PROTOCOL FOR PROPOSED BEME TOPIC REVIEW GROUP

EFFECTIVE METHODS OF TEACHING AND LEARNING IN ANATOMY AS A BASIC SCIENCE: A SYSTEMATIC REVIEW.

GROUP MEMBERS:

C. Dominique Losco: Lecturer in Clinical Chiropractic, School of Health Professions, Murdoch University, Perth, Western Australia

Dr Amanda Meyer: Lecturer in Anatomy, School of Health Professions, Murdoch University, Perth, Western Australia

Dr Anthony Armson: Senior Lecturer in Genetics, Immunology and Microbiology, School of Health Professions, Murdoch University, Perth, Western Australia

Professor William Grant, Professor of Emergency Medicine & Family Medicine, Associate Dean, Graduate Medical Education, State University of New York, Upstate Medical Centre, Syracuse, New York, USA. (International Collaborator)

Associate Professor Bruce Walker: Associate Dean (Research), School of Health Professions, Murdoch University, Perth, Western Australia

Lead Reviewer:

C. Dominique Losco

School of Health Professions, Discipline of Chiropractic

ECL Building, Room 4.007; Murdoch University

90 South Street; MURDOCH, W.A. 6150

Email: c.losco@murdoch.edu.au; Phone: + 61 8 9360 2084

BACKGROUND

Teaching is a process of conveying a body of knowledge to a group of students. Pedagogy is the science and art of education including teaching methods and practice (Churchill et al, 2011).

Teaching methods can be considered the pedagogic approach utilised by instructors to facilitate a set of learning outcomes expected of an “ideal curriculum”. In our area of interest teaching methods in Anatomy include student dissection, inspection of prosected specimens, the use of models and computer-assisted learning (CAL), didactic teaching, living and radiological anatomy (Kerby, Shukur & Shalhoub, 2011). The suitability of a given teaching method to achieve specific learning outcomes is encompassed by the concept of “fitness for purpose”. The teaching methods mentioned above of dissection, prosection, the use of models, living anatomy and radiological methods all demonstrate good “fitness for purpose” as reported by experts and medical students (Patel & Moxam, 2008; Kerby et al., 2011). In particular, both groups agreed that dissection was an excellent ‘‘fit’’ for the purpose of obtaining a 3-D conceptualisation of human anatomy (Patel & Moxam, 2008). The traditional didactic method of teaching and new innovative techniques such as CAL was not rated as effective as the previously mentioned methods (Kerby, Shukur and Shalhoub, 2011).

Learning methods are the strategies that students take to *organise and assimilate* learning matter, it is their way of engaging a learning task. It is important at this stage that we distinguish these strategies from student learning *styles* which categorise common ways in which students learn such as visual, auditory or kinesthetic. These are not the subject of this review. Students are known to adopt different approaches to learning methods, which may be classified as: superficial learning, deep learning and strategic learning. Superficial learning focuses on the assimilation of factual knowledge and memorisation, whereas deep learning occurs when the student makes connections with the broader knowledge on the topic, incorporating the significance of what is being taught. A third learning entity, “strategic” learning is often used where a large volume of information is to be learned. Here the learner may use rote memorisation (a superficial learning technique) as a stepping-stone to deep learning switching between the two in response to perceived changes in the relative significance of content areas. Deep learning has been considered to be the most successful approach in achieving desired learning outcomes (Newble & Entwistle, 1986). In contrast, and for our purposes, superficial approaches result in significantly worse anatomy grades (Ward, 2011).

The Basic Science of Anatomy

Knowledge retention is dependent on factors including intelligence, attitude and the learning strategies employed. Students often adopt a strategy of superficial learning in anatomy units due to the large volume of information presented. Superficial learning strategies negatively impact on retention of anatomy (Ward, 2011). Indeed, retention of basic science knowledge has been best described by a "negatively accelerated (logarithmic) forgetting curve" (Lazic et al., 2006). Approximately 25% of knowledge is lost after one year (Custers, 2010). A recent report of 5th year chiropractic students in Australia reported that only 38% of the cohort was able to accurately identify all eight carpal bones (Strkalj et al., 2011). This test has been used previously as a benchmark for anatomical knowledge in both Physical Therapy and Medical student populations (Valenza et al., 2012; Strkalj et al., 2011; Spielmann & Oliver, 2005).

While teaching methods and learning strategies are not quantifiable, knowledge retention can be measured through reliable and valid assessment. Ultimately, the most effective methods of teaching and learning will increase knowledge retention of basic sciences such as anatomy. Basic science knowledge may be valuable in the clinical setting by allowing students to recall or reconstruct the relationships between clinical presenting features and potential diagnoses (Woods, Brooks and Norman, 2005). As basic sciences, such as anatomy, underpin the clinical sciences the subsequent effect would be an increase in clinical knowledge. Indeed, a positive correlation exists between clinical knowledge and retained basic science concepts (Custers & Ten Cate, 2011). Therefore, evaluation of knowledge retention could elucidate the most effective methods of teaching basic sciences such as anatomy to ultimately increase clinical acumen.

