Assessment of Educational Visual Storytelling at the Smithsonian

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ABSTRACT

Museums use a variety of techniques that provide learning opportunities for people of different ages, levels of interest and knowledge. Museums face the same challenges as many organizations as they seek to adapt their instructional methods to reach and teach digital-media natives while continuing to serve members of other generations. With a desire to employ and evaluate potentially effective multimedia learning solutions, the Smithsonian's National Museum of Natural History (NMNH) developed an educational product with a visual-storytelling approach (i.e., Webcomic) embedded with social media elements as part of a new forensic anthropology exhibit, *Written in Bone*, which opened in February 2009. To view the Webcomic visit http://anthropology.si.edu/writteninbone/comic. Initial evaluations indicate this visually rich, educational experience is instructionally effective, engages the digitally savvy youth of today, and is surprisingly of interest to audiences over forty-five years old.

In this paper, we discuss the rationale for the design within a framework of recent research on the cognitive theory of multimedia learning, audience reading preferences, the tools and processes used, and the lessons learned from applying Visual Storytelling to motivate users to complete a number of voluntary educational challenges (scientific activities and articles). The evaluation of the impact of this approach includes the initial analysis of focus group feedback, user interviews, website tracking data for each page and supporting activities, the hundreds of completed end-user surveys, and traffic/postings on the social networking site, Facebook.

ABOUT THE AUTHORS

Robert Costello is the National Outreach Program Manager with the Smithsonian's National Museum of Natural History (NMNH), where he has worked for 11 years. Using multimedia products he communicates the relevance of the Museum's scientific research and collections to the public, and principally to education audiences. Mr. Costello also produces professional development programs for teachers, and other museum learning tools. He has wide-ranging curriculum design experience from twelve years of teaching math and science in secondary and postsecondary institutions across a number of disciplines, and from informal education at NMNH. He conducts front-end and formative evaluations of education products using online and onsite audiences. Mr. Costello has both undergraduate and advanced degrees in anthropology. He has written on topics in science education, and evolutionary biology, and taken part in scientific expeditions in the Andes, Rockies, and to the North Atlantic seafloor, where he learned to trust technology.

Dan Bliton is a learning strategist with Booz Allen Hamilton's Learning Team. He is a passionate learner and has been designing computer-based and Web-based training solutions for over 22 years. He is the creator of the documentary film "The Machinima Primer (compressed)," that looked at the use of video game technologies for storytelling and the rapid production of movies.

Mr. Bliton also has over eleven years of experience in defense-related training, particularly in the simulation and gaming arena. He has developed and managed blended training solutions involving stand-up instruction, Interactive Multimedia Instruction (IMI), cooperative game play, and free-play simulations for US and Allied forces worldwide. He has a B.S. degree in Management Engineering and a M.Ed. in Instructional Technologies.

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INTRODUCTION

In conjunction with a new exhibition on forensic anthropology, the Smithsonian's National Museum of Natural History (NMNH) desired to create online science activities for teens. The activities would place students in the role of forensic scientists and archaeologists examining and interpreting evidence. In terms of the user experience, it was important to create positive and enjoyable experiences for teens engaging with scientific content. Targeted learning outcomes include a better understanding of forensic anthropology and active participation in the scientific process.

One of the key design challenges was how to motivate teens to voluntarily read outside of their preferred genres. As one may presume, teen interests do not skew toward science; rather, their online foraging is thematically related to music, film, relationships, advice, and fashion, as measured by their top-ten websites (Montgomery, 2001). Data on teen reading preferences similarly shows teens prefer fiction, young adult, fantasy, humor, mysteries, adventure, romance, horror, and other non-science genres over science. In fact reading science interests only 3% of teens, so is it plausible to motivate at least some of the other 97% to read outside their interests?

Our solution to this set of challenges was to incorporate teen preferences into the product to engage their interest. Teens like to read about characters of a similar age that have done exceptional things, strong female characters, characters that are quite different from themselves, and detectives (Teen Read Week Survey, 1999). We used these preferences to create a mystery Webcomic with a young female central character, and scientists doing detective work. The Webcomic also includes a series of links to custom articles and activities that allow learners to dive deeper into the content areas discussed within the story.

