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Experiential Learning, Spatial Visualization and Metacognition: An Exercise with the "Blank Page" Technique for Learning Anatomy ☆

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Abstract

Purpose: Undergraduate students in the allied health science disciplines are normally required to complete a human anatomy course in their first year. Such courses, while popular, present challenges in that the content requires students to engage different approaches to learning. Recent literature reflects an increased interest in active, experiential learning activities to improve the learning of anatomy and physiology, but activities that focus on the development of metacognitive skills and visual-spatial thinking have been lacking. To address these inadequacies we developed a plasticine modeling and drawing activity in a tutorial room devoid of resources and visual cues referred to as the "blank page" room. The purpose of this manuscript is to communicate the merits of this intervention as an instructional technique used to facilitate the learning of anatomy for undergraduates of allied health disciplines.

Method: During anatomy laboratory sessions we randomly allocated student groups to the activity of plasticine modeling and drawing (blank page technique) or the completion of written review questions. We compared the grades achieved by students who had been exposed to the blank page intervention with the grades achieved by students who were given standard review questions. We also collected qualitative feedback in the form of questionnaires that required participating students to rate the learning efficacy of the activities.

Results: Students performed slightly better on assessment quizzes after the blank page activity compared with the review questions. Student feedback indicated that the blank page activity had greater learning value and promoted stronger engagement in the learning tasks.

Discussion: The blank page activity has merit in student engagement and facilitation of the learning of anatomy by broadening the scope of instruction to encompass multimodal learning preferences, metacognition and visual spatial thinking.

Keywords: Learning anatomy; Metacognition; Visual-spatial thinking; Anatomy laboratories; Clay modeling

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1. Introduction

In Australia, in-depth study of human anatomy is experienced for the most part at post-secondary level. In particular, students destined for careers in allied health are required to study a human anatomy and physiology course as part of their degree program. Most of these first year students have never been exposed to detailed human anatomical studies prior to arriving at university. We deliver a large first year anatomy and physiology course (800+ enrolled students) that is mandatory for a range of allied health programs. Based on student feedback, the course is perceived as relevant and interesting but the most challenging of their first year courses. While there is a broad distribution in grades, it is disappointing to report that many students fail to succeed in this course each year.

Our objective was to improve the success rate for all the students in the course and facilitate the learning of anatomy & physiology by implementing a technique that combines experiential learning (learning from a concrete experiences), visual-spatial thinking (construction of mental images) and metacognition (awareness of one's understanding or cognition). In this report we present an application of our technique and describe its alignment with current educational philosophies. Lecturers of anatomy and physiology, who have limited formal training in education and student approaches to learning, may find this technique beneficial, as well as teachers of secondary level science who are preparing students for university programs in the health sciences.

1.1. Learning anatomy

For students of health sciences, laboratory sessions make the learning of anatomy meaningful and relevant to a student's future clinical setting. Large first year undergraduate anatomy laboratory sessions using cadaveric material, models and plastinated specimens are potentially a rich learning platform for first time students of anatomy. These sessions are designed to promote deep learning by providing opportunities for students to observe and manipulate specimens and experience the texture and interrelationship between anatomical structures in 3 dimensions. In reality, in large undergraduate cohorts of 100–150 students per laboratory session, it can be difficult to allow students the time and opportunity to manipulate individual specimens and discover the details of anatomical structures, or create an active learning environment.

Learning anatomy presents a unique challenge for many students who for the first time are required to exercise visual-spatial thinking and construct mental images to enhance deep learning and long term memory. In resource-rich laboratory settings, based on observation and instruction, without active dissection, students can often become passive, superficial learners, and overwhelmed by content. This is particularly acute in first year students who have been accustomed to the small class and teacher-centered environment of secondary school. It has been established that students' approaches to learning are not fixed but change according to the educational context.[1] In addition, recent reports indicate that many first year students lack metacognitive skills or the ability to self-regulate their learning.[2,3]

Surrounded by visual cues in the laboratory, but lacking in metacognitive skills (an ability to monitor their understanding), it is in our experience that students can develop a false sense of knowing without practicing the deep cognitive processes required to construct the knowledge in their own minds. Practicing deep cognitive processing in order to construct knowledge is aligned with the constructivist educational paradigm. Constructivism asserts that learning is development or construction of knowledge where *active* learners interact with and manipulate their surroundings.[4] Aligned with constructivism and often associated with science education is experiential learning. Experiential learning, formalized by Kolb[5] is an approach to learning where the student engages in a concrete experience and reflects upon that experience, responds to it and then constructs the knowledge anew. In developing our learning activity we have blended elements of constructivism and experiential learning to facilitate the learning of anatomy. In addition, we believe the activity encourages the development of metacognitive skills and visual-spatial thinking.

1.2. Learning styles for anatomy

It is now widely accepted that students display multimodal learning preferences[6–8] and when specifically learning anatomy, it has been reported that students who integrate a number of learning methods, demonstrate better long term knowledge retention.[9] As instructors of a large cohort of allied health first year students, we needed to diversify the instructional design of the anatomy laboratories to incorporate different learning styles and encourage deep cognitive processing by the students. The impetus for change to diversify the learning experience was based on our observations that