

3-1-2017

Interactive Storytelling: Opportunities for Online Course Design

Sally Baldwin
Boise State University

Yu-Hui Ching
Boise State University

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Boise State University

Yu-Hui Ching

Department of Educational Technology

Boise State University

Abstract

Compelling interactive stories can be used to get and keep learners' interest in online courses. Interactive storytelling presents information in a manner that involves learners by allowing them to connect with the content. Incorporating interactive storytelling into online education offers the potential to increase student interest and knowledge retention. Interactive storytelling also allows learners to create a personalized experience. By analyzing examples of interactive stories, we identified five features of interactive storytelling: dynamic presentation, data visualization, multisensory media, interactivity, and narration. We explain each feature, and its educational benefits, with illustrations provided from five interactive storytelling examples. We also discuss the implications of interactive storytelling for online course design.

Introduction

There is an opportunity to take advantage of features used in journalism to increase the effectiveness and engagement of online learning. Interactive storytelling presents content in a narrative form with options for users to click and explore different paths for more information. Interactive stories provide an account, or story, of events and can convey information and instruction (Rossiter & Garcia, 2010; van Gils, 2005). With interactive storytelling, readers are presented with compelling graphics and the choice to click on hyperlinks and multimedia for additional information. Interactive stories include features (dynamic presentation, data visualization, multisensory media) that provide a non-linear path for users to interact with the narration. Interactive storytelling is used in journalism to capture readers' interest, extend engagement in material, and explain difficult concepts.

In education, stories are helpful in supporting transfer and retention of knowledge because the narrative chunks of stories are stored in memory as separate pieces for future retrieval as a coherent whole (Black & Bower, 1979). Storytelling is used to help students untangle new information and relate it to past knowledge (Liston, 1994). With stories, students are better able to make meaning, through reflection and synthesis. It is the narrative of the story that serves a cognitive function, allowing students to better store information and understand the information, as well as develop coherence about the world (Bers & Cassell, 1998). When stories are combined with interactivity, there is increased curiosity, flow, enjoyment, and aesthetic attractiveness (Vermeulen, Roth, Vorderer, & Klimmt, 2010). Interactivity helps stories resonate with learners because it broadens the text's novelty and appeal, and facilitates explanation (Nichani & Rajamanickam, 2003). Moreover, interactivity supports increased learning, when compared to stories with static pictures, because it creates a stronger tie between verbal and dynamic visual information (Bus, Takacs, & Kegel, 2015).

Interactive storytelling provides a way for users to select content that is personally meaningful while navigating through the story. Personalized learning can offer students of varying interests, attention spans, and diverse needs a chance to be in control of their learning (West, 2012). By offering different options to click and explore, interactive stories are similar to the way learners consume other online content, like games, in which users determine their path by the choices they make. Interactive storytelling supports the individuality and diversity of learners, helping to captivate their interest, and as a result, provide an enhanced, personalized learning experience.

Research on online storytelling tends to focus on digital storytelling. The terms ‘digital storytelling’ and ‘interactive storytelling’ are often used interchangeably but a distinction of interactive storytelling is the ability of learners to actively interact with the material. Interactive storytelling is similar to games or simulations in that learners become immersed in experience, and are able to choose their own path. Interaction provides learners with control, which increases learner communication and participation, and aids in the development of meaningful learning (Sims, 1999).

Interactive storytelling is theoretically linked to constructivism. Knowledge is actively constructed by the learner, not passively received, with new learning built upon prior knowledge (Good & Brophy, 1994). When learners are able to engage in constructing personally meaningful lessons, learning is more effective (Prensky, 2006). Effective learning occurs through interactive storytelling as learners determine which links to click and which videos to watch, based on their own interests.

We were initially drawn to interactive storytelling by *The New York Time’s* revolutionary project, *Snow Fall: The Avalanche at Tunnel Creek* (Branch, 2012), a Pulitzer Prize-winning story about skiers tragically involved in an avalanche. Sensing that interactive storytelling had potential to change education, we explored more, searching the Internet for examples of interactive storytelling. We analyzed the unique elements in the examples of interactive storytelling to understand how they attract and engage readers. We also identified the theoretical supports of these elements by connecting educational research literature. We performed a literature search in the EdITLib: Education & Information Technology Digital Library, Education Research Complete (EBSCO), Education Resources Information Center (ERIC), Web of Science, and Google Scholar databases. We initially utilized the keywords “interactive storytelling” but then expanded our search to include “data visualization,” “simulation,” and “multimedia.” Our analysis and search led us to identify a list of sub-elements, supported by literature in storytelling, games, and simulation. We distilled the sub-elements into five main features: dynamic presentation, data visualization, multisensory media, interactivity, and use of narrative. We selected interactive storytelling examples to showcase the way these five identified features are manifested in the stories. These interactive stories were selected because they feature appealing narratives, were developed by major news agencies, and were critically acclaimed. Our goal is to illustrate how dynamic presentation, data visualization, multisensory media, interactivity, and narration connect the learners to the content and increase engagement and interest, by presenting information in a new manner.