As we began developing the Webcomic, we focused exclusively on a teen audience without much consideration for adult groups. Whether or not adults would use the Webcomic was not an issue, given our primary audience was teens. With this as our mindset, we did not anticipate the quantity or level of positive survey results from adults, and particularly older adults. In fact, 70% of adult respondents were over 45 years old, the oldest age grouping we aimed to capture. 97% of that group say they would recommend the Webcomic to a friend by sharing the Web address (N = 154). All other survey indicators for adults were highly encouraging.

WHY STORYTELLING?

Stories are a good way to engage learners and to show relevance of the content, and therefore motivate voluntary action. Stories are typically associated with entertainment, but they are also told and retold because they contain wisdom and shared experiences. Because of this, one of the most common uses of stories is to share knowledge within a community. Within a corporation or another organization, a story by itself can be more effective in communicating that organization's message than either statistical data alone or even a combination of statistics and story. (Martin and Powers, 1983)

Stories have this effectiveness by enabling us to experience an event vicariously – to put ourselves in someone else's shoes. They illustrate causal relationships, highlight solutions to use or avoid, and record an event within a context. In education and training environments, stories can be thought of as experience simulators that provide learners with not only the knowledge of how to act, but also the motivation to act. (Heath and Heath, 2007; Klein, 1999)

Stephen Denning notes that most performance improvement or learning requires a change, with leadership (or the instructors) seeking to inspire people to undergo a mental shift or to act in an unfamiliar way. "Mind-numbing cascades of numbers or daze-inducing PowerPoint slides won't achieve this goal. Even the most logical arguments usually won't do the trick. But effective storytelling often does. In fact, in certain situations nothing else works." (Denning, 2004)

Studies have shown that when presented with a story, users construct a mental simulation of the events and of the spatial relationships described (Heath and Heath, 2007). Having learners construct spatial and time-related simulations adds an active element that may not fit with the notion of passivity we sometimes attribute to storytelling. This means that storytelling can be used to actively engage the learners and expand upon their current knowledge.

Because good storytelling activates mental simulation and incorporates drama, empathy, and wisdom, it provides the following advantages over pure data presentation approaches: it improves retention; engages learners; yields deeper, more accurate learning; enables emotional connections; and offers knowledge instead of data. Moreover, the supporting Webcomic activities provide the framework for learners to construct knowledge that is intrinsic to the story.

Stories embody many of the characteristics for memorable knowledge that is captured in the Heath brother's SUCCES (Simple, Unexpected, Concrete, Credible, Emotional, Story-based) framework for making communications sticky. For example, good learning stories contain drama, but they also are almost always concrete and plausible, consistent within and across the elements being used to generate the mental simulation, and are limited in extraneous details. Stories that match well with the SUCCES framework naturally align with learners' existing motivational goals in both the affective and cognitive goal areas, as described in Ford and Nichols Taxonomy of Human Goals (Ford, 1992). Storytelling can be effective because it provides the context and the content, and it aligns with learners' existing motivational goals of Entertainment, Exploration, and Understanding.

WHY VISUAL STORYTELLING?

The Design Team decided on a Webcomic as the delivery format (see Figure 1) because it would be seen as interesting to the target audience and, as Dan Pink, business author of "A Whole New Mind" and "Free Agent nation: The Future of Working for Yourself", says–it provides maximum efficiency of expression (Business Week, 2008).

There is high acceptance of comic books today with overall sales in the U.S. and Canada for 2008 up 5% over 2007. This is the slowest rate of growth since 2001, due in part to the slowing economy in 2008) (Publishers Weekly, 2009).

Figure 1. Example page from Webcomic

Comic books have a long history of being used for education and training. One notable example is the US Army's PS Magazine—The Preventative Maintenance Monthly that has been published since 1951. Although comic books have been popular with young males for years, readership among young females didn't explode, as it has within the last ten years, until mainstream bookstores started carrying strong relationship stories in the Manga style.

Visual Storytelling Terms

Digital Storytelling – Typically a digital media that combines static images and audio. A popular example is the Civil War series by Ken Burns.
Graphic Novel – Mostly a marketing term for a number of comic book issues (periodicals) bound into a single book (returnable regular stock for book stores). It can also be applied to new work rather than reprints.
Manga – Typically black and white comic books conforming to the style developed in Japan after World War II. Traditional or "true" Manga are written from top to bottom and right to left – in the traditional reading pattern of the Japanese written language.
Near-Peer Role Model – individuals of similar age, social class, or profession whom others may respect and admire.
Visual Storytelling – A broad term for a storytelling form that is supported mainly by static images and text (e.g., comic books). Visual storytelling can also refer to synchronous approaches like oral storytelling accompanied by photos or images.
Webcomics – Webcomics are different from traditional comic books that have been scanned and placed online in that Webcomics typically show only one panel at a time and may include limited animation or zooming.

