Numeracy matters: a case study in online assessment and feedback

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Patrick Saintas is a Principal Lecturer in the School of Nursing & Midwifery at the University of Brighton. He has been working with mature students in Nursing and Midwifery, assisting them in overcoming maths anxiety and developing their number skills through a range of pedagogical approaches. These approaches are based on evidence from literature findings and contemporary reports from the National Research and Development Centre for adult literacy and numeracy (NRDC).

Introduction

This case study outlines the process and outcome of the development of an e-learning package of resources. This integrated package includes online assessment, feedback and tutorial. It is aimed primarily at facilitating the acquisition of number skills by National Qualifications Framework (NQF) level 3 students prior to applying for professional training and education in health and social care. It can be accessed by practitioners logged in to The Open University’s Labspace. These resources can be adapted by teachers or used directly by students who need understanding of the metric system, practice in converting one unit of measurement to another, and opportunities to develop confidence in working with fractions and decimals.

The objectives of the project were:
- to develop an existing e-learning package so that it may be offered to learners and tutors as an online resource via the SLN website learner and practitioner network areas
- to set up a small number of pilot groups in a range of settings (including work-based learning, college-based learning, and adult and community groups) to evaluate the effectiveness of the e-learning package

Rationale

The technological changes and the range of drugs available in today’s health care systems have led to a situation where, for example, the mathematical skills required by nurses and midwives are more complex and critical (Weeks et al, 2000). This is underpinned by the Nursing and Midwifery Council’s stipulation that all student nurses should be competent in mathematical calculation skills for clinical Nursing Practice at the point of registration (NMC 2002, 2007). Surprisingly, there is no minimum level set by the NMC for maths as an entry requirement for nurse training. It does not believe that certified learning such as GCSE or equivalents guarantees an ability to manipulate numbers (Wallis, 2008).

Individual universities can set their own requirements for maths, although it has been argued that such a requirement might exclude some potentially competent trainees (Hutton, 1998). In a review of the issues surrounding nurses’ ability to undertake mathematical calculation, Hall (2005) referred to her previous unpublished thesis and insinuated that the problem may have multiple causative factors including the learner’s past experiences of the subject and societal issues such as gender. Interestingly, she highlighted the point that formal qualifications in mathematics do not reliably indicate whether learners will find numeracy in nursing difficult or easy, or be able to complete specific assessments.

Contemporary nursing literature (Wright 2008, Hall 2005, Thomas 2004 and Wilson 2003) and the media (BBC report, 2000) have alluded to the risks of potentially fatal mistakes being made by nurses due to a deficiency in mathematical ability. Consequently, prospective candidates for the Diploma in Nursing course at the University of Brighton and other higher education institutions are being asked to undertake a maths test as part of the selection process to enter the nurse education programme, irrespective of their pre-entry qualification. Empirical data from these tests appear to support the point made by Hall (2005) that a number of prospective candidates with GCSE or equivalents in maths were experiencing difficulties with these tests. The contents of the e-learning package developed so far appear to address the areas which these candidates find difficult.

Methodology
The first phase of the project involved contacting a number of institutions and agencies delivering work-based adult and community learning at level 3 to identify their interest in using the resources, particularly with learners planning on applying for professional training at level 4. The Workers’ Educational Association (WEA) and one Further Education College (FEC) delivering Access to Higher Education with a pathway in Nursing and Midwifery were contacted and only the FEC responded indicating interest.

I developed some online learning materials while studying on the postgraduate Certificate in e-Learning Design within the Virtual Learning Environment (VLE) of ‘Moodle’. I was able to transfer some resources from the University of Sussex’s Interactive Learning Environment to Labspace (another VLE) and made these accessible, while I continued the development of online diagnostic tests with immediate feedback using the quiz functionalities available within the ‘Moodle’ environment. These can be accessed at labspace.open.ac.uk/PUB_6_1.0.

‘Moodle’ is a Course Management System (CMS), a web-based application which provides educators with tools to create a course website and provides access control so that the site can normally only be viewed by enrolled students. This CMS provides both educators and learners with a range of tools to make a course/module more effective. It is a resource for uploading and sharing materials, holding online discussions and chats, conducting quizzes and surveys, gathering and reviewing assignments and recording grades (Cole, 2005).

