A research project to design, implement and assess the effectiveness of a sole eLearning module to prepare non-medical healthcare practitioners to report nuclear medicine bone scans

by

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A portfolio of research and development in a professional context

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Abstract

The premise for this research initially stemmed from a perceived crisis facing the provision of the nuclear medicine service within the United Kingdom, the possible impact posed by the shortage of nuclear medicine clinicians and the untapped potential of a body of non-medical healthcare practitioners working within the nuclear medicine sector to whom recognised additional roles, such as reporting of images, may sensibly be delegated. Yet, despite the support by various professional bodies and colleges, uptake is not widespread and appears to be ill provided for in terms of educational programmes.

From an educational perspective, with ever advancing technology and the ubiquity of web based resources, eLearning within healthcare is still in its infancy. Certainly its ability and flexibility to reach geographically diverse populations of learners, is undisputed, yet whilst advantageous to the professional leaner in accessing material away from a restricted campus based environment, its efficacy to teach a skill, or competence, and indeed to translate this to clinical practice remains largely unproven.

With both these issue in mind, the project question was posed as to whether it was possible to establish the efficacy and credibility of an eLearning resource to prepare and support the training of non-medical healthcare practitioners working within the field of nuclear medicine in reporting of bone scans.

Research aim and method

To design, implement and evaluate the impact/effectiveness of a solely e-based learning module to prepare non-medical healthcare professionals to report nuclear medicine bone scans and to ascertain its application as an educational programme for a wider audience.

Using an experimental instructional design method, a module was created using various software packages accessible through a virtual learning environment provided by the University of Portsmouth. This enabled the uploading and

provision of academic content, interactive elements and an image database through which a ‘real-to-life’ learning package, similar to the clinical situation, could take place.

Volunteers were invited to take part in the trial, working their way through a series of knowledge and competence based assessments (formative and summative) and to participate in two surveys at the beginning and on completion of the module. Additional data was gathered through quantitative features embedded within the learning management platform.

Findings

Of thirty-three volunteers recruited to the programme, sixteen completed all the advised summative elements and surveys. From a functional design perspective, the module was well received, pinpointing the benefits and need for this type of resource within the nuclear medicine sector, although the programme would benefit from further refinement for more widespread commercial use.

The eLearning programme clearly demonstrated knowledge gain, although its ability to impart a new skill/ competence, in terms of reporting, can only be cautiously expressed. Those with less experience showed the most marked improvement and as a cohort, there was statistical improvement in discerning normal from abnormal appearances. None of the cohort reached the desired level of concordance in the report writing elements with the reference standard reports, although this may have been, constrained due to programme limitations. There was, however, sufficient evidence to suggest the programme may be potentially suitable as a self-audit tool for reporting, or as a general continuing professional development resource.

Conclusion

eLearning holds widespread appeal to the practising healthcare professional in terms of its ability and flexibility to deliver education, suiting individual learning needs. It should be easily navigable, stimulating and interactive and wherever possible mimic the professional context.

The effectiveness of this programme to prepare non-medical healthcare professionals to acquire a new skill/competence remains outstanding at this time, although there are indications of its influence towards learning.

Some of the learning was clearly transferrable to the clinical setting and could be used for creating a much needed and useful resource for audit and/or continuing professional development purposes. There is also some indication it may be beneficial to professional advancement.

Ultimately, in line with European and national recommendations, eLearning should be allowed to evolve through closer collaboration between HEIs and the private sector, in creating sustainable eLearning resources, maximising its effectiveness for use both nationally and potentially, internationally.

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Declaration

Whilst registered as a candidate for the degree, Professional Doctorate in Medical Imaging, I have not been registered for any other research award. The results and conclusions embodied on this thesis are the work of the named candidate and have not been submitted for any other academic award.

