THE EFFECTS OF SIMPLIFIED DIAGRAMS ON STUDENT MISCONCEPTIONS ABOUT EVOLUTION

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Introduction

Modern science educators are faced with a new generation of learners that comes with a unique set of challenges. This new era demands a new set of scientifically literate individuals, that is, individuals who not only understand scientific concepts but can apply these concepts to everyday life (Bybee, 2010, pp. 4-5).

A commonly misunderstood topic is evolution, the central theory of biology. These are some of the common misconceptions:

- Evolution is "goal-oriented."
- Evolution always results in something better.
- Evolution happens at the individual level.
- Evolutionary innovations typically happen over a few years.

In order to promote understanding of biology and, more importantly, scientific literacy, these misconceptions should be addressed.

Research Question

As the current literature demonstrates, diagrams are useful teaching tools that can help address contemporary issues in teaching science. Diagrams can also have shortcomings that educators can take into consideration when deciding to include them in lessons.

Prior studies have examined the prevalence of diagrams that promote misconceptions and some of the effects these diagrams have. The following question remains:

RQ: How do overly simplified biology diagrams affect the amount of misconceptions students have?

Background and Literature Review

The 21st century has presented new challenges that require scientifically literate individuals (Bybee, 2010, pp. 4-5).

Current research establishes the effect of diagram quality on student learning in science. Visual aids are often used to enhance student learning, given that diagrams simplify complex topics and force students to use prior knowledge. However, diagrams that present inaccurate or overly simplified information can promote common misconceptions (Sirovina, et al., 2019)

One of the most misunderstood scientific phenomena is evolution, which is a process that is considered the central theory in biology. Ineffective teaching strategies have been identified as one of the contributing factors to student misconceptions about evolution. (Gregory, 2009) The goal of this study is to see whether diagrams that simplify evolution are contributors to misconceptions.

Methods

Approximately 100 participants will be tested from the Stanislaus State Biology Department. The participants will be enrolled in General Biology 1 to help control for prior knowledge that students may have about evolution.

Two diagrams, one that is more simplified than the other, will be randomly assigned to participants. In this study, an overly simplified diagram will be one that omits information that is required to draw the following conclusions: evolutionary innovation is often a slow process that takes many years, evolution is not goal-oriented, evolution does not always result in beneficial adaptations, and evolution cannot occur on the individual level.

With the diagram, the students will receive a ten-question assessment. Each question will test for a specific misconception about evolution that is addressed in the diagrams.

The effect of diagram quality on student misconceptions will be investigated by comparing the scores of both groups of students. A significant difference in scores will suggest that one diagram is more effective than the other in reducing specific misconceptions.

Expected Results

The hypothesis for this experiment is the following:

Overly simplified diagrams promote student misconceptions about evolution.

If this hypothesis is correct, we expect that the student group exposed to the overly simplified diagram will perform worse on the assessment than students with the updated diagram. This result is expected because previous studies have demonstrated that visual aids that omit key information about a specific scientific subject tend to promote misconceptions.

Significance

This study aims to identify prevalent misconceptions and how they are spread, specifically by improper visual aids.

Identifying these misconceptions and identifying strategies to combat them is useful in a time that requires students to be scientifically and visually literate.

References

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