CASE STUDY

Enhancing concept map teaching technology with student's handwritten concept map notes

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I. INTRODUCTION

Concept maps serve as teaching and learning tools that appear to assist medical students in cultivating critical thinking skills. This is attributed to the adaptability of the tool, acting as a facilitator for knowledge integration and a method for both learning and teaching. The extensive array of contexts, purposes, and approaches in utilising Concept maps and tools to evaluate critical thinking enhances our confidence in the consistent positive effects (Fonseca et al., 2023).

In the realm of medical education, employing concept maps as a learning strategy can prove to be beneficial (Torre et al., 2023). Concept maps, visual representations of learners' understanding of a set of concepts, have proven to be valuable tools in medical education (Novak & Cañas, 2008). The integration of concept maps as a teaching strategy allows for the depiction and exploration of the relationships among various medical concepts (Ruiz-Primo & Shavelson, 1996). In our instructional approach, instructors employ concept maps during lectures (Appendix 1), emphasising the interconnectedness of key concepts. Students actively participate in creating their own concept maps, facilitating collaborative learning. This flexible approach accommodates diverse learning styles, with students using both concept map notes and textbooks. The final evaluation includes an assessment of students based on

their application of concepts outlined in the concept maps, contributing to a well-rounded and adaptable learning experience in medical education.

In this study, we aimed to assess the impact of utilising the concept map teaching technique in conjunction with concept map notes on the academic performance of students.

II. METHODS

In the field of medical education, the adoption of Competency-Based Medical Education (CBME) introduced by the National Medical Commission (NMC) for the MBBS 2019 batch has led to the implementation of various innovative teaching approaches. This research, conducted with the approval of the Institutional Review Board (IRB) under the reference number 020/09/2023/Faculty/SRB/SMCH, focuses on comparing the academic outcomes of two MBBS batches of Saveetha Medical College and Hospital.

We evaluated the first-year results of the 2020 MBBS batch, which did not receive concept map teaching, and compared them with the first-year results of the 2021 MBBS batch, where concept map teaching was implemented. Students are encouraged to create concept map notes on A3 white sheets, as illustrated in Appendix 2. Furthermore, "subject-wise Saveetha Maps" were

developed, incorporating handwritten notes taken by students on each topic.

Generally, it was advised to all the included students to carry on with the books and concept map notes. Furthermore, if they encounter any difficulty in referring the books, they are advised to make use of the concept map notes. In our educational setup, we promoted the combined use of concept maps notes and books for all the students. All students received their compiled handwritten notes, which include all the topics included in their particular subject, as a part of the final evaluation during summative assessment at the end of academic year, and their performance was examined by the examiners.

III. RESULTS

Performance of both the 2020 MBBS batch and the 2021 MBBS batch was assessed. To compare the percentages of first-year results of the 2020 MBBS batch (without concept map) and first-year results of the 2021 MBBS batch (with concept map), a t-test was used, and the results were highly significant (P <0.001) (Table 1 and Appendix 3).

Percentage	N	Mean	SD	t value	P value
First-year results of the 2021 MBBS batch (with concept map)	248	75.7100	7.70000	14.953	<0.001*
First-year results of the 2020 MBBS batch (without concept map)	249	62.7800	11.25000		

Table 1. Mean comparison for percentages of first-year results of the 2021 MBBS batch (withconcept map) and the first-year results of the 2020 MBBS batch (without concept map)

IV. DISCUSSION

For students and physicians who are pursuing a career in medicine, teaching via concept maps has been proven to be an effective tool. However, there has been a lack of exploration regarding its integration with students' personally crafted concept map notes. The initial year of the curriculum encompasses subjects such as anatomy, physiology, and biochemistry. Our investigation revealed that the average percentage of first-year results for the 2021 MBBS batch, which had been exposed to the concept mapping teaching technique, was 75.7%. In contrast, the mean percentage of first-year results for the 2020 MBBS batch, which had not been exposed to the concept mapping technique, was 62.8%. The disparity in results proved to be statistically significant (P <0.001) as indicated in Table 1 and Appendix 3.

This shows the very good effectiveness of the concept map teaching technique supplemented with students handwritten notes over conventional teaching methods like PowerPoint lectures on students' academic performance (Niamtu, 2001).

