Using Concept Cartoons as Formative and Summative Assessments in Biology

1 Introduction

- Brenda Keogh and Stuart Naylor developed the use of Concept Cartoons in the 1990s as a means of addressing science misconceptions and encouraging discussion about science (1).

- Joseph Stepans’ described a sequence of steps that students could be directed through to address science misconceptions. He called this progression “The Conceptual Change Model”, and it is shown below (2).

- This capstone project focused on the use of Concept Cartoons to assess student learning throughout and at the end of a cell biology and a genetics unit in an introductory high school biology course.

2 Project Questions

Central Question: How can concept cartoons be used as a form of alternative assessment to guide and gauge student learning that addresses common high school biology misconceptions?

Sub-questions:
- How well does the use of prepared concept cartoons serve as a formative assessment in gauging student misconceptions in biology?
- How well does the use of prepared Concept Cartoons serve as a summative assessment in gauging student learning of concepts within a study unit?
- Do collaborative group generated Concept Cartoons increase individual student summative understanding of biology concepts?
- How does the use of concept cartoons impact my teaching of a unit in biology?

3 Methodology

Teacher constructed concept cartoons (see above left for an example) were used as formative probes to lead students through the first two steps of The Conceptual Change Model (CCM).

- Students were asked to write down which statements they thought were true and then compared their choices with the entire class.

- Lab activities and classroom discussions helped students address steps three and four of the CCM.

- As a summative assessment, the concept cartoons were used again to prompt students to explain the valid statement and to give an explanation for all of the statements in the cartoon.

- Introductory and final feedback surveys, a focus group interview, and pre- and post-test data were also analyzed to determine the effectiveness of using this visual approach as a formative or summative assessment.

4 Sample Group

This project was conducted at a large suburban high school in Kansas with a sample size of 76 biology students.

- Gender: 55% Male, 45% Female
- Special Designations:
  - 3% English Language Learner
  - 23% Economic Disadvantage
  - 0% Special Education
  - 15% Non-Caucasian

5 Excerpts from Key Findings

Unit Test Scores Comparison

- 18.5% increase in average unit test scores from biochemistry unit (non – visual misconception probes used) to cells and genetics units when Concept Cartoon probes used
- 4.5% decrease shown in the previous year when no misconception probes of any type were used

Student Feedback: Usefulness of Concept Cartoon Probes

The average of the seven categories shown in the graph to the left was a score of 3.66. This indicated that the group found it was “somewhat true” that the Concept Cartoon activities were of value.

Overall, students responses on the final feedback survey showed they found the Concept Cartoon misconception probes to be useful and helpful learning activities.

6 Conclusions

- Concept Cartoons are a useful tool to integrate into a differentiated classroom.
- Future Concept Cartoons will be developed with an emphasis on characters in a lab setting talking about related biology misconceptions.

7 Sources

1. Keogh and Naylor’s work with concept cartoons: http://www.conceptcartoons.com/science/wha t_is_a_concept_cartoon.html


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