Using animation to improve student learning of difficult concepts in undergraduate biology classrooms.

Chan Jason¹ and Paliulis, Leocadia V.²
¹Juniata College, Huntingdon, PA ²Bucknell University, Lewisburg, PA

ABSTRACT Active learning has dominated recent discussion on how to improve science teaching and learning on college and university campuses. Most teaching strategies that include active learning approaches increase student engagement with course material, improve student performance, and foster classroom inclusivity. On two campuses, Bucknell University (PA) and Juniata College (PA), we examined the impact of one strategy, animation production as a mode of learning, on student performance and attitudes. Students produced an animated science video to deconstruct difficult topics like misconceptions and reading of primary literature. They wrote a script for their video, generated storyboards, and then produced a video animation using an iPad or tablet. We posited that animation production would help students learn material more accurately, exercise creativity, and improve their communication skills by telling stories. To address whether animation production improved learning of important scientific concepts, we surveyed upper level biology students at both institutions on their attitudes using a survey, a Likert scale, showed that students either strongly agreed or agreed that using animations improved their “understanding of the hypothesis” of the primary literature and caused them to “more critically analyze the research paper more than a normal reading assignment.” Moreover, students thought that opportunities for creative expression were important in biology classes. However, students also expressed that making the animations required a lot of class time. At Bucknell, students used animation to tackle misconceptions in biology. Students produced a short animation of mitosis, then watched time-lapse videos of mitosis to reveal their misconceptions about the process. Students then reanimated mitosis based on their view of the process. A quiz given two months after the animation projects were completed revealed that students created accurate drawings of chromosome distribution in mitosis, retaining what they learned from watching time-lapse videos and preparing new animations. Further application of animation production in science classrooms may lead to gains in student knowledge and communication.

INTRODUCTION

Goals: To improve student understanding of difficult science concepts

To do this, we aimed to implement team-based learning and stop-motion videos to teach the core concepts and competencies outlined by AAAS’s Vision and Change (V&C). These included core competencies that increase student gains in their ability 1) to communicate and collaborate with other disciplines, and 2) to use modeling and simulations

METHODS AND RESOURCES

1. Script Students craft their story with accurate scientific descriptions and a creative storyline.
2. Storyboards We wanted students to better understand the process and importance of creating a story in science. To do this, we used Alfred Hitchcock’s North by Northwest, whose storyboard examples can be used by students to see the detail required for a story. Examples of a student’s storyboard is below.
3. Students make a video using an animation App - Animation Desk (kdanmobile.com). This app allows creators to sketch their story in layers, so that each frame transitions seamlessly to the next. Video export is easy.

REFERENCES

Hitchcock’s North by Northwest resources
- https://www.youtube.com/watch?v=mEpT9QC3CNU

Animation desk App
Other
- Vision and Change, In Undergraduate Biology Education. AAAS

Student responses to using Animation in classes

Results (misconceptions animation)
16/16 drew chromosomes with correct cohesion patterns in pre-animation
16/16 drew correct cohesion pairs in post-animation
11/16 drew correct cohesion pairs in end-of-semester quiz

Results (paper explanation animation)
14/16 thought animation contributed positively to learning
6/16 complained about the amount of time animations took

Communication primary articles using animation @ Juniata College

Abstract
What’s the student read
- students often have trouble reading and communicating information from primary articles
- students were required to describe the hypothesis of the primary articles
- students were required to describe the hypothesis of the experiment, the methods, and findings
- students were required to communicate a main hypothesis and results of a primary paper

Methods
- Upper level research methods class with 6 students
- A survey, using a Likert scale, showed that students either strongly agreed or agreed that using animations improved their “understanding of the hypothesis” of the primary literature and contributed to “more critically analyze the research paper more than a normal reading assignment.”
- Students then drew correct cohesion pairs in post-animations
- Students then draw correct cohesion pairs in post-animations

Discussion
- Students thought that opportunities for creative expression were important in biology classes
- Students were required to describe the hypothesis of the primary articles
- Students then draw correct cohesion pairs in post-animations
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