Interactive Storytelling Examples

Here are brief synopses of the stories chosen to demonstrate the features of interactive stories:

- [A Nation Divided](#) (Bangel, 2014) depicts Germany since the fall of the Berlin Wall encouraging the reader to become immersed in the subject with videos and large data visualization charts.
- [NSA Files: Decoded. What the revelations mean for you](#) (Macaskill & Dance, 2013) explains the National Security Agency’s (NSA) procedures in response to Americans’ fear of national surveillance. The piece encourages readers to add data about themselves to explore the topic in a more personal, relatable way.
- [Planet Money Makes a T-Shirt](#) (Blumberg, 2013) describes how cotton is made into t-shirts, from the cotton fields to factory floor and all the way to the end user, highlighting the economies behind the process and the people involved in the production.
- [Snow Fall: The Avalanche at Tunnel Creek](#) (Branch, 2012) chronicles a deadly avalanche, describing not only the disaster but also drawing the reader in with personal details about the victims and their families with the use of taped 911 calls, satellite weather pictures, and visualizations.
- [What is Code?](#) (Ford, 2015) explains coding with the use of a friendly animated bot, options to click on links within the story, and interactive activities to try. Readers get a chance to try coding at the end of the 38,000-word narrative.

Five Features of Interactive Stories

Dynamic Presentation

Dynamic presentation is multisensory (a feature discussed below), however, it is included as a separate feature because it is used specifically as a way to extend or modify content with the use of video, movement, or action. Throughout the previously mentioned examples of interactive stories, action is used to draw readers in and capture their attention. As readers scroll down *A Nation Divided*, graphics change to communicate new information. In the *NSA Files*, viewers watch and listen to video interviews with experts. *Planet Money* uses video to show cotton being fluffed, spun and dyed to illustrate the process more effectively than simply conveying the same information via text. *Planet Money* is broken into chapters (e.g., cotton, machines, boxes), and each chapter is introduced with an eye-catching dynamic element. In the figure below (Figure 1), cotton is pictured blowing in the breeze as a crop duster plane crosses the screen buzzing the field below. *Snow Fall* uses dynamic pictorial animations of the avalanche, as well as showing satellite images of the weather system moving in to thwart search and rescue activities. Movement attracts the viewer. It adds interest and additional information to the story.

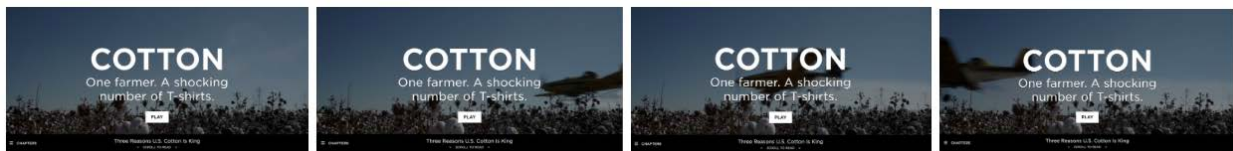


Figure 1. Dynamic presentation is used at the start of each chapter in *Planet Money* (Blumberg, 2013). Copyright 2013 by NPR. Reprinted with permission.

The presentation of each story is crafted to appeal to the viewer visually, while inspiring the viewer to step inside the story and explore further (e.g., by clicking on interactive features). Online learners have been shown to be significantly more motivated, in terms of attention, when using video-based learning compared to traditional text-based learning (Choi & Johnson, 2005).

Data visualization

Data visualization helps learners to better understand large amounts of information by using color, shapes, maps and graphs in a simple manner. In the *NSA Files*, data visualization is used in the form of a timeline and charts, presenting authentic information that connects with the subject matter, and serves to support and further develop content. A specific example is the use of an interactive sliding button for viewers to see changes in data based on different inputs (Figure 2).