The Design Team also thought that a Webcomic would be interesting and agreeable to a broader audience,

since Visual Storytelling is also being used in the corporate world. For example: Dan Pink wrote a Manga-style career guide for those just entering the business world. Also, scanned versions of Scott McCloud's technical manual for Google's Web browser (in comic book format) were so popular that Google had to publish a cleaner Web version.

Visual Storytelling has the potential to combine characteristics from both textual and visual linguistics. There is clear evidence in support of Mayer's Multimedia Principle–people learn more deeply from the combination of words and meaningful images than from words alone (either in textual or audio formats). So while storytelling is good, Visual Storytelling might be even better.

The visual elements used in Visual Storytelling reduce the amount of written text (a form of representative graphics) to be interpret ted and provide comprehension clues that make the understanding of the content/message an easier task. In general, Visual Storytelling has the following advantages over pure oral or written storytelling: it makes oral and written text more concrete; it increases the number of concepts learned; it improves recall; it taps into existing visual acuity skills; and it facilitates action-based stories with limited text.

Considerations when using Visual Storytelling

When using engaging approaches or content, users may be engaged but not learning due to the interesting material being irrelevant to the learning objectives—the irrelevant materials are called seductive details (Mayers and others, 2008). The Design Team decided that as long as the storyline itself was tied to the learning objectives or goals, then the succinct information included in support of the story should not have the negative impact of seductive details. Also, the static images that support the storyline and provide additional cues for understanding the content and context would not be seductive details. During the design process, student focus groups revealed an interest in character development, as would be done in a movie script or novel (e.g., "What is Ana's social life like?;" "What other interests does she have?"). We did not develop the characters to any extent as that would have introduced interesting material—seductive details—extraneous to the learning objectives.

WEBCOMIC DESIGN

Process and Focus Groups

The Design Team held student focus groups on a draft script and initial pencil sketches. The Webcomic activities were not included in the formative evaluation. Approximately 100 students from four schools in three states participated—California, Louisiana, and Montana. Student grade levels ranged from 7th through 12th grade.

Students were given the opportunity to self-select one of five characters in the Webcomic, which they portrayed by reading the character's part aloud. Additionally, one student read the scene settings. This small group of "acting" students sat at one table while the rest of the class sat around them. The classes checked off whether they thought each panel worked and provided written suggestions for improvement. After students finished reading the Webcomic, they wrote down their overall impressions with suggested changes that would make it more interesting for them. The surveys were followed directly by open-ended discussions between the teens and members of the Webcomic development team.

By listening to students reading the Webcomic, we were able to gauge their fluency with the vocabulary, their ability to interpret and express non-word text (e.g., "?!"), and whether they laughed, groaned, or generally understood the humor written into some of the dialogue. Listening to students read aloud gave us valuable information that did not otherwise emerge from their written responses. For instance, one group from California was composed predominantly of English Language Learners (ELL). This group struggled with some technical vocabulary, which the team addressed by incorporating a glossary. We also gleaned from open-ended discussions just how sensitive teens are to products that reflect on them. They were keen for the Webcomic to reflect a sophistication befitting their age. If the Webcomic was to be perceived as a product for teens, they did not want language usages they recognize as being associated with a younger or more "juvenile" audience. Teens, for example, do not say "cool," or so they told us, yet they used the term in their written responses. Their ability to articulate teen identity was an unexpected outcome of the conversations.

The script and illustrations were revised based on the collected focus group feedback, both written and oral.

Storytelling Techniques for Active Learning

The Design Team created main characters to represent the roles of the people in the real world (e.g., anthropologist, archeologist), and the main character

was created to be a person the primary target audience (middle and high school students) could relate to as similar to themselves. A female character provides a positive role model that learners could aspire to be like or would like to be with.

The main character was conceived at an age slightly higher than the highest age of the target audience. Near-Peer Role Modeling (NPRM) has been shown to positively affect student beliefs and behaviors, and consequently, motivation (Murphey & Arao, 2001). Essentially, the recognition of the "other," similar person's success leads to the realization that it also should be possible for "me" (Bandura, 1997). The lead central Webcomic character, Ana, is a college teen. She is multiracial and has a Latina name as we intended to reach out to female minorities. This extends NPRM beyond real people as role models to characters in role positions—a topic for further study—yet we do have preliminary survey data consistent with this relationship between Ana as a role model for young female users. Of the respondents 18 years old and younger, 80% are female (N = 39). The skew flattens out dramatically for users over 36 years old with women making up 52% (N = 23).

