparison with the accompanying paper based calculations.

## Conclusion

Overall the experience of using mobile technology to record and present evidence has been a very positive one for the learners in terms of enjoyment of learning and development of organisation, communication and numeracy skills. In addition, it demonstrates that evidence-gathering methodology need not impede the assessment process and this innovative approach removed the often perceived toil of portfolio building. There are still issues that need to be addressed; most notably the engagement of those internally verifying the assessment process and it is considered that they would benefit from observing the use of such technology within the classroom in order to fulfil the complete quality assurance process and to build their own confidence in alternative methods of evidencing skills.

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