How Not to Lose Your Students with Concept Maps

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Abstract

In the reformation of teaching practices in physiology and other science courses, concept maps have been increasingly introduced as a tool that promotes meaningful learning and integration of ideas. Following a faculty training session on the use of concept maps in the classroom, four Integrative Physiology faculty members independently began using concept maps in four different core physiology courses. Students in one course in particular had substantially higher perceived value in the concept map technique on the end-of-term surveys. Following this result, we used additional end-of-term survey questions, faculty and teaching assistant interviews, and a review of course materials to assess what factors lead to greater student value in the technique. Based on a review of these materials, we identified two key factors that students indicate are important for their acceptance of the technique. One, the mapping activity needs to be appropriately designed to meet the educational goals, i.e. not excessively complex. Two, there needs to be adequate feedback from teachers or teaching assistants. When implemented properly, students view concept mapping as a valuable tool in their learning of physiology, but this requires careful attention to the issues outlined above.

Study Purpose

In this study, we examined student perceptions of usefulness of concept mapping across four different physiology courses that varied in their implementation. Three of the courses had similar responses, with about half the students saying concept mapping was of little or no value, while in the fourth course students found them far more useful to their learning. With this finding we sought to determine what factors led students to find concept maps helpful for their learning compared to the three other course.

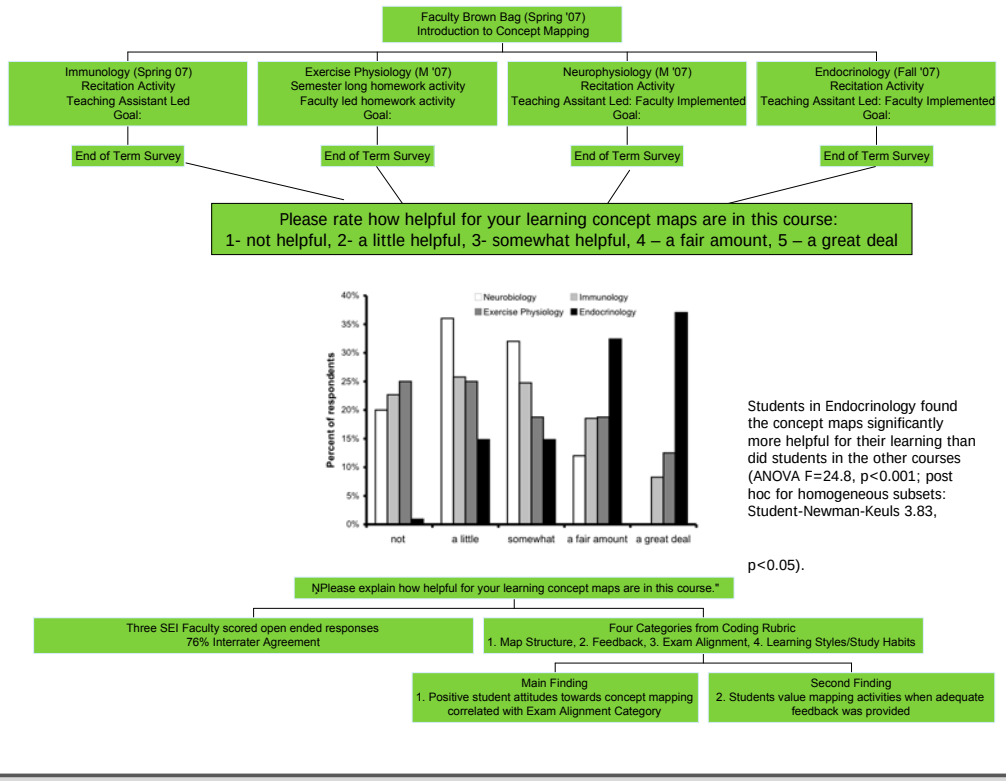
Approval: University of Colorado, Boulder Institutional Review Board (exempt status, protocol 0108.9)

