

**Storytelling as an active learning tool to engage students in a genetics classroom**

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## **Story telling as an active learning tool to engage students in a genetics classroom**

### **ABSTRACT**

Storytelling is an ancient art that originated long before the written word. Story telling interspersed with traditional lectures has been used as a teaching tool in an Introductory Genetics course. Students have eagerly responded to the story-telling pedagogy, suggesting that it can be leveraged to help students grasp complicated theories, engage students, and help improve student retention in STEM fields.

**Key words:** Story telling, narrative, STEM, Genetics.

## INTRODUCTION

Stories can be appealing educational tools because they engage students, are believable, entertaining, and enable students to easily recall facts from the story (1). In order to engage students in undergraduate Genetics classrooms an Introductory Genetics course based around story telling was created. There were eleven stories included in the course interspersed with a few traditional lectures. The stories used in the classroom (see <http://www.slideshare.net/karobi/story-telling-in-the-classroom-lilly-conference-presentation-2014-1hr-session-copy-3> for syllabus) were broadly based on two books, “The Tears of the Cheetah” by Stephen J O’Brien (2), and “The Journey of Man” by Spencer Wells (3). Both are non-fictional accounts of important discoveries in genetics. The stories were incorporated into PowerPoint presentations with questions, videos, and links embedded within them in order to provide visual impact to help create interest in the classroom (For an example see [http://www.slideshare.net/karobi/tears-of-the-cheetah?utm\\_campaign=ss\\_search&utm\\_medium=default&utm\\_source=9&qid=4f225c94-313b-461b-8348-dd66a87bd915&v=default&b=&from\\_search=9](http://www.slideshare.net/karobi/tears-of-the-cheetah?utm_campaign=ss_search&utm_medium=default&utm_source=9&qid=4f225c94-313b-461b-8348-dd66a87bd915&v=default&b=&from_search=9).)

## CONSTRUCTING A SCIENTIFIC STORY

Several steps were followed to create an educational narrative. For the sake of clarity each step is addressed through an example that was used in class (4, 5).

### *Step 1: Creating or obtaining an appropriate story*

In order to illustrate the story-telling concept, “The Journey of Man” by Spencer Wells (3) will be used as an example. “The Journey of Man” is a novel based on the non-fictional scientific account of the journey of modern man out of Africa and how this journey was traced with the help of modern genetics. In place of an entire novel/book a scientific paper could also form the basis for a story. Steven O’Brien based his book (2) of short stories on his own vast body of work by setting each paper out as a scientific case study/scientific story. For the more creative instructors writing an original story based around a specific scientific topic would also provide a good source for a story.

*Step 2: Determining learning goals and objectives*

This is a very important part of the storytelling process. It is necessary to determine what you want your students to learn from the story in terms of the intellectual content you are trying to provide.

The specific learning objectives for ‘The Journey of Man’ were:

1. Tracing the journey of modern man out of Africa with the use of Y chromosome and mitochondrial DNA markers
2. The application of single nucleotide polymorphisms and chromosome mapping in genetics.

Each story will have unique learning objectives that the instructor needs to determine.

*Step 3: Building the narrative framework*

After determining the learning objectives the story needs to be constructed around the learning objectives.

For example in “The Journey of Man” the story was based on the actual human journey by tracing the migration of humans out of Africa to the various parts of the world. This formed the ‘bare bones’ of the narrative.

*Step 4: Adding scientific / educational content*

Scientific/educational content then needs to be added in the appropriate places based on the learning objectives. Material from various textbooks, papers, online sources can be added. In the “Journey of Man” information on genetic markers and chromosome mapping was integrated into the story (see <http://www.slideshare.net/karobi/story-telling-in-the-classroom-lilly-conference-presentation-2014-1hr-session-copy-3>). Ancestry tracing through the maternal lineage with the help of mitochondrial markers was also incorporated.

*Step 5: Adding visual content, links to resources, and inquiry-based questions*

The next step is to add multimedia content to engage the students, also resources that can be used by the students to gather more information; instructor-created questions may also be added to the story. For visual

content pictures, links to videos

([http://www.youtube.com/watch?v=nBJDGzrMyQ&list=PLWZV5kah919pzbtXykm\\_zFVCJ2NkLFi4v](http://www.youtube.com/watch?v=nBJDGzrMyQ&list=PLWZV5kah919pzbtXykm_zFVCJ2NkLFi4v)), and educational resources (<https://genographic.nationalgeographic.com>) were added. The lesson was set up as a mystery story that the students solved while working their way through the narrative via embedded questions and instructor-provided clues (both within the story itself and orally during class). One question that the students were asked was: What were the reasons that modern man moved out of Africa? The students were also provided with clues that helped them figure out the probable answers. The questions were embedded into the PowerPoint presentation and the students were given time to discuss the questions as a group and move step by step through the journey to the big reveal at the end

(<http://www.slideshare.net/karobi/story-telling-in-the-classroom-lilly-conference-presentation-2014-1hr-session-copy-3>).