A typical storytelling technique is to end a scene with an open question of what is going to happen next—keeping the audience interested in continuing the story. This is a different approach from what is frequently used in traditional instruction—where the learners are told what they will be told, they are told, and then they are told what they were told. The use of the open question or unresolved situation may allow learners the opportunity to be reflective or instill the desire to access additional materials.

Predictive activities

The Design Team created a series of activities, accessed via links at the bottom of pages, for the learners to assess case evidence and test hypotheses—essentially stepping into the role of either an archaeologist or a forensic anthropologist (see Figure 2). This injection of nonfiction, the actual bones and artifacts, the evidence, and real hypotheses about a real case, relies on the power of Visual Storytelling to motivate users to complete activities they may not otherwise be interested in doing. The Visual Storytelling format must move free-choice users to the next level of engagement, from reading to doing, and incidentally from fiction (in this case based on actual events) to nonfiction.

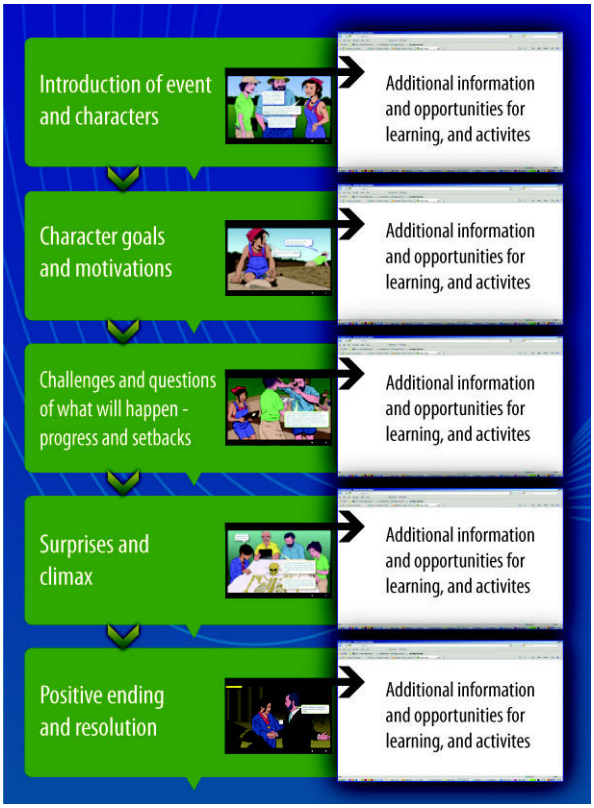

Figure 2. Activities are links from the main storyline

Frequently the activities allow the learners to determine the answers themselves before being told the answer/solution within the story. For example—at one point in the story, determining the sex of the skeleton is revealed as one of the next tasks for the characters to complete. A link at the bottom of the page to the activity "Is the skeleton male or female?" provides the learners the opportunity to analyze skeletal evidence and determine the answer. This approach aligns with the motivation goals of Exploration, Understanding, Self-Determination, and Superiority (Ford, 1992).

Embedded Social Media Questions

Social media attributes were incorporated into the judging element of the activities. The social medium was in the form of a polling question. The learners submitted their selected answer to a question via a VOTE button. Then elaboration feedback was provided in text format, along with the response results of all previous learners—shown as graphical percentages (see Figure 3).

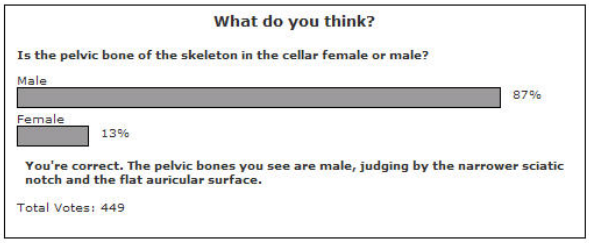

Figure 3. Example embedded social media question that the learner has already answered

Designers used social media questions instead of more traditional multiple-choice questions with the intent of aligning with multiple motivational goals of the learner group, including Superiority and Belongingness (Ford, 1992). Social media questions allow learners to immediately measure themselves against all other learners and judge the validity of the question itself. In the past, the use of non-social media questions only allowed for data analysis by the Design or Evaluation Team, not the learning audience itself.