The resources were presented to practitioners at one of the SLN e-learning events at the Creativity Centre at the University of Brighton. As no participant was forthcoming from either the WEA or the FE colleges, I decided to design an evaluation package using the templates already available within Labspace. This enabled me to evaluate the diagnostic tests with feedback from new nursing students (May 2008 cohort) who had chosen to attend optional tutorials in number skills, following a diagnostic pre-test (also designed in a VLE).

In total, 46 students from the May 2008 cohort used and evaluated the package. There were 40 students from Brighton and Worthing and five students from Eastbourne. The number skills evaluation was completed by 31 students.

Apart from the May 2008 student cohort, the site has also been accessed by other nursing students who have found the online resources valuable in addressing their fear of maths. They also shared their experiences on the wiki designed as part of this package on Labspace.

Outcomes

In spite of not being able to evaluate this package with adult learners from the WEA and FE sector, I was able to undertake the evaluation indirectly with another group of students who have similar characteristics to the initially intended participants. A number of our students have to undertake some diagnostic tests followed by a number of tutorials in the first six weeks of study. This uses a blended approach to facilitate the development of number skills needed for the safe administration of medicine to clients. These students have to demonstrate competence in number skills by successfully undertaking a summative assessment by the end of the first year of the programme as part of the requirements of the Nursing and Midwifery Council (NMC).

The notion of this impending assessment has, in some circumstances, led to unnecessary stress and anxiety in a number of these students. This is mainly due to the fact that nurse education access programmes may have a wide entry gate and attract a number of mature entrants. Many of these have significant problems with manipulating decimal points and converting from one unit of measurement to another. This is often exacerbated by maths anxiety, normally linked to their previous experience of learning maths.

Research undertaken by the National Research and Development Centre for Adult Literacy and Numeracy (NRDC, 2005) has shown that a number of adults have a real fear of maths or a sense of defeat, following bad experiences at school. It is important to note that fear of maths is only one of the underlying issues which adult learners may have with number skills. Weeks et al (2000) have
categorised the nature of the drugs calculation errors as being conceptual, arithmetical and computational.

The quiz used by the Institute of Nursing and Midwifery in the recruitment and selection process contains calculations involving the manipulation of decimal points and demands skills in converting from one unit of measurement to another. These diagnostic tests and the resources available within Labspace have been designed to facilitate the acquisition of these skills. Results obtained from the recruitment and selection tests so far seem to indicate that some of the prospective entrants have similar difficulties; therefore using the new students for the evaluation is valid.

The Moodle’s functionalities, such as the ability to use an online journal for self-reflection and wikis for sharing experiences, have been used as an attempt to make maths in nursing interesting and to address the maths anxiety theme. Students can work through the topic and subtopics at their own pace and are provided with a number of online resources and tutorials. They are able to access the package as many times as they wish, away from the campus and from the threat of having to expose their skills deficiency amongst their peers. The importance of practice in maintaining numerical efficiency has been highlighted by Wilson (2003) and Alessi and Trollip (2001). Comments received within the evaluation and the wiki available on the site appear to support the points made above. The following is a small section of quotes offered by the students:

“The try and try again aspect of the test was very encouraging to a maths failure like me!!!”

“Maths is not my strongest point - using these helpful tests makes me feel a lot better “

“I needed to acquire the skills to divide and multiply and where to move the decimal point...this programme has helped to achieve this.”

“Practice makes perfect”

“Maths is a huge barrier for me. My fear comes from school, when my two maths teachers used to get us to stand up in front of the class and say our times tables. I was very nervous about it anyway, but when I got it wrong the class would laugh and the teachers did nothing to discourage them. …I get very frustrated if I don't understand how it works and I can feel my anxiety levels going through the roof, but I'm determined enough not to let it beat me. So doing the review assessment online is great for me. I can do it when no one is around, at my own pace. I found nursing calculations by Gatford and Phillips to be a great help also.”