Based on our experience, we wish to emphasise that elucidating key concepts through concept map lectures may prove beneficial for slow learners. Given the extensive topics in the MBBS curriculum, this approach may enable slow learners to prepare for exams more efficiently. Further research should be conducted to see the effect of concept maps on the learning capacity of slow learners. On the other hand, quick learners may leverage the advantage of quickly summarising and identifying main points from these handwritten concept map notes, complementing their book reading efforts. Substituting conventional teaching methods with the concept map teaching approach, enhanced by students' handwritten concept map notes, significantly improves academic performance.

V. CONCLUSION

According to the findings of our study, we deduce that substituting conventional teaching methods with the concept map teaching approach, enhanced by students' personally crafted concept map notes, leads to a more significant enhancement in students' academic performance. In future studies, students may be classified into slow learners and fast learners depending upon the results of the previous year's final examination and the feedback should be collected from the students in regards to the concept maps teaching approach.

Note on Contributors

Sulthan Al Rashid contributed to the concept, scientific content, data collection, statistical analysis, and manuscript preparation.

Syed Ziaur Rahman helped with the manuscript writing, editing, and proofreading.

Santosh R Patil helped with the review and editing of the manuscript.

Mohmed Isaqali Karobari helped with the review and editing of the manuscript.

The final manuscript has been read and approved by all the authors.

Ethical Approval

This study was conducted after IRB approval (020/09/2023/Faculty/SRB/SMCH).

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Declaration of Interest

The authors claim to have no conflicts of interest.