Numerous studies evaluate the effect of teaching methods in Anatomy, but the majority are evaluating singular interventions and their outcome. This review ultimately aims to consolidate this information and provide guidance to those teaching undergraduate Anatomy students in the development of effective teaching strategies to promote learning.

REVIEW QUESTION, OBJECTIVES AND KEY TERMS

The primary review question is: **What methods of teaching and learning in Anatomy would assist undergraduate students with improving their knowledge retention?** The objectives of this review are therefore to specifically:

1. Identify methods used to teach Anatomy
2. Identify those methods that are demonstrated to enhance knowledge retention in Anatomy, either short-term or long-term

3. Identify what factors, other than the teaching methods, affect long-term knowledge retention in Anatomy

Five Key Terms:

Anatomy, teaching method(s), pedagogy, learning, knowledge retention

SEARCH SOURCES AND STRATEGIES

Proposed Databases

PubMed (1946 – 2013), CINAHL (1937 – 2013), ERIC (1966 – 2013), Academic OneFile (1980 – 2013), ProQuest (all dates), Sage journals (1847 – 2013), Scopus (1966 – 2013)

Proposed Search Terms

Free text search will be utilised to allow capturing of all potentially relevant articles.

(Terms below marked with an asterisk are truncations to allow for variations of the root word)

Anatomy	**AND Teaching**	**AND Effectiv***
	OR method* OR pedagogy OR teaching/trends OR education OR technology OR educational technology OR computer-assisted instruction OR computer simulation* OR simulation OR educational models OR web-based learning OR asynchronous learning	OR instructional effectiveness OR knowledge OR knowledge retention OR learning OR retention OR retention (psychology) OR enhanc*

In addition, we will search the references of all included studies and for any further relevant articles cited as well as relevant journals such as *Anatomical Sciences Education* and *Instructional Science*.

Grey literature from the Association for Medical Education in Europe (AMEE) and the Association for the Study of Medical Education (ASME) will not be included in this particular review due to restriction of the study designs being evaluated.

STUDY SELECTION CRITERIA

PICO	Inclusion Criteria	Exclusion Criteria
Population	Student Undergraduate Anatomy	Technical college / TAFE student
Study Design	Randomised control trials Comparative studies	Retrospective studies Case series Cross-over design on a single group
Intervention	Teaching in conjunction with: Method* Pedagogy Teaching/trends Education Technology Educational technology Computer-assisted instruction Computer simulation* Simulation Educational models Web-based learning Asynchronous learning	Shadowing Practice audits Feedback alone
Comparison	Any comparison of teaching methods described under the intervention inclusion criteria that investigates a measureable outcome of knowledge retention in Anatomy as a basic science	
Outcome	Levels knowledge retention • Observed assessment scores; after specified retention interval • Reported outcomes according to modification of Kirkpatrick's levels of educational outcomes	Subjective outcome measures

PROCEDURE FOR EXTRACTING DATA

Screening of titles and abstracts: Pilot review process

Two independent reviewers to blindly review 8-10 titles and abstracts and assess these against the selection criteria (quantified with a *percent agreement calculation*)

Piloting and modification of BEME coding sheet to occur during this process

Exchange of papers and coding sheets, discussion and modification as needed

If disagreement, third reviewer to be consulted and decide

Selection of articles for inclusion

Two independent reviewers to blindly review all titles and abstracts and assess these against the selection criteria (quantified with a *kappa coefficient*)

Include: obtain full article

Exclude: No further action required

Discussion if required, if unclear: third reviewer to be consulted and decide

Secondary screening of full articles

Two independent reviewers assess each full article using the modified BEME coding sheet(s)

Each blind reviewer to proceed to data extraction

Comparison and discussion, if unclear: third reviewer to be consulted and decide

ASSESSMENT OF RISK OF BIAS (INCLUDING STUDY QUALITY)

Assessment of methodological quality will be determined using applicable components of the Cochrane Collaboration's tool (Higgins & Green, 2008), namely random sequence generation (allocation process), blinding of outcome assessment. Group characteristics such as appropriate heterogeneity will also be included in quality assessment. Methodological quality will be reported as high (all 3 components addressed to satisfaction); medium (acceptable though with some components lacking) and low (not acceptable for the purpose of this review).

ANALYSIS AND SYNTHESIS OF EXTRACTED EVIDENCE

Agreement between the initial two reviewers on selected articles for inclusion will be evaluated by calculation of a kappa coefficient. The development of a BEME coding sheet will be informed through the pilot review process and extracted data recorded on the sheet.

