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Original Article

Creating an engaging and stimulating anatomy lecture environment using the Cognitive Load Theory-based Lecture Model: Students' experiences

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الملخص

أهداف البحث: هناك حاجة لعمل محاضرة نموذجية تفاعلية لمادة التشريح تشرك الطلبة في عملية التعلم. تبحث هذه الدراسة في تأثير إعطاء المحاضرات بالقواعد الإرشادية الجديدة، نظرية العبء المعرفي- القائم على محاضرة نموذجية، على المشاركة المعرفية للطلبة وتحفيزهم.

طرق البحث: تم أخذ عينة عشوائية تضمنت ١٩٧ مشاركا من ثلاث مؤسسات تعليمية. حضرت المجموعة الضابطة محاضرة حرة على التشريح الإجمالي للقلب، قدمها مؤهل في علم التشريح من كل مؤسسة. وحضرت مجموعة التدخل "نظرية العبء المعرفي- القائم على محاضرة نموذجية" لموضوع مماثل، قدمت بواسطة نفس المحاضر بعد ثلاثة أسابيع. حضر المحاضرون ورشة عمل عن نظرية العبء المعرفي- القائم على محاضرة نموذجية مما سمح لهم بالاستعداد للمحاضرة خلال ثلاثة أسابيع. تم قياس التصنيف الشخصي للطلبة على مشاركتهم المعرفية والتحفيز الذاتي فورا بعد المحاضرة باستخدام استبانة مشاركة المتعلمين وتحفيزهم التي تم التحقق من صحتها. تم تحليل الفروق بين المتغيرات، وتم تثليث النتائج مع نتائج مناقشات مجموعة التركيز التي استكشفت تجربة الطلبة عند حضورهم المحاضرة.

النتائج: كان لدى مجموعة التدخل مستوى أعلى بكثير للمشاركة المعرفية من المجموعة الضابطة، ولكن، لم يتم العثور على فرق كبير في نطاق التحفيز الذاتي. بالإضافة إلى ذلك، لمست مجموعة التدخل تجربة تعلم جيدة من المحاضرات.

الاستنتاجات: حفزت القواعد الإرشادية بنجاح المشاركة المعرفية للطلبة وخبرة التعلم، مما يدل على التحفيز الناجح للموارد ذات الصلة للطلبة. تحفيز هذه الموارد المعرفية ضروري لنجاح المعالجة المعرفية خصوصا عند تعلم موضوع صعب كعلم التشريح.

الكلمات المفتاحية: نظرية العبء المعرفي؛ المحاضرة؛ المشاركة المعرفية؛ التحفيز الذاتي؛ التعلم الذاتي الملموس

Abstract

Objective: There is a need to create a standard interactive anatomy lecture that can engage students in their learning process. This study investigated the impact of a new lecturing guideline, the Cognitive Load Theory-based Lecture Model (CLT-bLM), on students' cognitive engagement and motivation.

Methods: A randomised controlled trial involving 197 participants from three institutions was conducted. The control group attended a freestyle lecture on the gross anatomy of the heart, delivered by a qualified anatomist from each institution. The intervention group attended a CLT-bLM-based lecture on a similar topic, delivered by the same lecturer, three weeks thereafter. The lecturers had attended a CLT-bLM workshop that allowed them to prepare for the CLT-bLM-based lecture over the course of three weeks. The students' ratings on their cognitive engagement and internal motivation were evaluated immediately after the lecture using a validated

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Learners' Engagement and Motivation Questionnaire. The differences between variables were analysed and the results were triangulated with the focus group discussion findings that explored students' experience while attending the lecture.

Results: The intervention group has a significantly higher level of cognitive engagement than the control group; however, no significant difference in internal motivation score was found. In addition, the intervention group reported having a good learning experience from the lectures.

Conclusion: The guideline successfully stimulated students' cognitive engagement and learning experience, which indicates a successful stimulation of students' germane resources. Stimulation of these cognitive resources is essential for successful cognitive processing, especially when learning a difficult subject such as anatomy.