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Appendix 1: Anticancer pharmacology concept map
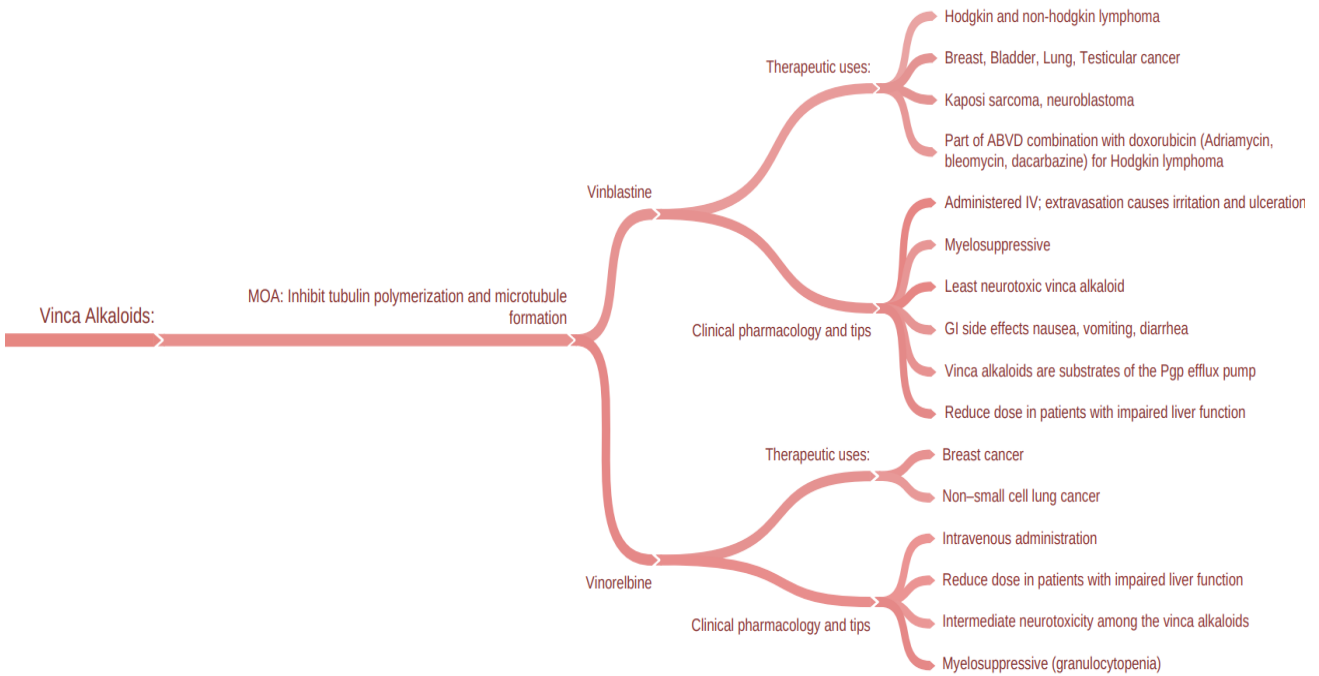
Appendix 2: Antipsychotic handwritten Saveetha map notes
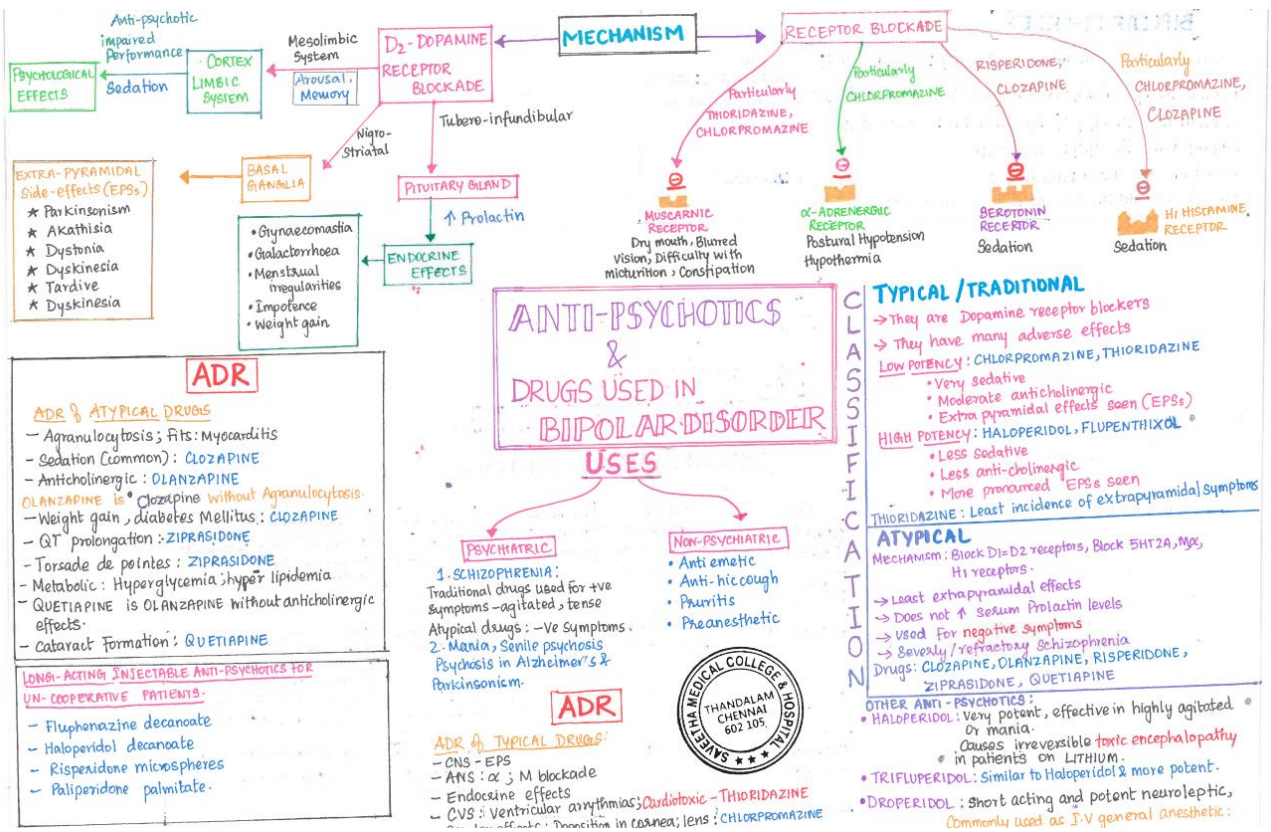
Appendix 3: Comparison of the mean percentages of the first-year results of the 2021 MBBS batch (with concept map) and the first-year results of the 2020 MBBS batch (without concept map)