

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

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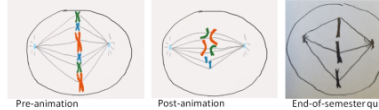


**ABSTRACT** Active learning has dominated recent discussion on how to improve science teaching and learning on college and university classrooms. Most teaching strategies that include active learning approaches **increase student engagement** with course material, improve student performance, and foster 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 on using animation production to learn. **At Juniata**, students produced a 1-2 minute animation to communicate a main hypothesis and results of a **primary paper**. 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 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**.

## Overcoming Misconceptions Using Animation @Bucknell Univ.

- Many students retain misconceptions that can be hard to overcome.
- Goal: use animation to overcome misconceptions about mitosis
- Cytogenetics class at Bucknell University
  - 16 students
  - Junior/Senior-level course
- **Procedure**
  - Students create animation of mitosis as they remember it
  - Students then watch four time-lapse videos of mitosis in various cell types
  - Students then create a second animation, correcting any errors from the first

Sample widely-held misconception: Chromosomes only stuck together at centromeres in mitosis



## INTRODUCTION

**Goals:** To improve student understanding of difficult science concepts

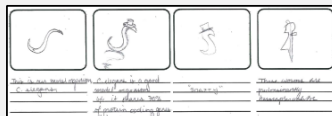
To do this, we aimed to implement team-based learning and **stop-motion videos** to teach the core concepts and competencies outlined by AAAS's Vision and Change (V&C). These included **core competencies** that increase student gains in their ability

- 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.



## Communicating primary articles using animation @ Juniata College

**Abstract**

*What's the students need*

- students often have trouble reading and communicating information from primary articles
- Goal: to use animation to better understand, describe, visualize complex material in articles
- Course: Upper level research methods class with 6 students

**Introduction**

**Methods**

**Results**

**Discussion**

*Procedures*

- student create an animation on that describes one main finding from the research article
- students were required to describe the hypothesis of the experiment, the methods, and findings.
- students worked with our computer center to edit and integrate voice recordings into their animation

## REFERENCES

Hitchcock's North by Northwest resources

- <https://alfredhitchblog.wordpress.com/2015/07/04/north-by-northwest-deconstruction-of-a-scene-the-crop-duster-sequence/>
- <https://www.youtube.com/watch?v=mEpt9QC3CNU>

Animation desk App

- <https://www.kdanmobile.com/en/animation-desk/>

Other

- Vision and Change, In Undergraduate Biology Education. AAAS

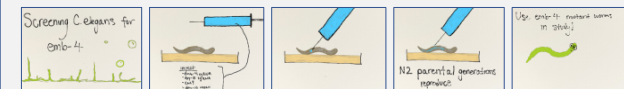
## Student responses to using Animation in classes

### Results (misconceptions animation)

- 100%** 16/16 drew chromosomes with correct cohesion patterns in pre-animation
- 100%** 16/16 drew correct cohesion pairs in post-animation
- 69%** 11/16 drew correct cohesion pairs in end-of-semester quiz
- 89%** 14/16 thought animation contributed positively to learning
- 38%** 6/16 complained about the amount of time animations took

### Results (paper explanation animation)

Example of a series of slides from a student animation, showing part of injection process of the methods section of a paper



Survey Question	SA	A	N
I think making an animation helped me better understand the biology/topic of the research paper	16.7%	33.3%	33.3%
I think making an animation helped me better understand the hypothesis of the research paper	50.0%	50.0%	0.0%
I think making an animation helped me better understand the data/figures of the research paper	33.3%	33.3%	33.3%
I think making an animation helped me critically analyze the research paper more than a normal reading assignment."	16.7%	66.7%	16.7%
I think making an animation helped was a good use of my time in a biology class	0.0%	33.3%	50.0%
I enjoyed making an animation in a biology class	33.3%	33.3%	16.7%
Opportunities to express yourself creatively is important in a biology class	33.3%	66.7%	0.0%

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