The Argument and Evidence for Comics in the Classroom

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Today I'm going to talk about the creation of a comic book textbook, *Optical Allusions,* which was produced specifically for my Sensory Biology class. The project started in 2004 and has taken six years to complete. Today we will consider aspects of the design of this book. In addition to providing a textbook for the course (which had not had one up until that point), I wanted to test comics as an effective way to explain science.

Some might ask, "Why bother?" This is similar to a question my wife Lisa has asked me: "Why do you want kids to read comic books?" It's a very good question. As a kid, comics were an important imaginative outlet for me. I could connect to other worlds. I also learned a lot of vocabulary, words like "invincible," "amazing," and "indestructible." My favorite was a word that I picked up from reading *Peanuts*. I used it on my mom when she asked me if I had eaten the last cookie. I looked at her and said, "Mom, I can't 'denny' it." She gave me a puzzled look. I knew how to spell "deny" and I knew what it meant, but I didn't know how to say it. So, back to why I want kids to read comics. The National Science Board in 2004 identified a big problem with the public's poor understanding of science. It's not that the world isn't amazing and wonderful and fantastically complex and an exciting place. The problem is that scientists haven't done a very good job of explaining this. We do a great job of throwing data out there but we're not always as effective as we could be in conveying the wonder that drives us to do what can be quite tedious tasks. Comics may be one way to tell stories about the natural world that can engage and excite students of all ages.

The work I focus on today are long comic book stories, single-panel works such as *The Far Side,* and strips such as *Peanuts*. There are two major components of graphic stories that make them particularly potent. The first is their visual elements. A little card of text explaining how to exit an airplane may not be the most effective means of communicating the information when the plane is heading into the ocean. The text has to be perceived and processed. But a cartoon (as most planes have) of someone calmly pulling the life vest out and, with a smile, inflating it not only gets the information straight into you brain, but it just looks fun! In this case, you learn how to inflate that life vest quickly!

Comics have had the potential to be a powerful pedagogical tool since the acme of their popularity back in the 1940s. In fact, every four or five years a paper comes out talking about how comics can help kids learn. These papers, however, offer more advocacy than evidence, a way of introducing the possibility of comics to the uninitiated instructor. In 2008, a comic website had an article announcing the publication of a paper in the *School Library Journal* that "proves that comics are great in the classroom." I said, "*&^%^, I've been scooped." But when I downloaded the paper, I found that it was entirely advocacy and that the purported merits, which may seem intuitive, were not supported by any classroom data.[1]

I am interested in the ability of comics to do two things for the non-majors in my Sensory Biology class: a) get them to read about science and b) get them to learn something about science in the process. Of course, this isn't necessarily a disciplinary problem; you could replace "science" in those two statements with any discipline. We all struggle to get our students to do the reading. This is hard even in the classes students want to take. It is an even steeper uphill battle when they are taking a distribution course in a subject area that intimidates them. This is the problem I see with the non-majors in Sensory Biology. I have seen white knuckles gripping the desks on the first day of class. That is not a promising starting point for student engagement. Let's consider that starting point.

On the first day of my class I see students who are terrified. And I don't say that in a metaphorical, "Oh wow, I'm really scared of this." As I've said, I've seen kids on the first day gripping the table, their knuckles white and backs straight. They are no doubt terrified because, like most evil scientists, I teach using a whip. Sometimes their fear is rooted in an absolute conviction that they are incapable of mastering the material. I had a student in this class several years ago who wanted to come to office hours. I thought, "Okay great! She was an 'A' student and it is always nice to talk to engaged students." When she arrived at my office she started the conversation by saying, "I just can't do this." I asked her if she had seen her grades and she insisted that she can't do science. She had an "A" on the first test, an "A" on the second test, and an "A" on every daily quiz she'd taken, every single day of the semester. She was so committed to the idea that she couldn't comprehend science that she completely ignored the evidence of her senses. The obstacles here are more than just the fear of the content. We are facing deep-seated negative attitudes that necessarily affect how a student learns. So can we use comics to help bridge this fear/attitude gulf? Can comics help them dip their little tootsies into the water and realize it's not too cold or too hot?

Faculty members have access to a certain body of specialized knowledge. A student seeks access to that information and can go about achieving this in traditional ways. Usually, the bridge between professor and student is constructed from traditional pedagogies. The textbook is probably the most common but there can be any number of ways to reach out to our students and pull them in to what we do.