Use of the social networking site Facebook

Stories are effective in creating a shared experience and provide a specific context to which learners respond. Stories have also been shown to stimulate conversations in online forums (Cianciolo and others, 2007). In order to provide a location for online discussions or comments about the Webcomic, a Facebook fan site was set up for the main character—the young college female intern (see http://www.facebook.com/pages/Ana-The-Forensic-Anthropologist/63382096154). This site allows members to post their opinions about the Webcomic and notify their friends of their experience. The fan site is both a discussion area and potentially a viral marketing channel since a member's activities may be broadcast to their friends. Ana the forensic anthropologist has attracted 101 fans to date.

Behind the Scenes – Fiction and Non-Fiction

One strong indicator of Visual Storytelling as a motivator for users to delve deeper into a subject is the degree to which they actively pursue more information after finishing the story. *The Secret in the Cellar* Webcomic has 36 illustrated comic pages followed by a credit page. The credit page includes a link to the nonfiction version of the story called "Behind the Scenes." "Behind the Scenes" refers to the archaeologists and forensic anthropologists involved in the case by actual name, and includes images from the archaeological excavation, artifacts, and skeletal remains. Of the twenty-eight links to popup files, the nonfiction version of the story is the most frequently opened file. This user behavior strongly indicates the story stimulates a thirst for more information, that is, it enhances the user's task motivation. The nonfiction forensic case does not resolve differently from the Webcomic story, only all the evidence and facts are gathered in one place.

Considerations for using audio

The use of audio can be effective in supporting animations of processes, but it can also be a confounding factor if presented along with similar or matching text. With matching audio and text, dual encoding may not be achieved because of the disconnect between the reading and frame-scanning speed of learners and the speed of the audio narration. Also, studies have shown that a series of static illustrations with printed text can yield the same or higher learning transfer than animations with narration (Clark and Mayer, 2007).

The Webcomic was designed without audio in order to allow learners to control the order (e.g., scanning) and pace of their processing in support of science reading improvement and ELL reading.

WEBCOMIC DEVELOPMENT

The Webcomic is Flash-based with a simple HTML page holder. The activity links in the Webcomic open new browser windows that contain basic HTML pages. The development process was very similar to any other asynchronous e-Learning project. The Webcomic Team was made up of three instructional designers, two subject-matter experts, two illustrators (one for storyline images and one for scientific illustrations in the activities), a Flash developer and a basic HTML developer. Schedule and level of effort for the 36-page Webcomic with 28 links to additional materials was similar to the development of one hour of traditional asynchronous e-Learning.

The key differences in the project centered on the writing of the storyline and the creation of the custom visuals for each Webcomic page. The writing of a story is a deliberate process that benefits from team members with story and script-writing experience. Each custom illustration for each Webcomic page took about one day of an illustrator's effort to create after the draft pencils were done. The visuals were rough drafted by hand and then redrawn in a scalable vector format (Adobe Illustrator and then Flash) once the storyboards were approved. Flash scripting was minimal, since the Webcomic storyline had limited

animation and no branching. The additional materials were presented in HTML pop-up windows with custom scientific illustrations and questions. The embedded social media questions were created with a Web polling tool, which creates JavaScript that calls out to the PollMonkey server.

Compliance with Section 508 of the Rehabilitation Act

The Flash-based Webcomic is navigable and readable by the target screen-reader applications (Jaws and Window-Eyes). It was necessary to write additional cues to the dialogue script to indicate which character was speaking (instead of the visual cues of the tails-of-the-dialogue balloons). For example, "Look what I found!" became "Ana says, look what I found!"

A separate HTML-only document was also provided as a Long Description document. The Long Description link is read by screen reader applications, but is not visible to sighted readers. This entire document can be read by a screen reader with no additional navigation actions required (e.g., no clicking Next to access the next page). A PDF version of the Webcomic and all other materials were also provided for printing or screen reader use. Keyboard navigation was implemented to support non-mouse navigation. Visual Storytelling is natively accessible for the hearing challenged.