Concept Map Implementation

Table 4. *Concept map implementation in IPHY courses.*

	Endocrinology	Exercise Physiology	Immunology	Neurophysiology
Practice maps	**With instructor; endocrinology-related**	With instructor; physiology-related	With instructor; immunology-related	With instructor; non-physiology related
No. of terms	**15-20**	75	20	20+
Source of terms	**Instructor**	Students	Instructor	Instructor
Frequency within course	**1 per 4 weeks (4 maps)**	1 per 5-week course (1 cumulative map)	1 per 2 weeks for 8 weeks (4 maps)	8 per week for 2 weeks (16 maps)
Setting of activity	**Recitation**	Homework	Recitation & Homework	Recitation & Homework
Done in groups?	**Yes, groups also had to present their maps to other groups and encouraged to give feedback to each other.**	Not necessarily, though students were allowed to work outside class together.	Yes, groups did not present their maps to other groups and did not necessarily work together outside of class to finish work.	Yes, groups did not present their maps to other groups.
Instructor Feedback	**Some (when asked discussed maps and helped clarify concepts and connections)**	Some (when asked provided guidance on how to choose concepts for map)	No	No
Exam alignment with concept mapping activity	**100% of corresponding exams**	N/A (due to the fact that each student chose their own concepts to map)	6% of corresponding exams	N/A (due to cancellation of map activities)

Methods & Results



Students in Endocrinology found the concept maps significantly more helpful for their learning than did students in the other courses (ANOVA $F=24.8$, $p<0.001$; post hoc for homogeneous subsets: Student-Newman-Keuls 3.83, $p<0.05$).

Example Quotes from Students Used for Coding

Category	Example Quote 1	Example Quote 2
Exam Alignment	"The concept maps were very helpful for exam 3 and 2 because the test questions were more congruent with the use of the concept maps. The first test was more matching and the concept maps did not really help with that as much."	"I did not find them useful most of time but though they were a form of busy work."
Feedback	"Concept maps would have been useful if there had been some sort of key that you could compare your concept map to. E in order to see whether or not your had all the components connected where they should be."	"They were not useful because there was barely any instruction or help from the TA. ET There was never any active discussion about the course material."

Summary of Student Open-ended Responses

Table 5. *Summary of specific reasons students gave for helpfulness of concept maps.*

Specific Reasoning Categories	Endocrinology (n=41)	Exercise Physiology (n=10)	Immunology (n=38)
NOT helpful			
Presentation	**26%**	**83%**	**23%**
Size (too big)	(24%)	(83%)	(13%)
Didn't like group work	(2%)	(0%)	(10%)
Feedback	**35%**	**0%**	**54%**
Wanted answer key	(15%)	(0%)	(8%)
Wanted more discussion	(20%)	(0%)	(31%)
Wanted more encouragement	(0%)	(0%)	(15%)
Exam Alignment "busy work"	**2%**	**33%**	**16%**
Helpful			
Exam Alignment Helped with exam preparation	**17%**	**0%**	**3%**

Values are given as percents of students giving specific reasoning.
In some cases, students listed multiple reasons. n= number of students giving specific reasoning.

Conclusions

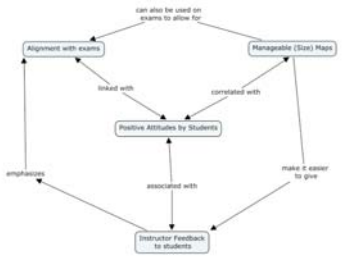
1. Concept mapping activities should be clearly aligned with course assessments (summative or formative). The alignment should be done in a way that is both clear for instructor but students as well.

Why? Two possible considerations.

A. Grades are highly motivating factor for students,
B. Exams may define for students what they are supposed to be learning in courses where learning goals do not exist.

2. Adequate feedback should be provided to the students. This feedback can come in various forms:

A. Instructor to student feedback
B. Peer to peer feedback.



Citations

1. Novak JD, Canas AJ. The theory underlying concept maps and how to construct and use them (Technical Report IMHC Cmap Tools). Pensicola, FL: Florida Institute for Human and Machine Cognition, 2006-01, Rev 01-2008; available at: http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf

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