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Changing teaching strategies and lecture preparation to improve medical students' knowledge acquisition and retention

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Abstract

Background of the study: Lecturers are driven by a passion for transferring knowledge to students. However, the teaching and learning process is often carried out in a tight schedule, causing lecturers to overpack lectures to cover the necessary learning outcomes. Due to the extensive medical curriculum and time constraints, students must endure long, boring, and demotivating lectures, affecting their ability to acquire and retain knowledge.

Problem Statement: Medical Students' failure to engage in long crammed lectures affected their ability to acquire, recall and retain new knowledge. Therefore, it is imperative to find new teaching strategies to create a meaningful learning experience and improve student engagement, knowledge acquisition and retention.

Aim: Explore new teaching and lecture preparation skills to help students acquire and retain knowledge when learning complex concepts.

Objective: To adopt suitable teaching strategies and improve lecture preparation skills to help students acquire and retain knowledge.

Study questions:

1. Why the change in teaching strategies and lecture preparation can help students acquire and retain knowledge?
2. How did the change in teaching strategies and lecture preparation help improving students' knowledge acquisition and retention?

Literature Review and Underlying Theories: Two theories underlying this action research are Cognitive Load Theory and Knowles' adult learning theory.

Methodology: Mixed-method action research was adopted, and third-year medical students were recruited for this study.

Results and Analysis: The findings revealed that apart from the students' increased levels of satisfaction and engagement with the learning process, there was a significant improvement in their ability to acquire and retain knowledge.

Conclusion: Changing how complex concepts are taught using different teaching strategies and lecture preparation could improve students' learning experience and help improve knowledge acquisition and retention.

Keywords: Teaching strategies, lecture preparation, increase knowledge acquisition and retention, improve student engagement

Introduction

Core conditions in the medical curriculum are commonly covered in didactic lectures; despite evidence questioning learners gaining and retaining knowledge [1]. The task to cover each outcome is overwhelming, and the excessive focus on content causes lecturers to deliver long, monotonous lectures affecting students' ability to gain and retain knowledge [2, 3]. To ensure that the curriculum's contents and outcomes are covered on time, they are often left with no choice but to cram each session with heavy information [4]. Hence, lecturers must improve their teaching approaches to create a learning environment that covers critical learning outcomes within the stipulated time while enhancing students' engagement and motivation [5, 6].

Problem Statement

During a lecture on epilepsy in pregnancy, the researcher noticed that seventeen (3rd Year) NUMed Medical students were disinterested in the lecture.

Their lack of engagement and participation in the session was attributed to the lecture's monotonous delivery. At the end of the 30-minute lecture, the researcher used the remaining time to ask for their feedback on the day's session. As expected, they did not enjoy the lecture, and the researcher felt that the lecture's content could be improved to enhance students' learning experience and acquire a complex topic. Based on the students' responses, the researcher decided to approach the topic differently and conduct another session on the same topic at another time.

Aim: Explore new teaching strategies and lecture preparation skills to help students acquire and retain knowledge when learning complex concepts.

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Literature review and underlying Theories

The backbone of this study is Sweller's Cognitive load theory. The theory divides memory into two sections, namely i) short or working memory and ii) long-term memory^[7] (see Figure 1).

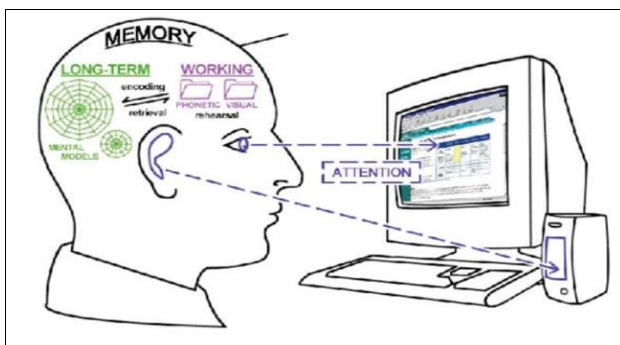


Fig 1: Cognitive load theory^[26]

According to Cowan, 2001^[8], the human working memory has its limitations. It can hold a certain amount of information for a short time, causing a critical limitation of human cognition. Kane, *et al.*, 2007^[9] and Gathercole, 2003^[10] believed that learners are dependent on their ability to expand their working memory. Failure to do so could hamper their effort to learn when the memory's capacity is exceeded^[11]. Baddeley & Hitch, 1974^[12] posited that working memory is responsible for processing information through visuospatial information and phonological information. These views align with Yuan *et al.*, 2006^[13] who stated that individual working memory performance, cognitive abilities and academic achievement are all correlated.