Penelope J. Delf
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Abbreviations

ACTOR - Accredited Clinical teaching Online Resources

AVI - Audio-visual interface

BNMS - British Nuclear Medicine Society

CETL - Centre for Excellence in Teaching and Learning, University of Nottingham

CPD - Continuing professional development

DCR - Diploma of the College of Radiographers

DICOM - Digital image communication in medicine

DRI - Diploma in Radionuclide Imaging

DoH - Department of Health

e-LfH - elearning for healthcare

GMC - General Medical Council

HE - Higher Education

HEI - Higher Educational Institution

HNC - Higher National Certificate

ICSCNM - Intercollegiate Standing Committee on Nuclear Medicine

JISC - Joint Information Systems Committee

JPEG - Joint photographics experts group

JRCPTB - Joint Royal Colleges of Physicians Training Board

KM - Kirkpatrick Model

LDAP - Lightweight Directory Access Protocol

MA - Master of Arts

MBA - Masters in Business and Administration

MSc - Masters of Science

MSc Eng - Masters in Engineering

MTO - Medical Technical Officer

MWU – Mann Whitney U test

NHS - National Health Service

OER - Open source educational resource

PACS - Picture Archiving and Communication Systems

PET - Positron emission tomography

PgD (interp) - Postgraduate Diploma in Interpretation

PORSCHE - Pathways to Open Resource Sharing through Convergence of Healthcare Education

QMP - Question*mark*™ Perception™

RCN – Royal College of Nursing

RCR - Royal College of Radiologists

RCP - Royal College of Physicians

RLO - Reusable learning object

SCoR - Society and College of Radiographers

TEL - Technology enhanced learning department at the University of Portsmouth

VLE - Virtual learning environment

UK – United Kingdom

Glossary

DICOM - an acronym for Digital Image Communication in Medicine which denotes a set of standards that describe a digital file format which can be recognised by other systems (Jones & Oakley, 2003, p.52) for handling, storage, printing and information exchange in medical imaging. Images held are usually uncompressed, of high quality, but usually require large storage space (Cosson & Willis, 2011, p.113).

Digital Literacy – in the context of this research has been defined as the ability to interact with computer technology quickly and efficiently to enhance learning**.**

Dual Learning - highlights the importance of realistic learning, learning in the workplace and promoting the coordination and integration of knowledge, skills and competencies (such as those found in the professional context) thereby minimising the gap between formalised education and professional practice.

Flash - is a software authoring tool, originally developed by Macromedia. It can be used to create animation with special effects, audio tracks and interactivity, allowing for a full screen navigation interface. Content is saved in a file with a Shockwave Flash (SWF) file name extension. It can be used across a normal modem connection and is a popular piece of software, regarded as being ubiquitous on the Web owing to its speed and smooth rendering of graphics.

Flexible Learning - is a concept wherein the student manages their own time and place of study. Ideally suited to the adult learner, study is enabled outside of the work place and without making demands of single location based learning. It also supports the notion of student-centred learning where instruction can be personalised and taken at the individuals own pace and level of competency.

Integrated Learning - combines the elements of complex, flexible and dual learning into an integrated approach where new technologies such as E-learning, inevitably play a key role in helping to achieve learning goals.

JPEG - is a term coined from the Joint Photographic Experts Group to describe a standard method, commonly used, of lossy compression of digital images, which allows a 'trade off' between storage size and image quality (Cosson & Willis, 2011). **Note:** 'Lossy' compression is a method of data encoding which discards (loses) some information to minimise file size, thereby reducing storage, handling and transmitting issues. When compressing images, this will inevitably result in the degradation of the image.

LDAP - stands for Lightweight Directory Access Protocol. It is an standard internet application protocol, which allows reading and editing of directories over an Internet provider network. In simple terms it allows email and other programmes to access information from a server so individuals or groups can be identified.

PACS - Picture Archiving and Communication Systems. This is a system used within a healthcare setting which enables diagnostic images (radiographs and scans) to be stored electronically and viewed on screens, creating a near filmless process. It can be remotely accessed and allow comparability of multiple images, thereby improve and enhancing diagnostic methods.

Shibbolith® - a standards based, open source software package for web single sign-on across or within organizational boundaries. It allows sites to make informed authorization decisions for individual access of protected online resources in a privacy-preserving manner (definition from Shibboleth® accessed 20.6.11).

Victory - is a local name for the Blackboard based eLearning platform used by the University of Portsmouth for intranet provision.