Personally, I love textbooks and as a student found them to be excellent bridges to understanding. The problem arises when you have students for whom there is a gulf between them and these traditional methods. They can't bridge the gap if they can't reach the bridge. This situation is what inspired the creation of *Optical Allusions.*

For those who might be interested in starting their own Scholarship of Teaching and Learning (SoTL) project, let me give you a little background about the process leading to *Optical Allusions*. This book was funded by a grant from the National Science Foundation (NSF). The goal of the grant was to test the hypothesis that using a visual story to deliver scientific information would provide imagery and context that would enhance student learning. In other words, if I made a comic in the right way, "Could I teach students something" and "Could I make them like it?" That's essentially the hypothesis that we're testing.

The NSF review board gave the first proposal I submitted five "excellent" ratings and everyone told me that meant it would be funded for sure. But it wasn't. So, I called the program office. Everyone had told me how nice and helpful program officers were but, if that is the case, then I found myself on the other end of the line with the black sheep of the program officer family. He told me in no uncertain terms that NSF was not funding a comic book. This, of course, didn't change my mind about science comics and I was going to do the project anyway, just without funding. But obviously funding did come, and it came through the most unlikely means for someone whose natural tendency is introversion: namely, networking. In March of 2004, I attended a Project Kaleidoscope (PKAL) conference at Bryn Mawr on general education at Liberal Arts institutions. During the meeting, participants sat at various tables and one of the folks at my table was Jeanne Small, an NSF representative. At one break, someone mentioned an NPR story on "Morning Edition" about a guy who makes science comics and—never one to miss an opportunity to talk about myself—I mentioned that the story was about my work. Jeanne said she remembered my grant proposal and that the committee really liked it. I reminded her that the program officer did not, and she informed me that that individual wasn't with NSF anymore. She encouraged me to resubmit, which I did. The second version of the proposal was much better but when the reviews came back, the committee (just one year removed from five ratings of "excellent") did not recommend funding. So, just as I resigned myself to not getting any money, I got an email from the program officer who said she liked the high-risk, low-cost nature of the project and that she was going to fund it from her discretionary fund.

The second value of networking is finding collaborators. The statistics for this study were done by K.B. Boomer, a statistician at Bucknell University. I met K.B. when she was at the Penn State Statistic

Center, running stats for The Pennsylvania Governor's Institute of Life Sciences held at Juniata. We tested the book here at Juniata in the early part of 2009; the analysis was done at the end of the summer.

Let me talk a little bit about the design. *Optical Allusions* stars Wrinkles the Wonder Brain. Wrinkles works for the three Graeae sisters (from the Perseus story) who share a single eye and must take turns using it. In this story those three sisters are actually scientists, and "Wrinkles" is their lab assistant, in charge of shuttling the eye among the sisters. In the opening chapter, he is carrying the eye through the lab when he trips and drops it in a bubbling vat of distilled human imagination. Wrinkles then dives into the vat and proceeds to have a series of eye-evolution-themed adventures as he searches for the sister's eye. Each story takes place in a different setting, addresses a different aspect of eye evolution and visual biology, and ends with a cliffhanger. Between each comic are six to eight pages of more traditional, illustrated text that expands on the ideas in the comic chapter. The comic story gives students a little information so that when they move into the text section, their prior exposure (and the context it provides) gives them more confidence in wrestling with the material.

I was curious to know if a) the book changed attitudes and made biology any more palatable, and b) students learned anything from the book. To get at the first question, I used the "Biology Attitude Scale" available on the NSF-funded website "Field Test of Learning Assessment Guide" (FLAG).[2] I modified the Biology Attitude Scale to make a Comic Attitude Scale. Finally, I composed a twenty-three-question test to assess the students' content knowledge about the eye and evolution. I gave all three of these tests as a pre-test on the first day of class and as a post-test two weeks after we finished using *Optical Allusions*.

I tested the book in four courses. I used it in Sensory Biology, which is traditionally a non-majors class composed primarily of freshmen and sophomores. This, of course, was the class for which the book was designed. I also tested it in Evolution (a 300-level course), which is usually a mix of sophomores and juniors, and in Neurobiology (a 400-level course), which is populated by second-semester seniors. The control was Biology 2, a 200-level course and the second course students take in the Biology sequence. The students in the control group did not read *Optical Allusions* but were exposed to the same concepts during the semester.

Comparing non-majors to majors meant each group had different levels of experience with biology. However, between pre- and post-test, all groups were exposed to the same material about the eye and evolution. Also, I was not as interested in cross-class comparisons as in changes within a group of students. So when we consider the scores on the content knowledge pre-test we see that biology students scored higher. However, all groups showed significant improvement after using *Optical Allusions* and the

non-majors in Sensory Biology made the biggest leap. So, our initial interpretation is that everybody learns.

