RDME Research and Development in Medical Education
Res Dev Med Educ, 2020, 9, 22
doi: 10.34172/rdme.2020.022
https://rdme.tbzmed.ac.ir
TUOMS PRESS

Letter to Editor

5E Instructional design in undergraduate neuroanatomy teaching

Dinesh Kumar[1*], Rajasekhar Sajja SN[1]

[1]Department of Anatomy, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India

Received: 22 Sep. 2020 Accepted: 9 Dec. 2020 epublished: 28 Dec. 2020

Dear Editor,

Despite being a complex subject, neuroanatomy teaching limits itself to demonstration of gross features in overcrowded curricula. This leaves scant opportunity for engaging students in active learning to reinforce foundational neuroanatomical concepts with clinical applications. We often see students failing to correlate anatomical knowledge within clinical scenarios while performing neurological examinations of patients. Another issue of concern for students is that neuroanatomy, owing to both content and orientation difficulties, imposes a huge cognitive load. These failures in the translation of knowledge and the significant cognitive load constitute a major reason for "neurophobia" in medical education.[1] As part of an effort to improve active learning among students, we propose an active learning pedagogy in neuroanatomy based on 5E instructional design integrated with collaborative learning and hypothetico-deduction-based reasoning.

The 5E design, based on *Merrill's* instructional design principles, postulates that: a) a learner should be able to solve real-world problems; b) existing knowledge should be re-activated and used as a scaffold for new knowledge; and c) new knowledge should be applied by the learner and integrated in possible ways.[2] In order to attain these principles, students need to be engaged, made to explore, elaborate, explain, and evaluate [5Es]. In a two-hour session, we initially briefed students about the functional columns and cranial nuclei arrangement in the brainstem. I) *Engagement:* For the first activity, students were instructed to create a paper-based schematic model of the brainstem and specify functional columns using prescribed colours. As this activity connects prior knowledge to future activities, it engages them with the knowledge base. The subsequent phases consisted of four more activities: II) *Exploration:* students were asked to identify and label annotated structures in flashcards containing stained brainstem sections. III) *Explanation*: next, students were asked to link clinical correlates to corresponding structures in the brainstem using five extended match-type questions. Students were allowed to "think-pair-share" with their peers. IV) *Extension:* following this, students were presented with a PowerPoint® presentation containing five clinical case vignettes corresponding to classical brainstem vascular lesions. Students were prompted to differentiate and identify the level of the lesion on an individual basis. This necessitates hypothetico-deduction reasoning in novice students, leading to neuroanatomical localization. V) *Evaluation:* students were instructed to construct a concept map outlining the following cues: 1) anatomical site of lesion; 2) name of the syndrome; and 3) name of blood vessel involved. We designed this sequence of cues according to *Marzano's taxonomy* [retrieval – comprehension – analysis – knowledge utilization].[3] At the end of the session, we revealed the answers along with their corresponding explanations.

We received positive feedback responses from most students and peer faculty. Upon compiling the informal feedback survey results from the students, we found that 72% of students (91 of 126) felt that the presented instructional design was more conductive for their learning when compared to conventional modalities. In all, 87% (110 of 126) of the students noted that the sequential narration helped them explore core neuroanatomical concepts at a deeper level. Reinforcing cognitive schema on equivalence-based instruction may lead to a significant reduction in cognitive load for students.[4] As this 5E instructional design involves zero cost and minimal technology infrastructure, it can be implemented in a low-resource setting as an easy tool for constructivist learning and hypothetico-deduction in neuroanatomy with a significant reduction in cognitive load for students.

Ethical approval

Though it is an innovative educational method, we have conducted it under the purview of curriculum. This enabled us to maintain ethical integrity and thus warranted mere intimation

***Corresponding author:** Dinesh Kumar, Email: dinesh.88560@gmail.com

© 2020 The Author(s). This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.

to ethical review committee. We narrated the steps to students and obtained verbal consent before commencing the session. The feedback responses were provided on anonymous basis.

Competing interests

On behalf of both authors, the corresponding author declare that there are no conflicts of interest

Authors' contributions

DK has defined the concept, done literature search and designed the manuscript. RS has contributed towards manuscript preparation, edited and helped in terms of technical inputs

References

1. Abulaban AA, Obeid TH, Algahtani HA, Kojan SM, Al-Khathaami AM, Abulaban AA, et al. Neurophobia among medical students. Neurosciences (Riyadh). 2015;20(1):37-40.
2. Balci S, Cakiroglu J, Tekkaya C. Engagement, exploration, explanation, extension, and evaluation (5E) learning cycle and conceptual change text as learning tools. Biochem Mol Biol Educ. 2006;34(3):199-203. doi: 10.1002/bmb.2006.49403403199.
3. Marzano RJ, Marzano JS. The key to classroom management. Educ Leadersh. 2003;61(1):6-13.
4. Sunde KE, Cutsforth-Gregory JK, Leep Hunderfund AN. The basic four approach to clinical neuroscience instruction: using cognitive load theory to enhance case-based learning. J Med Educ Curric Dev. 2018;5:2382120518815698. doi: 10.1177/2382120518815698.