Concept Mapping as a Tool to Promote Cognitive Integration

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Introduction

For 20 years there has been a push to integrate the basic and clinical sciences in medical school curricula. Recently, studies have suggested that cognitive integration by the student is best achieved when the relationships between basic and clinical domains are explicitly demonstrated. Concept mapping in response to a prompt, which adds students to these explicit relationships among clinical and basic science concepts, should provide explicit connections that lead to a deeper conceptual understanding of the material. We designed a study to test the hypothesis that concept mapping improves the ability of students to cognitively discriminate between multiple endocrinopathies when compared to students who were provided with similar resources. We also looked to see if knowledge retention was correlated with concept mapping or the type of notes taken during studying.

Questions Addressed

- Do students who use concept mapping retain knowledge better?
- Does the type of resource affect the type of notes taken by the students?
- Do students who take integrated notes retain knowledge better?

Methods

The study was based on an experimental design developed by Kulaevgeram et al. (2015) and was approved by the UNE IRB. Participants in the study were recruited from the first-year medical student class. The students who volunteered were divided into three groups based on their grade in the fall Osteopathic Medical Knowledge (OMK) course and were randomly assigned from each group to one of the three experimental groups. The average OMK grade between the three groups was not significantly different.

Students in each of three experimental groups were given a written resource about related clinical disorders associated with the hypothalamic-pituitary-adrenal axis, where the resource either had a basic science section following a clinical description of the disorders (BC group), or the same information that was rewritten so that the causal links between the basic science and clinical features of each of the disorders was explained (INT group). A third group (BC- cMAP) was given the BC resource and was given a prompt to create a concept map to show the basic science mechanisms underlying the clinical presentations of the endocrinopathies. Students were given an hour to study the material or create the concept map. Students were given a white board on which to create the concept map and were directed to use whiteboard resources or take notes on a blank piece of paper which was supplied. All resources and notes were collected prior to the testing session and pictures of the concept maps were taken.

Factual comprehension and the ability to cognitively discriminate between disorders was tested following the study session with a single memory text of facts about the disorders, Memory Test 1, and a test that used clinical vignettes to test clinical reasoning skills, Diagnostic Test 1. A week later, students were tested for their retention of the material. Because the questions on the second set of tests were only slight modifications of the questions from the Memory Test 1 and Diagnostic Test 1 and assessed the same concepts, the retention rates could be calculated as the percent of the questions that were correctly answered on the first tests, which were also answered correctly on the second tests.

Following the second testing session students were surveyed regarding their impressions of the study materials given, including if they thought concept mapping helped them learn the material. Student notes taken during the study period were collected and reviewed by three of the investigators. These reviewers used a rating scale of 0-3 to describe and enumerate the type and quantity of notes each student took based on the categories listed in Table 1. The averages of these ratings are listed in Table 1. For the integration category, a rubric was used to quantify the amount of integration between basic and clinical concepts.

Results

Table 1

<table>
<thead>
<tr>
<th>Type of Notes</th>
<th>Integrated Basic and Clinical</th>
<th>Basic Science Only</th>
<th>Clinical Science Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes in Minutes</td>
<td>20.00</td>
<td>50.00</td>
<td>90.00</td>
</tr>
<tr>
<td>Outlines/Flowcharts</td>
<td>20.00</td>
<td>50.00</td>
<td>90.00</td>
</tr>
<tr>
<td>Tables</td>
<td>20.00</td>
<td>50.00</td>
<td>90.00</td>
</tr>
<tr>
<td>Graphics</td>
<td>20.00</td>
<td>50.00</td>
<td>90.00</td>
</tr>
<tr>
<td>Drawings</td>
<td>20.00</td>
<td>50.00</td>
<td>90.00</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Does the type of resource affect the type of notes taken by the students?

- No significant differences were found between the groups regarding the quantity or type of notes they took.

Do students who take integrated notes retain knowledge better?

- Eight of 17 in the INT group had integration scores greater than 1.5 while only 4 of 18 in the BC group had scores greater than 1.5.

Do students who use concept mapping retain knowledge better?

- We are unable to draw any conclusions regarding the effects of concept mapping on learning due to the study design. It was clear that the students could not finish the concept mapping task within the time period, which significantly affected their performance on all of the tasks.

Conclusions

Our study suggests that the type of resources can influence the type of notes taken by students, and that the process of taking integrated notes can enhance learning and retention. This was a pilot study and is limited by a small sample size. Additional research is planned to confirm and expand on these results.