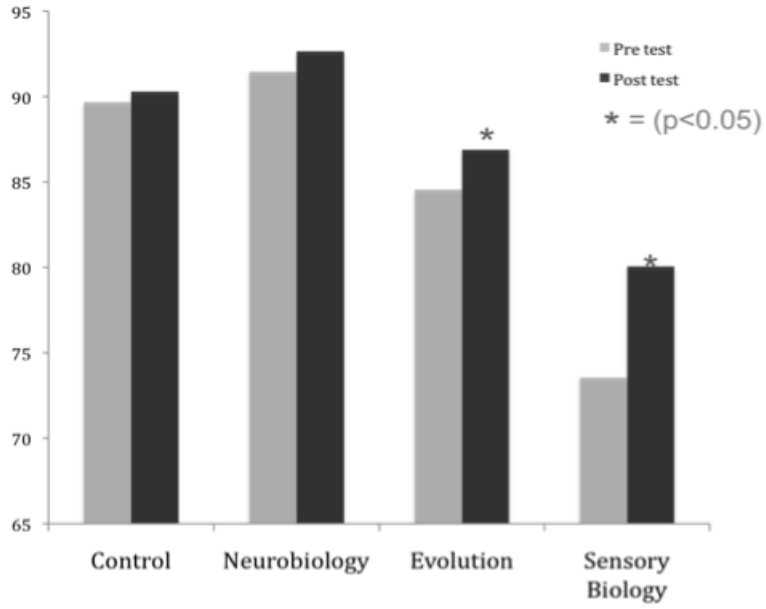

Fig 1. Optical Allusions: Biology Attitude Results.
Scores Possible: 110 maximum, 22 minimum

The students' change in attitude is the most important aspect of this study. When considering the pre-test attitudes about biology, it's not surprising that those in the control and in Neurobiology all are pretty positive. They are all Biology majors. However, I was a little surprised that the attitudes of Biology majors in Evolution weren't more positive. The post-test reveals no real change in the attitudes of students in the Neurobiology or control groups. The truth is, that doesn't really surprise me; their scores started high and didn't have much room to move. By contrast, the Sensory Biology students showed a significant increase in their opinion about biology. Sensory Biology students had a low opinion of biology at the outset. There is also a significant leap in the Evolution kids' attitudes.

But is this a function of the book or something else? For a possible answer, we looked at the students' scores on the Comic Attitude Survey. Attitudes about comics in Evolution, Sensory Biology, and Neurobiology all started at about the same place. All three used *Optical Allusions*, but only Evolution and Sensory Biology students showed an increase in their opinion of comics. When K.B. compared the Biology Attitude and Comics Attitude data, she found a strong positive correlation between the students' attitudes about comics and their attitudes about Biology. That may (or may not) mean that they liked the comic, which elevated their opinion of biology. And if the comic were responsible, was it the visual

component of the story or simply the narrative itself that engaged students? These sorts of questions are the focus of my ongoing research.

NOTES

[1] Carol L. Tilley, "Reading Comics," *School Library Media Activities Monthly*, (May 2008), 24, 9.

[2] FLAG is available at http://www.flaguide.org/index.php.

Specific elements in comics can be used as a good resources. Bahl states, â€œThe majority of academics do not have the time, training, or resources to fully flesh out an argument as thoroughly composed comicâ€ (178). Another good point that was mentioned was that since comics can consist of â€œtexts that equally weight words, images, and layoutâ€, it is more welcomed â€œfully into the field as knowledge-making modalityâ€ (179). The article then goes into a digital environment aspect of comics.Â Greer 4 In a scholarly article, called â€œ The Argument and Evidence for Comics in the Classroom â€, a college professor, Jay Hosler tests and explains how comics can be a sufficient way to explain science. Visual narratives, such as comics and animations, are becoming increasingly popular as a tool for science education and communication. Combining the benefits of visualization with powerful metaphors and character-driven narratives, comics have the potential to make scientific subjects more accessible and engaging for a wider audience.Â Some of the authors rightfully observed that the effects of comics in the classroom may be biased by the novelty effects of comics [Hosler and Boomer, 2011], therefore it would be important for future studies to measure comic literacy and predispositions amongst readers [Caldwell, 2012; Tatalovic, 2009]. More importantly, the goals and settings of science communication are often different from those of classroom education.