Radiography (2009) **15**, e22–e28

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radi

Retention of anatomy knowledge by student radiographers

A. Susanne Hall [a,*], **Brian R. Durward** [b,c]

[a] *Division of Radiography, School of Health and Social Care, Glasgow Caledonian University, Cowcaddens Road, Glasgow G4 0BA, UK*
[b] *Educational Development, NHS Education for Scotland, Floor 5, Thistle House, 91 Haymarket Terrace, Edinburgh EH12 5HD, UK*

Received 21 August 2008; revised 13 February 2009; accepted 11 March 2009
Available online 17 April 2009

KEYWORDS
Anatomical detail;
Retention;
Approaches;
Learning;
Assessment;
Image interpretation

Abstract *Introduction:* Anatomy has long been regarded as an integral part of the core curriculum. However, anecdotal evidence suggests that long-term retention of anatomy knowledge may be deficient. This study aims to evidence whether student radiographers demonstrate the same level of knowledge of anatomy after a period of time has elapsed and to correlate to approaches to learning and studying.
Methodology: A repeated measures design was utilised to measure retention of anatomy knowledge for both MCQs and short-response answers to a Practical Radiographic Anatomy Examination; alpha value $p < 0.05$. Fifty-one students from levels 2 and 3 were retested after a time lapse of 10 and 22 months respectively. The students were not aware that their knowledge was being retested. Approaches to learning and studying were measured using the ASSIST inventory.
Results: Statistical analysis found no difference in performance on MCQ assessment, in either the combined sample or levels 2 and 3 separately, from baseline to retention occasions; average retention rate being 99%. However, a statistical difference in performance on PRAE assessment was found, with level 2 experiencing a larger reduction in scores; retention rate of 67% compared to level 3 at 77%. The students perceived themselves to be principally strategic in their approach to learning and studying but no strong relationships were found when correlated to test scores.
Conclusion: The student radiographers in this study demonstrated varied anatomy retention rates dependent on assessment method employed and time interval that had elapsed. It is recommended that diverse teaching and assessment strategies are adopted to encourage a deeper approach to learning and studying.

* Corresponding author. Tel.: +44 141 331 3234; fax: +141 331 8112.
E-mail address: a.s.hall@gcal.ac.uk (A.S. Hall).
[c] Tel.: +131 313 8000. brian.durward@nes.scot.nhs.uk (B.R. Durward).

1078-8174/$ - see front matter © 2009 The College of Radiographers. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.radi.2009.03.002

Introduction

''Students don't know their anatomy'' is a concern often expressed anecdotally by qualified radiographers. Not only has human anatomy been part of the core curriculum since the inception of the Society of Radiographers (SoR) in the 1920s,[1] but recent initiatives by the Quality Assurance Agency (QAA),[2] College of Radiographers (CoR)[3] and Health Professions Council (HPC)[4] reaffirm the importance of anatomy as an integral part of radiography education and training. Radiographers require to conceptualise the human body in regional and cross sectional domains integrating structure and function with signs and symptoms of disease and trauma.[4] Basic knowledge, understanding and skills including anatomy, developed in the early years of undergraduate programmes, need to extend more fully to subsequent undergraduate levels of study and a lifelong application of anatomy, within image interpretation.

Traditional teaching methods focus on lectures as the main method of delivering a large body of syllabus content, formally assessed by written examination. This mode of delivery is believed to promote a surface approach to learning. The early work of educational psychologists[5–7] proposed that students adopt a deep or surface approach to learning depending on their level of study, motivation, learning environment or assessment demands.[8] In basic terms, the 'deep learner' seeks to understand the meaning behind the subject under discussion and is likely to read widely, while the 'surface learner' merely wants to remember facts, usually by rote learning.[9,10] A strategic approach to learning was subsequently identified[11–13] co-existing with deep and surface approaches, where learning is perceived as a game, with the acquisition of a technique to 'get good marks' being the main motivation (Table 1). Interestingly, one study found an association between a deep approach to learning for an assignment essay (demonstrating analysis, interpretation, synthesis and application) and a surface approach to learning for multiple choice questions (MCQs) (indicating factual recall and reproduction of information).[14] This proposition is largely supported by McMahon,[10] who also purports that the surface approach promotes 'forgetting' of facts after the assessment event thus affecting retention of knowledge. However, these approaches are not stable attributes in an individual but all can be adapted depending on the motivating factor at the time.[15]

Table 1 Summary of motivation and approaches to learning and studying.

Approach	Motivation	Process
'Deep'	• Vocational relevance • Personal understanding • Interest in the subject • Enjoyment in learning	• Seeks meaning • Relates ideas to evidence • Integrates different domains of knowledge
'Strategic'	• Desire for success • Need to achieve • Need to meet the demands of the assessment • Competition with other students	• Uses techniques that achieve highest grades • Level of understanding is variable and patchy
'Surface'	• Fear of failure • Completion of the course • Meet the course requirements • Minimal effort • Hurdles to overcome	• Rote-learning of facts and ideas • Usually followed by forgetting • Focuses on task components in isolation • Little real interest in the content

Adapted from McManus et al.[9]; Tait et al.[13]; Prosser and Trigwell.[51]

Nevertheless, questionnaires such as the ''Approaches and Study Skills Inventory for Students'' (ASSIST)[16] attempt to measure approaches to learning and studying utilising the 'parent' scales of deep, strategic and surface.[12,13,16–19] Coffield et al.[20] produced a comprehensive systematic review of such inventories largely supporting ASSIST[16] for use in higher education because it explores 'approaches' to learning and studying as being less fixed than learning 'styles' and more reflective of student behaviour.

Some researchers have explored retention of anatomical knowledge within their own clinical disciplines. An early study of student nurses[21] found a 20% reduction of anatomy knowledge between 'first test' and 'retest'. Physiotherapy students, tested on three occasions, found their anatomy knowledge mean scores fell from 80.2% to 64.3% after one year, only rising to 66.9% a year later.[22] Similarly, Fiebert and Waggoner[23] tested physical therapy students, finding their extremity anatomy knowledge mean scores fell from 89.6% to 59.1% after 13 months rising to 71.1% 10 months later. These authors were surprised at the magnitude of the decline in retention of learned material, posing questions on how to improve anatomy retention long-term but importantly how much retention is needed in order to be a competent practitioner.[23]

More recently, Feigin et al.[24] found anatomy scores fell from 90% to 37.25% when investigating fourth year medical students' ability to retain and apply knowledge of radiographic anatomy of the chest as taught and assessed during the foundation years; the students taking the 2-year retest without prior notice. These authors reflect critically on their own teaching methods, considering that the very specific nature of radiographic anatomy, with no clinical experience to underpin learning, plus subsequent sensory overload from other modules and early delivery of anatomy within the curriculum contributed to their results. Indeed, the Medical Council in Ireland[25] concurs citing factual overload as an issue for immediate attention within medical curricula.

While it is difficult to accurately compare such contrasting educational methodologies, it was nevertheless deemed important to address issues of apparent failure to retain anatomical knowledge. Radiography educators (both clinical and academic) are often aware of deficiencies in anatomy knowledge in student radiographers as they progress through a programme of study but little appears to