#### *Step 6: Test driving the narrative in the classroom*

This final step is designed to help students as they work their way through the narrative and to encourage student discussion and participation. We discussed as a group the genetic evidence for the migrations and watched short videos while going through the story. Please see link below for class presentation and embedded questions: <http://www.slideshare.net/karobi/the-story-of-us-the-journey-of-man-by-karobi-moitra>. After the test drive the instructor may make modifications if required.

Story telling classes are designed to fit into a 1 hour 15 minute class period. Homework is usually given in the form of questions based on the actual scientific article for the story. Additional class periods are used for discussion/revision if required.

## **CONCLUSIONS**

The approach of narrative storytelling was used in an Introductory Genetics course. The students consented to taking a survey and the Trinity Washington University Institutional Review Board (IRB) exempted the project from review. Some of the survey results are presented in Figure 1.

Briefly, most of the students agreed that they found the contents of the stories interesting, informative, and that listening to the stories helped them learn genetics. All of the students strongly agreed/agreed that they were engaged in the classroom as a result of the stories and that they were motivated to remain in a STEM field after taking this Genetics course. I can conclude that storytelling engaged students--they enjoyed this technique of teaching--and that this genetics course has motivated them to remain in a STEM field. The 'test drive' was very successful judging from the engaging class discussions, student surveys, and student comments on the course as a whole (see: <http://www.slideshare.net/karobi/storytelling-in-stem-poster-lily-conference-2014-karobi-moitra>). Further modification of the 'story-telling' content was not necessary, however, I found it prudent to add to the course a few more basic concept lectures (such as transcription, and protein synthesis) to make sure that the students understood the core concepts of genetics.

## REFERENCES

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## FIGURE LEGEND

Figure 1. Bar chart depicting the results of a student survey on the story-telling pedagogy.

## FIGURE

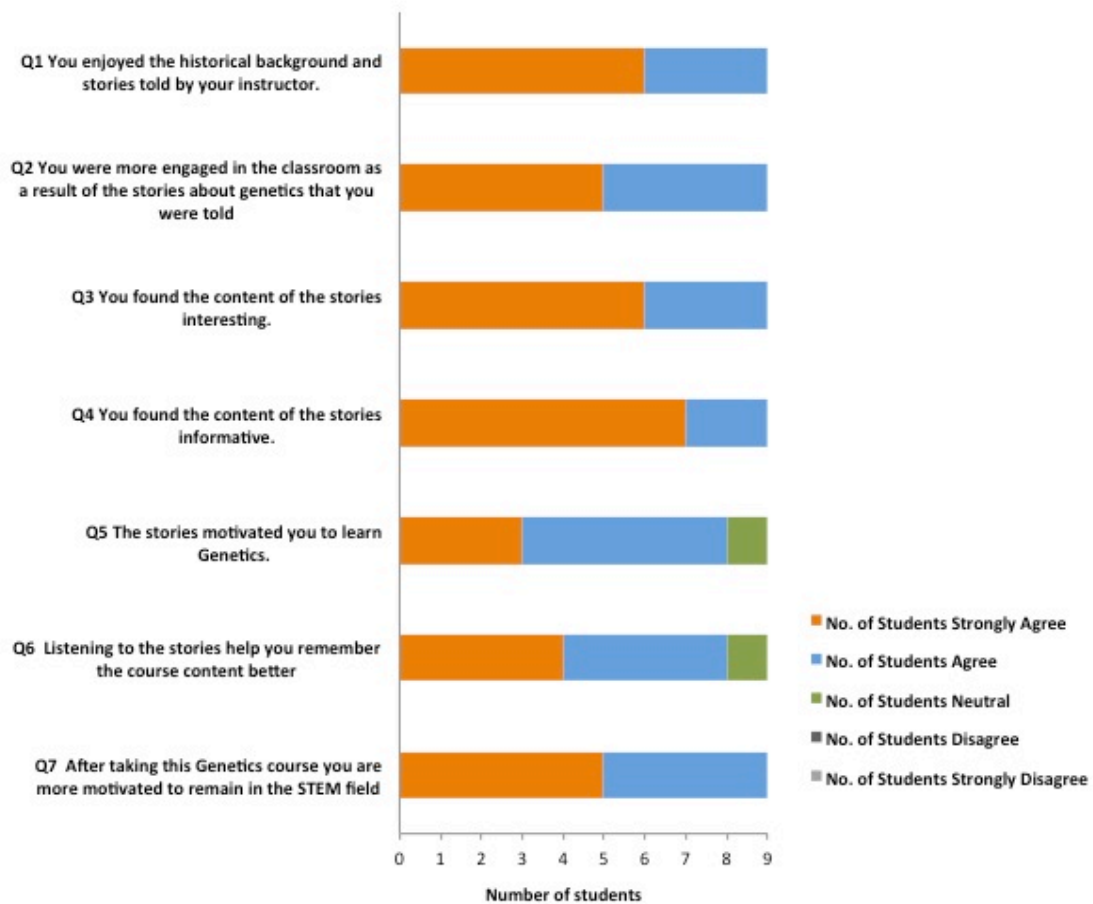


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