The working memory's limitation could be expanded by reducing the intrinsic cognitive load (relates to inherent characteristics of the content to be learned) and extraneous

cognitive load (the instructional material used to present the content). The reduction process is crucial as it enhances the germane cognitive load (load imposed by learning processes) (see Figure 2). If the working memory is overloaded, the stored memory would be lost, and less long-term memory is achieved^[7, 11].

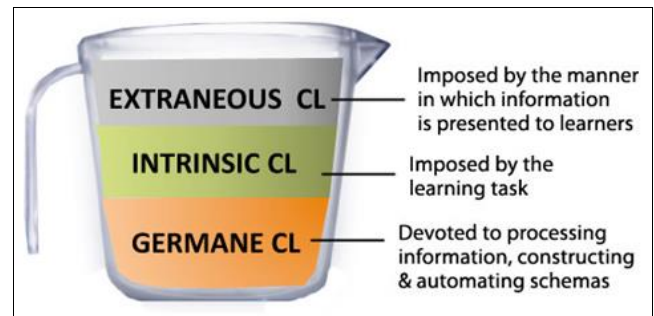


Fig 2: Types of cognitive loads^[27]

Sweller & Chandler, 1994^[14] described intrinsic cognitive load as difficulties experienced when attempting to understand a subject matter. Specifically, many interactive materials are more challenging to understand than a smaller number of materials and/or low interactivity^[15]. However, despite having the same material and interactivity, some types of content are more complex^[7]. The ability to use intrinsic load effectively is dependent on the subject matter and the individual's capacity to activate the prior knowledge to recall what had been learned^[16].

The instructional material evokes an extraneous cognitive load. It does not contribute to learning directly and can be altered using instructional interventions^[17]. The load is avoidable by preventing the "split-attention" effect, where learners must keep one domain element in memory while searching for another element relatable to the first^[18].

The working memory's capacity can be manipulated when the visual and auditory parts are utilised simultaneously. An extraneous load may arise only one of the working memory's subsystems are used. Therefore, Low & Sweller, 2005^[19] recommended combining visual and auditory materials would increase the working memory's efficacy. Baddeley & Hitch, 1974^[12] also opined that redundancy should be avoided as it could lead to unnecessary cognitive load.

Kolfschoten *et al.*, 2010^[20] defined germane load as the students' understanding of the contents and their effort to construct a schema to understand the processed information. Comprehension is achieved when students can interpret, exemplify, classify, infer, differentiate, and organise information effectively^[7]. Germane load is reflective and represents students' effort to construct schema linked to their interest and motivation^[21]. Subsequently, the process leads to forming a set of learning strategies employed to understand the delivered content, creating a more positive learning experience^[22].

Another theory relevant to this investigation is Knowles' adult learning theory. The theory's assumptions and principles of adult learning emphasised the importance of motivating learners to relate what they have learned to their practice and real-life experiences. Pappas^[23] believed that exposing students to real-life instances would keep them motivated while allowing them to knowledge consolidation and recall.

Methodology

This action research adopted a mixed-method approach. The study was carried out in Newcastle University Medicine Malaysia (NUMed) in January 2018 and involved a group of seventeen 3rd-year medical students. The students were part of the group who attended their placement in Woman’s health. The lecture was on epilepsy in pregnancy, and during the first lecture, the researcher noted that the students were inattentive and passive. They were not able to understand the lecture’s content and failed to remember what was taught. When asked for feedback, 15 out of 17 students did not like the lecture and how it was delivered.

Based on these observations and feedback, the researcher made significant changes to the existing content and teaching strategies. Another lecture on the same topic was scheduled based on the students’ availability, and they were invited to attend the lecture. The responses were positive compared to the previous session, where 15 out of 17 enjoyed the second lecture. The percentage for feedback was used as part of the quantitative data.

For the qualitative strain, the researcher carried out a focused group interview to obtain students’ perceptions of the lectures. The students were invited via emails, and six students volunteered. For ethical purposes, the students were briefed on the study’s purpose, and informed consent to participate in the study was taken.