RESULTS

In addition to the formative evaluation mentioned, several data sources were used to analyze user experiences and behavior. A survey link was added to the last page of the Webcomic for three categories of users—educators, students, and others. Using split logic, respondents from each group were sent to a survey specific to the group. The survey had a total of 28 questions distributed across the groups. The survey ran for approximately five months, and had a large number of respondents for a non-incentive survey (N = 558). A second survey replaced the first to capture finer grained information on user ages, the learning experience, and the use of activities. The survey is currently running and has N = 76 respondents at this writing. A Web metric application, Google Analytics (GA), was also used to collect standard visitor information.

Survey Data

Although survey respondents are self-selecting rather than randomly selected, the information they provide is nevertheless informative. Overall, educators (N = 43) high school students (N = 9), and non-student 25 year-olds and under (N = 6) were least likely to take the survey. Most unexpected were the number of adult respondents over 45 years old—70% of N = 221 in the "other" category.

The following charts (Figures 4 to 7) summarize the combined results of the survey:

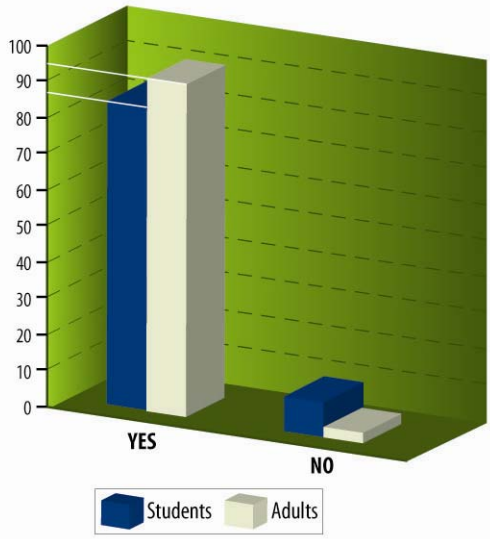

Figure 4. Would you recommend the Webcomic to a friend by sharing the Web address? (Students N = 117, Adults N = 221)

All groups had unequivocally positive responses with respect to their self-rated learning experiences (see Figure 4), yet broad trends show the youngest audiences in both the "student" and "other" categories had lower perceived learning experiences and thought somewhat less of the Webcomic relative to older students and older others (see Figure 5). The spread between middle-school students and college students is prominent across the "average – good – excellent" ranks for their overall learning experience. Nineteen percent of middle school students rated their learning as average versus only 5% of college students. Similarly, 77% of middle-school students had more positive experiences (good + excellent), whereas college students were much higher at 97%. Ironically, low numbers of respondents for high-school students and 25 year-olds and under—the primary audiences—make it imprudent to claim any trends for these two subgroups. This may suggest these two groups are less likely to take a survey than both younger and older groups.

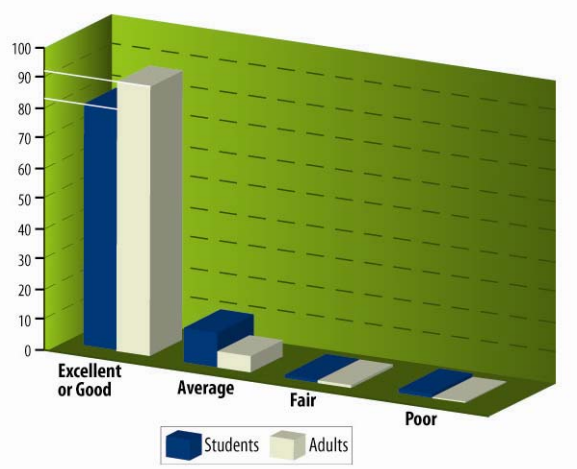

Figure 5. Overall learning experience with the Webcomic (Students N = 117, Adults N = 221)

When asked to rate the story, artwork, and supporting materials relative to how each contributed to the learning experience, both middle school and college students ranked story and artwork higher than links. Combining the two most positive rankings—"very" and "extremely"—middle-school students do not show any distinction between story and artwork (65% each), and college students only rank artwork 5% lower in importance than story. Adults of various ages show the same trend (see Figure 6), indicating high importance to story and artwork, with 26 – 35 year-olds placing less importance on artwork.