On a personal note, it was quite pleasing to have confirmation that using evidence-based guidelines to underpin the design and implementation of any learning is crucial. It is important to note that it is ‘not the delivery media that enables learning’ but how any given delivery technology supports human learning processes (Clark, 2007). The number skills package development within Labspace has been influenced by an eclectic approach, using aspects of behaviourist, cognitivist and constructivist frameworks derived from Alessi & Trollip (2001) on instructional design, Mayer’s (2001) dual coding principle (using both visual and auditory material simultaneously to facilitate learning), and Jonassen’s (1991) three stages model of knowledge acquisition.

The use of the wiki was intended to facilitate collaborative learning as a major component of the constructivist approaches on the Labspace site. The materials from the wiki were intended to be used at an individual or group level (negotiated learning) to address the issues of maths anxiety where relevant. The importance of immediate feedback and its influence on learning has been commented upon by Gibbs and Simpson (2002) and is an integral and crucial component of this package. The following selected comments from participants illustrate the features which have just been addressed:

“Despite initial anxieties, under Patrick’s excellent tuition I am starting to develop an addiction to the thrill of seeing ‘CORRECT’ appearing on the screen! It’s the little boosts that give you the confidence to flex those mental muscles and apply cold hard reasoning to what, before today, was a daunting prospect “
“I really liked the fact that if you got a question wrong once, it would show you how to work it out and give you another chance.”

“I used to be good at maths in school, haven’t used my skills for over 20 years and I have only just started using a computer and it’s the fear of the unknown which panics me. If I write on paper and go through it slowly I can get there eventually. I do like that you can check your answers straight away as it builds my confidence as I work through the test…”

Further quantitative data about the package can be accessed through the number skills evaluation topic on Labspace.

Further work

Number skills materials are already being used by other practitioners within Labspace. However, one has to be cautious that packages are not being copied and given a new version number without indicating that this has been done. This is confusing to users and also gives no credit to the initial developer.

An interactive multimedia tutorial using Flash has already been developed and implemented within the conversion topic on Labspace in conjunction with a graphic designer from East Sussex Design. Teamwork is important in designing and implementing online learning materials, as one facilitator may not have all the skills necessary to produce and upload learning materials of significant quality. Apart from the research funding granted by the SLN which has enabled the involvement of a graphic designer in the development and implementation of the tutorial, I was fortunate enough to be supported by Jenny Gray from The Open University in being granted editorial access to Labspace and with assistance in the development and implementation of resources.

I have just started using ‘Articulate’ and ‘Adobe Captivate 3’ in order to establish the benefits for practitioners of developing online learning materials without having knowledge and expertise of Flash. Bersin (2005), as part of his rationale for the emergence of this fastest-growing category of online training, defines “rapid e-Learning” as web-based training that can be created in weeks and is typically authored by subject-matter experts (SMEs). De Vries 2004 defines the Rapid E-Learning category as having the following criteria:

- courseware that can be developed in less than three weeks
- Subject Matter Experts (SMEs) act as the primary development resource
- a well-known tool (eg PowerPoint) or user-friendly templates form the starting point for courseware
- simple assessment, feedback and tracking are usually provided
- media elements that enhance learning but do not create technology barriers may be included (eg voice)
- learning modules can be taken in an hour or less, often in less than 30 minutes
- synchronous (scheduled or live) and asynchronous (self-paced) models may be used

Conclusion

It is hoped that this article has provided an account of the practitioner’s involvement in the SLN project. It also includes literature, findings and references to frameworks which I have found useful in facilitating the learning of number skills. These number skills are clearly relevant for access to higher education and employability, and crucial for the delivery of health and social care.

Finally, I would like to thank Jenny Lynden of The Open University for her extensive help with this project and article.

Useful links

A free trial of Adobe Captivate 3 can be downloaded at http://www.adobe.com/uk/products/captivate/?sdid=DLEPX
Articulate Rapid E-Learning website can be accessed at http://www.articulate.com/

Online Assessment and Feedback can be accessed at http://www.bbk.ac.uk/olaaf/contactus/siteleaders.html

Summary of the Three by the Sea conference held by the Sussex Learning Network http://www.sussexlearningnetwork.org.uk/sln-research/research-projects/research-18/research-zone/sln-research-projects/patrick-saintas-and-jenny-lynden

References


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