The discussion held at the university’s library discussion room, was recorded with the students’ permission, and their anonymity was preserved. The students were interviewed for approximately 10 to 15 minutes.

The semi-structured interview questions are as follows

1. Which lecture was more effective for your learning to gain and retain knowledge?
2. What makes the lecture you are interested in more effective?
3. Show differences between the lecture you liked versus the one you did not.
4. How do you think that the lecture you choose made a better gain and retention of knowledge for you?
5. What was the difference in the flow of the lecture you prefer?
6. Which lecture is more practical for students’ study? Why?
7. Which lecture was motivating for you? Why?
8. Which lecture do you think helps in your clinical implementation? Why?

The audio-recorded discussions were transcribed verbatim. During the transcribing process, the researcher listened to the recording several times. The transcripts were read repetitively and analysed using the Interpretative Phenomenological Analysis (IPA) framework. The concepts were labelled, and codes were attached to the data. The codes were subsequently grouped into similar themes, which emerged from the interpretation of the identified coded data.

Results and Analysis

The feedback showed that 88.2% of students disliked the first lecture, while 88.2% liked the second lecture.

The focused group discussion results and analysis showed that the students agreed that the second lecture helped to gain & retain knowledge due to; content, structure, and fluency factors. The second lecture helped more in learning as it was motivating, relatable to their study, and has many clinical implementations (See Figures 3, 4, 5 &6).

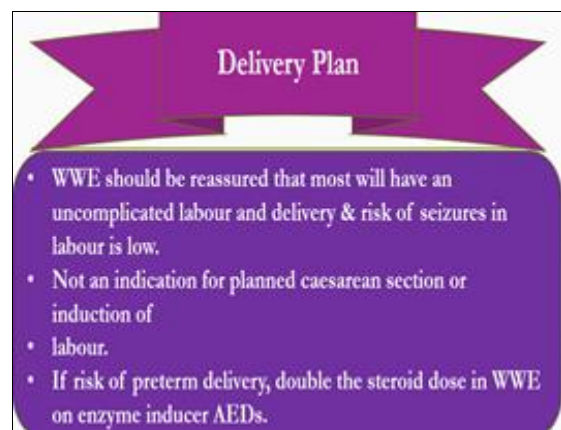


Fig 3: First lecture

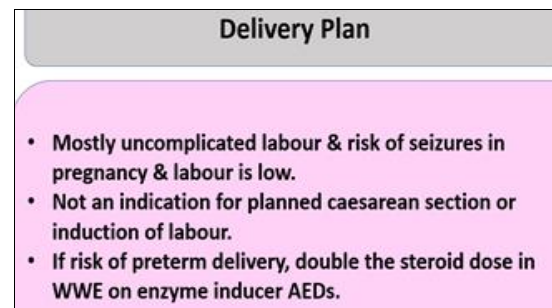


Fig 4: Second lecture

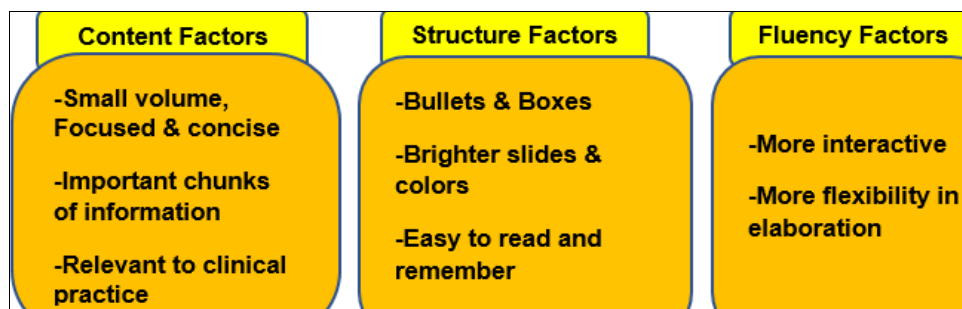


Fig 5: Participants agreed that the second lecture helped them gain & retain knowledge