VLE - Virtual Learning Environment is an educational system based on Web 2.0 technology, usually used in tandem with a content management system, allowing two way interaction for learning and teaching purposes.

Foreword

The main driver for this project stems from the perceived crisis in manpower facing the provision of a high quality, safe and effective nuclear medicine service within the United Kingdom (UK) (Intercollegiate Standing Committee on Nuclear Medicine [ICSCNM], 2003, p.vii; Royal College of Physicians [RCP], 2008, p.243).

Most hospitals in the UK provide some form of nuclear medicine service. This may range from a comprehensive service offered by dedicated nuclear medicine specialists, to radiologist-led services with a subspecialty interest in this field. Yet, "*non-medical personnel are essential to the routine provision of a nuclear medicine service*" (RCP, 2008, p.245) acknowledging that a high quality service, relies on a multi-disciplinary approach.

Nuclear medicine has developed rapidly in the last decade and with the addition of new technologies, such as positron emission tomography (PET) and new radiopharmaceuticals, it is becoming increasingly difficult to keep pace with demand (RCP, 2008, p.243). In conjunction with this, is an imbalance between junior doctors entering the specialty and planned retirements of clinicians currently in post, this has been highlighted as potentially contributing to the collapse of the service, unless there is a radical rethink of service provision (ICSCNM, 2003, p.9; RCP, 2008, p.255).

It takes time to train junior clinicians, particularly where negative perceptions of the specialty exist (limited clinical variety, potential clinical isolation and few consultant positions). Increased clinician numbers are needed and whilst this is being addressed through specialty registrar training programmes, there is still doubt as to whether this will be adequate to meet with demand. Over the next decade, it is anticipated that 100-120 whole time equivalent consultants will be needed just to maintain the existing level of service, excluding growth areas such as PET (ICSCNM, 2003, p.vii; RCP, 2008, p.254).

If the service is to remain viable in the foreseeable future, looking to the largely untapped resource and skill of non-medical healthcare professionals, such as

radiographers and medical technical officers, currently working within the field, may provide a more immediate solution. In fact, the British Nuclear Medicine Society [BNMS] has developed guidelines outlining *"the training and experience required for the extension of roles for non-medical healthcare professionals"* (RCP, 2008, p.250).

The move to utilise non-medical healthcare professionals and to promote cross boundary working is not new. In the past, the Royal College of Radiologists [RCR] advocated the extension of the radiographers' role and with the modernization of the National Health Service [NHS] increasing the skill mix has been seen as providing a more structured career progression and improving staff retention amongst non-medical personnel (Society and College of Radiographers [SCoR] 2010, p.6; joint paper by RCR and SCoR, 2007, p.6). However, with changing healthcare and political climates, further pressure for enhancing the role of non-medical healthcare professionals has gathered pace. The ever increasing demand on already stretched services has led to non-medical professionals from all sectors being asked to raise their level of practice to ease the burden on clinicians (Great Britain. Department of Health [DoH], 2000, p.7; Great Britain. DoH, 2002a, p.10; RCR, 2006, p.6; joint paper by RCR and SCoR, 2007, p.7). This is evident within nuclear medicine, where there are clear moves to maintain the service and increase patient choice by allowing some non-medical practitioners to provide timely and accurate reports of examination findings for referring clinicians (Nuclear Medicine Communications [NMC], 2004, p.751; BNMS, 2005, p.1).

Despite the advantages to service provision and the more effective use of existing manpower, cross boundary working does not come without some concerns, not least the perceived knowledge gap between medical and non-medical healthcare professionals. Currently, there is a lack of adequate resources and training programmes to help non-medical professionals expand their practice (Forsyth & Robertson, 2007, p.54).

The rationale for this project is the result of developments regarding changing professional boundaries, healthcare provision and practice, potential manpower shortages in nuclear medicine and the role of higher education (HE) in supporting

the '*learning society*' and the promotion of learning technologies (Messer & Griffiths, 2007, p.97).

With technology constantly evolving and with regard to the eLearning process, this project aims to develop and implement a discrete eLearning module in nuclear medicine skeletal reporting for non-medical healthcare professionals, focusing on the efficacy and reliability of the programme, knowledge and competence gained and possible transference to the clinical setting.