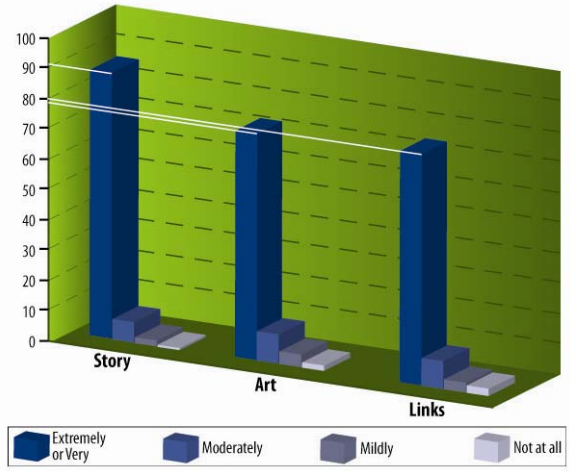

Figure 6. How helpful were each of these components to your learning experience? (Adults N = 221) Students were similar

This trend of not distinguishing between artwork and story was also noticed during another small survey where teens were asked to identify the best of three comic artists from samples—to help the development team select one of three artists to illustrate the Webcomic. African American teens selected artwork that included African Americans, and White Americans selected artwork that included White Americans. Apparently most subjects were not able to separate content from style and skillfulness.

Overall, 70% of the adults and 68% of all respondents said that they would be extremely or very interested in additional educational materials in the Visual Storytelling format (see Figure 7). In all groups, the level of interest in Webcomics fell below the level of recommending this Webcomic to a peer.

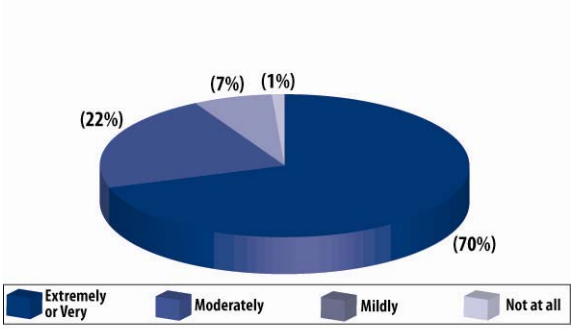

Figure 7. How interested would you be in having access to other Webcomics, comic books, graphic novels, or Manga for educational/informational purposes? (Adults N = 221) Students were similar

In addition to multiple-choice questions, there were open-ended questions. One asked how the Webcomic could be improved. One suggestion given by a number of survey respondents commented about the lack of audio in the Webcomic, even though it is not common for online comic books to have audio. The comments may be due to the users viewing the Webcomic as an entertainment platform more than an educational device.

Webmetrics

Webmetrics indicating user interest and motivation to seek more information include time on Webcomic and activities (stickiness), and the popularity of "Behind the Scenes.

All metrics were gathered for a period of five months from February – May, 2009, and were collected on Google Analytics. As with any webmetrics, the data should be compared with other website data from within the organization and should not be taken as highly accurate or "fixed" data. The average time on site is 10:02 min. with a 38.35% bounce rate. There is no other public website at NMNH (100+ websites and

30 million online visitors in 2008) that comes close to this duration. Typically, the average time on site for a public website at NMNH is less than three minutes. The next highest NMNH website for this measure is on Lewis and Clark, and that is five minutes. Looking at the time on activities, again we see very high rates—11:27 for estimating the sex of the skeleton, 8:10 for identifying ancestry from skeletal evidence, and 7:29 for dating the archaeological site. The remaining activities average three-to-four minutes each. "Behind the Scenes" ranks number one in popularity among all linked materials, followed closely by the three activities showing highest rates for time on site.

Next Steps

Determining the influence Visual Storytelling has on motivation will require controlled experiments, and two versions of the forensic case—the Webcomic, and the same case presented as a file report without names or characters, but with the same links to activities and articles as the Webcomic.

Initial evaluation of the Webcomic on the Apple iPod touch (see Figure 8) indicates the text may be too small to read comfortably. Therefore, we plan on adding audio to the story portion of the Webcomic before converting it to video for downloading from iTunes U (part of Apple's iTunes Store). This will allow us to measure differences in learning between graphics with text versus graphics with audio, as well as the user experience.

Fig**ure 8. The story is viewable on the iPod touch**

Finally, tagging Webcomic pages with webmetric code for path analysis will yield specific information on when learners make decisions to investigate the case further, as they encounter opportunities to solve the case, or after reading the entire story, or to what extent users do both.

CONCLUSIONS

Time on Webcomic and activities, and the popularity of "Behind the Scenes" all point strongly to the Webcomic as a motivating tool for user initiative in seeking additional learning experiences on the same topic. The most recent survey (N = 76) is not yet robust enough to draw solid conclusions; however, it is worth noting 67% of the respondents are female, 56% completed at least one activity, and 27% completed five or more. It is unlikely the activities alone would attract or sustain such interest. And in the most recent survey, 95% of the respondents replied "no" to preferring the case as text only.