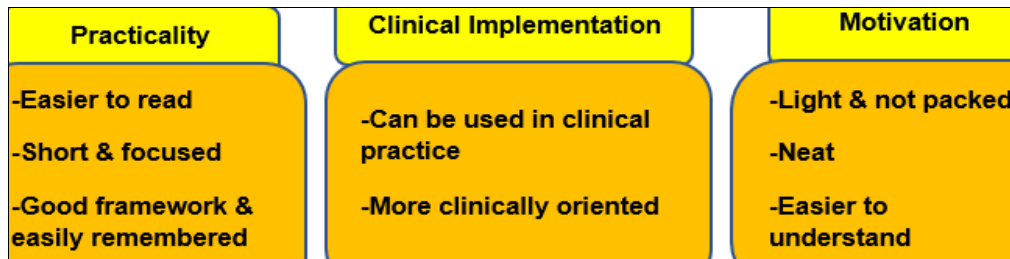


Fig 6: How the second lecture help learners to learn

Discussion

Participants agreed that the second lecture helps them gain and retain knowledge related to these factors.

Student 1 commented that “the first lecture looks like guidelines packed and detailed” whilst Student 2 opined that “its presentational aspects enhance concentration and recall.” Student 3 shared that he remembered most from the first lecture was the slides’ background colour, which affected his ability to focus on the teaching and content. Unlike the first lecture, he felt that the second lecture enhances engagement and concentration. The second lecture’s fluency is consistent with Sweller’s Cognitive Load Theory [7]. The session was more interactive and had flexible elaboration that helped structure an excellent practical framework.

The second lecture brought real-life instances into the classroom as it associated the new knowledge with clinical practices. The knowledge’s relevance to their future medical career motivated them to learn, and their increased level of motivation during the second lecture is also linked to Sweller’s Cognitive Load [7]. The second lecture was delivered in small chunks of focused knowledge and neat slides. It was also delivered in an interactive elaboration which stimulated learners’ visual and auditory channels as suggested by Low & Sweller, 2005 [19]. The new delivery process reduced intrinsic and extraneous cognitive loads on students’ working memory. Sweller *et al.*, 1998 and Bannert, 2002 [15, 16] posited that when the information was presented in smaller chunks related to their previous knowledge (intrinsic load) and the use of neat slides and class discussion (extraneous cognitive load), students were able to comprehend and process the new input efficiently. Gross-Davis, 1993 [26] suggested that lectures should be audibly and not visually prepared using short, straightforward sentences. Sawatsky *et al.*, 2014 [27] noted that to match learners’ needs lectures must be more focused, active, and shorter.

With the other loads reduced, the strategy increased their germane cognitive load through active engagement in practical framework discussion described by de Jong, 2010 and Schnotz, 2007 [7, 22]. The second lecture had clinical implementation through which students could integrate new information with their prior knowledge about epilepsy taken in their foundation of clinical practice rotation in the first semester and built long-term memory. This finding was consistent with Bannert, 2002 and Shadieva *et al.*, 2015 [16, 21].

Knowles’ adult learning theory stated on the third Principle of Andragogy that adult learners tend to have more interest in learning subjects relevant to them and benefit them either on a professional or personal level [23]. In this action research, improving the lecture’s content and integrating clinical implementation helped students gain and retain

knowledge. According to Morton, 2007 [28], an outstanding lecture is organised, informative, easy to follow, giving relevant examples, and developing discussion and participation. Sheldon and Biddle, 1998 [29] supported that motivated student retain knowledge longer, develop a deeper understanding and demonstrate greater creativity and cognitive flexibility.

Conclusion

This study showed how lecturers could achieve remarkable changes in helping students acquire and retain the knowledge they modify and refine their teaching strategies and lecture preparation. Creating neat lecture materials using suitable visual properties (slide colours and font size) and a practical content summary would help students understand the subject matter effectively. Moreover, when information is presented in smaller chunks, students’ engagement with the learning process will improve, allowing them to engage, digest, reflect and interact actively with their peers and lecturers. The learning experience would also benefit from integrating practical and real-life examples of motivation and learning in the classroom.

Limitations of the study

As this study was carried out in one medical university and involved a small number of participants, the findings could not be used to generalise the learning preferences of medical students nationwide. Moreover, more detailed feedback on the session is needed, especially to make clear quantitative comparisons.

Recommendation

The researcher recommended that future studies consider investigating the benefits of clinical implementation and life examples on medical students’ learning experience. Future research could use teaching strategies and lectures as independent variables when exploring lecturers’ workload to produce teaching materials to improve students’ knowledge acquisition and retention.

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