If data is of sufficient homogeneity to combine (similar interventions, comparisons, outcomes and study designs), standard methods for meta-analysis will be employed according to the Cochrane Handbook. Due to the broad nature of the studies likely to be included, grouping and reporting of studies according to a modification of Kirkpatrick's levels of educational outcomes (hierarchy) will be employed where necessary. A descriptive table of studies included will be developed and included in the systematic review.

PROJECT TIMETABLE

Activity	**Timeline**
Protocol re-submitted to BEME for final approval	September 2013
Conduct search for relevant titles, abstracts (screening) and full text articles	September / October 2013
Pilot review including piloting of coding sheet conducted	September / October 2013
Coding of studies (data extraction) and data analysis	November / December 2013
Writing up of BEME review	December / January 2014
Final submission to BEME	February 2014

CONFLICT OF INTEREST STATEMENT

Nil.

PLANS FOR UPDATING THE REVIEW

We intend to update the systematic review after five years of the date of the review.

CHANGES TO THE PROTOCOL

Nil at this time.

References:

1. Bandiera, G., Boucher, A., Neville, A., Kuper, A. and Hodges, B. 2013. "Integration and timing of basic and clinical sciences education". *Medical Teacher.* doi: 10.3109/0142159X.2013.769674.
2. Churchill, R., Ferguson, P., Godinho, S., Johnson, N.F., Keddie, A., Letts, W., Mackay, J., McGill, M., Moss, J. Nagel, M.C., Nicholson, P. and Vick, M. 2011. *Teaching: Making a Difference*. Australia: John Wiley & Sons.
3. Custers, E.J.F.M (2010). "Long-term retention of basic science knowledge: a review study". *Advances in Health Sciences Education* 15: 109-128.
4. Custers, E.J and Ten Cate, O.T. 2011. "Very long-term retention of basic science knowledge in doctors after graduation". *Medical Education* 45: 422-30.
5. Higgins, J.P.T, Altman, D.G. and Sterne, J.A.C. 2011. Assessing risk of bias in included studies. In: Higgins JPT, Green S (Eds). *Cochrane Handbook for Systematic Reviews of Interventions: Version 5.1.0*. The Cochrane Collaboration. www.cochrane-handbook.org.
6. Kerby, J., Shukur, Z.N. and Shalhoub, J. 2011. "The Relationships Between Learning Outcomes and Methods of Teaching Anatomy as Perceived by Medical Students". *Clinical Anatomy* 24:489-497. doi: 10.1002/ca.21059.
7. Kirkpatrick, D. 1967. "*Evaluation of Training". In Training and Development Handbook*, edited by Craig, R and Bittel, L., 131-167. New York: McGraw-Hill.
8. Lazic, E., Dujmovic, J and Hren, D. 2006. "Retention of basic sciences knowledge at clinical years of medical curriculum." *Croation Medical Journal* 47: (6).
9. Newble, D.I. and Entwistle, N.J. 1986. "Learning styles and approaches: Implications for medical education". *Medical Education 20*(3): 162-75. doi: 10.1111/j.1365-2923.1986.tb01163.x.
10. Patel KM, and Moxham BJ. 2008. The relationships between learning outcomes and methods of teaching anatomy as perceived by professional anatomists. *Clinical Anatomy* 21:182–189. doi: 10.1002/ca.20584.
11. Spielmann, P.M. and Oliver, C.W. 2005. "The carpal bones: a basic test of medical students' and junior doctors' knowledge of anatomy". *Surgeon 3*(4): 257-9.
12. Strkalj, G., Schroder, T., Panther, N. and Solyali, V. 2011. "A preliminary assessment of the fifth-year chiropractic students' knowledge of anatomy". *Journal of Alternative and Complementary Medicine*. *17*(1): 63-6.
13. Sugand, K., Abrahams, P. and Khurana, A. 2010. "The Anatomy of Anatomy: A Review for Its Modernization". *Anatomical Sciences Education* 3:83–93.

14. Valenza, M. C., Castro-Martin, E., Valenza, G., Guirao-Pineiro, M., De-La-llave-Rincon, A.I. and Fernandez-de-las-Penas, C. 2012. "Comparison of third-year medical and physical therapy students' knowledge of anatomy using the carpal bone test". *Journal of Manipulative and Physiological Therapeutics 35*(2): 121-6.
15. Ward, P.J. 2011. "First Year Medical Students' approaches to study and their outcomes in a gross anatomy course". *Clinical Anatomy 24*(1): 120-7.
16. Woods, N.W., Brooks, L.R. and Norman, G.R. 2005. "The value of basic science in clinical diagnosis: creating coherence among signs and symptoms". *Medical Education* 39: 107–112. doi: 10.1111/j.1365-2929.2004.02036.x.
17. Wilhelmsson, N., Dahlgre, L.O., Hult, H., Scheja, M., Lonka, K. and Josephson, A. 2009. "The anatomy of learning anatomy". *Advances in Health Sciences Education* 15:153-165. doi: 10.1007/s10459-009-9171-5.