With Ana as the only character for teen modeling, the Webcomic did not use Near Peer Role Modeling to an extent that would appeal to males or other ethnic groups as strongly. Surprising to us is how the format attracted both much younger and much older users. The script, articles and activities are written for ages 13 and older; however, survey responses indicate the youngest users may be experiencing the Webcomic with an adult family member. Older users appear to spend more time investigating the links, and appreciate the Visual Storytelling format. In fact, at 93 years old, one of the survey respondents is nearly as old as the comic genre itself. Formative evaluation of the script and artwork and direct conversations with teens lowered the risk of producing an artifact for the collections. Hundreds of survey respondents left testimonials in their open-ended responses that we found convincing as first-hand accounts of positive learning experiences.

That my son was willing to read something from history FINALLY, and he enjoyed it.

I found myself interested in a topic that wouldn't normally interest me.

At first, I thought sound might help. However, on second thought, it would prohibit the student from focusing on the PROCESS of learning, which I believe is the goal of Education; I think it was a job WELL DONE!

I don't usually go for" Webcomic" type things, but this one was different . . . very well done. I especially appreciated the links to more extensive information at the bottom of each page.

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REFERENCES

American Library Association's Young Adult Library Services Association & SmartGirl (1999). Report on teen read week 1999 Survey! From http://www.smartgirl.org/speakout/archives/trw1999/trwsummary.html

American Library Association's Young Adult Library Services Association & SmartGirl (2007). Report on teen read week 2007 Survey! from www.SmartGirl.org/reports/7482493.html.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W.H. Freeman and Company.

Berfield, S. (2008) Career advice from a comic book, *Business Week*, February 21, from http://www.businessweek.com/print/magazine/content/08_09/b4073073477127.htm.

Cianciolo, A. T., Cianciolo, D., Prevou, M. I., & Morris, R. F. (2007). Using digital storytelling to stimulate discussion in Army professional forums. *Proceedings of the Interservice/Industry Training, Education, & Simulation Conference (I/ITSEC).*

Clark, R. C., Mayer, R. E. (2007) E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning, (2nd edition), (p. 70). San Francisco CA: Pfeiffer.

Denning, S. (2004) First Person, Telling Tales, *Harvard Business Review*, May, (pp. 122-129).

Ford, M. (1992). *Motivating humans: Goals, emotions, and personal agency beliefs.* London: Sage Publications, Inc. (pp. 88-89).

Glazer, S. (2005). Manga for Girls. *New York Times*, The Book Business, September 18, from http://www.nytimes.com/2005/09/18/books/review/18glazer.html.

Heath, D. and Heath, C. (2007). *Made to Stick*, (pp. 206, 209) New York: Random House.

Klein, G. (1999). *Sources of Power: How People Make Decisions*, (pp. 181-183) Massachusetts: The MIT Press.

Lenhart, A., Simon, M. and Graziano, M. (2001). *The Internet and Education: Findings of the Pew Internet & American Life Project.* Pew Internet & American Life Project, from http://www.pewinternet.org.

Martin, J. and Powers, M. (1983) Organizational Stories: More Vivid and Persuasive than Quantitative Data. In B. M. Staw (Ed.), *Psychological Foundations of Organizational Behavior, (2nd ed.).* (pp 162-168) Glenview, IL: Scott, Foresman.

Mayer, R., Griffith, E., Jurkowitz, I., & Rothman D., (2008) Increased interestingness of extraneous details in a multimedia science presentation leads to decreased learning. *Journal of Experimental Psychology: Applied*. Vol 14(4), 329-339.

Montgomery, K. C. (2001). TeenSites.com: A Field Guide to the New Digital Landscape, a Report from the Center for Media Education, from http://www.centerforsocialmedia.org/resources/publications/teensitescom_a_field_guide_to_the_new_digital_landscape/

Murphey, T. & Arao, H. (2001). Reported Belief Changes through Near Peer Role Modeling. *Teaching English as a Second or Foreign Language*, Vol. 5 No. 3.

Reid, C. (2009), 2008 Graphic Novel Sales Up 5%; Manga Off 17%, *Publishers Weekly*, February 6, from http://www.publishersweekly.com/article/CA6635333.html