Keywords: Cognitive Load Theory; Cognitive engagement; Internal motivation; Lecture; Self-perceived learning

Introduction

Anatomy is a medical subject that elaborates on the macroscopic and microscopic structures of a normal human body. It is regarded as the central pillar of medical knowledge; medical students are required to know the usual anatomical structures in detail prior to studying subjects related to clinical applied knowledge.[1] Despite a continuous search for an effective teaching strategy in anatomy education, lecturing, which many educators have claimed is ineffective, has prevailed as a teaching method used to deliver anatomy information to medical students.[2–5] This is because anatomy is commonly perceived by medical students as a cognitively challenging subject that requires teachers' direct guidance during learning.[6,7] In fact, the delivering of anatomy lectures has become a common practice in many medical schools prior to other active learning activities such as cadaveric dissection and practical, tutorial, seminar, or problem-based learning.

As opposed to traditional anatomy lectures, modern anatomy lectures have been continuously improvised to suit the emerging changes of medical curriculum. The use of lectures is limited to delivering introductory concepts of an anatomy topic, and it is sometimes integrated with other medical subjects such as physiology, pathology, and radiology.[8,9] Clinical applied anatomy is often introduced during pre-clinical anatomy classes in order to stimulate students' interest and appreciation of value towards the subject.[10] To assist in the visualisation of anatomical structures, especially in situations where there is significant decline in cadaveric dissection classes,[11–13] anatomy educators have begun to use technology-based teaching aids during anatomy lectures.[2,14–16] However, the dynamic visualisation of anatomical structures using these teaching aids does not always benefit learning, especially when the learners are novices.[17,18]Therefore, it is essential to find a way to create a stimulating and engaging lecturing environment that can promote the visuospatial ability of the students.

In the context of human cognition, visuospatial ability reflects the capacity of working memory to process visuospatial input.[19] Prior to this cognitive process, the visual stimulus is first received by the sensory memory, which holds the information for less than one second.[20,21] With the presence of learner's 'attention focus', the visual information can be transferred from sensory to working memories. Within its limited capacity, the working memory – which contains both visual (visuospatial sketchpad) and auditory (phonological loop) centres[19] – converts the information into cognitive schema, which is an organised form of information,[22] and transfers the schema into the long-term memory for permanent storage.[23] Once the schema is stored in long-term memory, actual learning is said to occur.[24] Hence, to achieve the actual learning during a lecture, it is imperative to create a lecturing environment that can stimulate students 'attention focus' and foster deliberate investment of the working memory resources for schema construction and storage. This can be done by applying the evidence-based lecturing strategies of the Cognitive Load Theory-based Lecture Model (CLT-bLM),[25] which was developed using the principles of the Cognitive Load Theory (CLT) and the Cognitive Theory of Multimedia Learning (CTML).

CLT and CTML are instructional design theories that aim to produce teaching instruction methods – including multimedia instruction – that are intelligible to learners.[26] The central tenet of these theories is to align the design of these instructions with human cognitive architecture and function.[27] In cognitive science, actual learning is said to occur when the learner's working memory has successfully converted newly received information into cognitive schema, an organised form of information that can eventually be transferred and stored in the learner's long-term memory.[23,24] Unfortunately, the working memory has a very limited capacity, as it can only hold and process a limited amount of information at one time[28,29]; if this amount is exceeded, the result is unsuccessful schema construction. Hence, to ensure successful schema construction and storage, instruction should be designed and delivered in a manner that does not exceed the working memory capacity.

In order to create such instruction, it is paramount to ensure an appropriate selection of information that is to be incorporated into the instruction. In the CLT context, any input that is introduced during teaching and learning activities is known as the cognitive load.[30] The traditional formulation of CLT described three type of loads: intrinsic, extraneous, and germane loads.[30] The intrinsic load (IL) refers to input related to instructional content and therefore reflects the complexity of the instruction.[17,31] In other words, a difficult subject imposes a higher IL to learners compared to a less difficult subject. In addition, IL also depends on the learner's prior knowledge, as those who have prior knowledge on the subject matter experience lower IL than those without it.[31] The extraneous load (EL) is imposed by