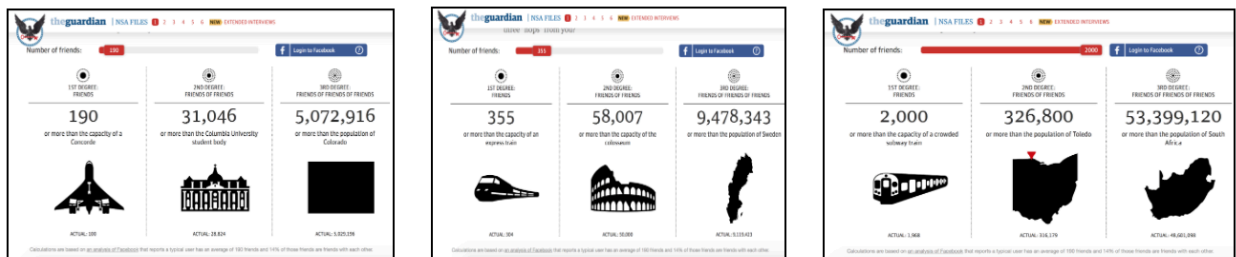


Figure 2. Data visualization examples in the *NSA Files* (Macaskill & Dance, 2013). Copyright 2013 by Guardian News & Media Ltd. Reprinted with permission.

In *A Nation Divided*, maps are presented to show regional use of specific words, demonstrating the differences that exist within Germany (Figure 3).

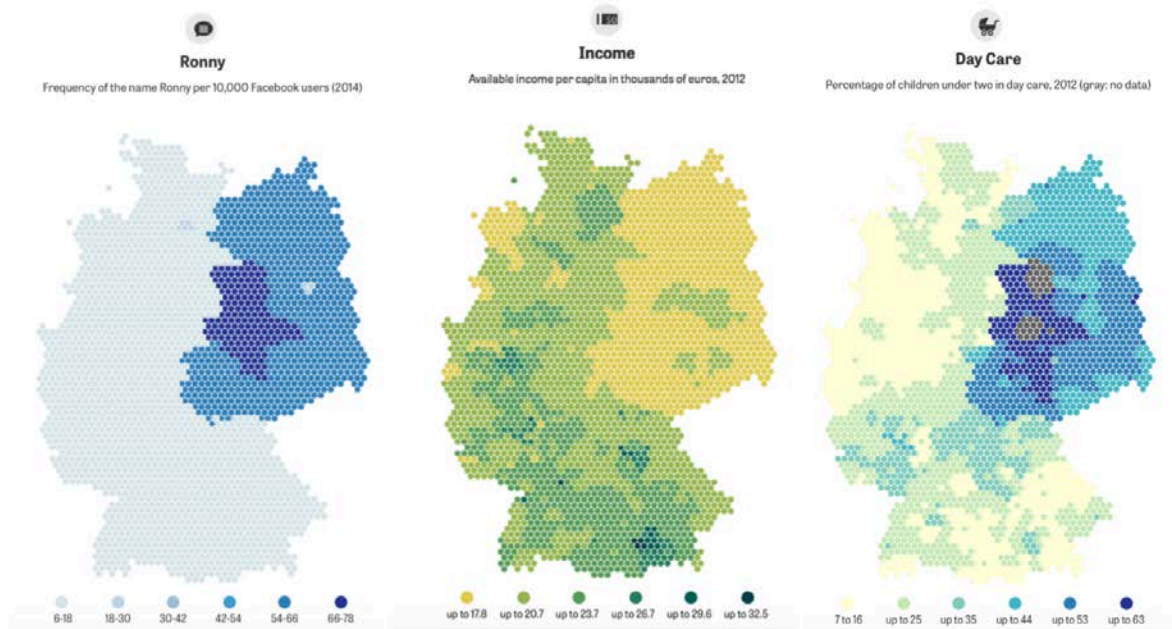


Figure 3. Statistical maps of Germany from *A Nation Divided* (Bangel, 2014). Copyright 2014 by Die Zeit. Reprinted with permission.

Maps are often used in interactive storytelling to add “verity...to give the audience a sense of rootedness in their own space and geography, to connect them with news events” (Dick, 2014, p. 501). Bar graphs show the difference in ownership of home appliances between former East and West Germany (Figure 4). The text states that “data ...speaks more precisely than many direct witnesses” (Bangel, 2014).

Ownership of household appliances

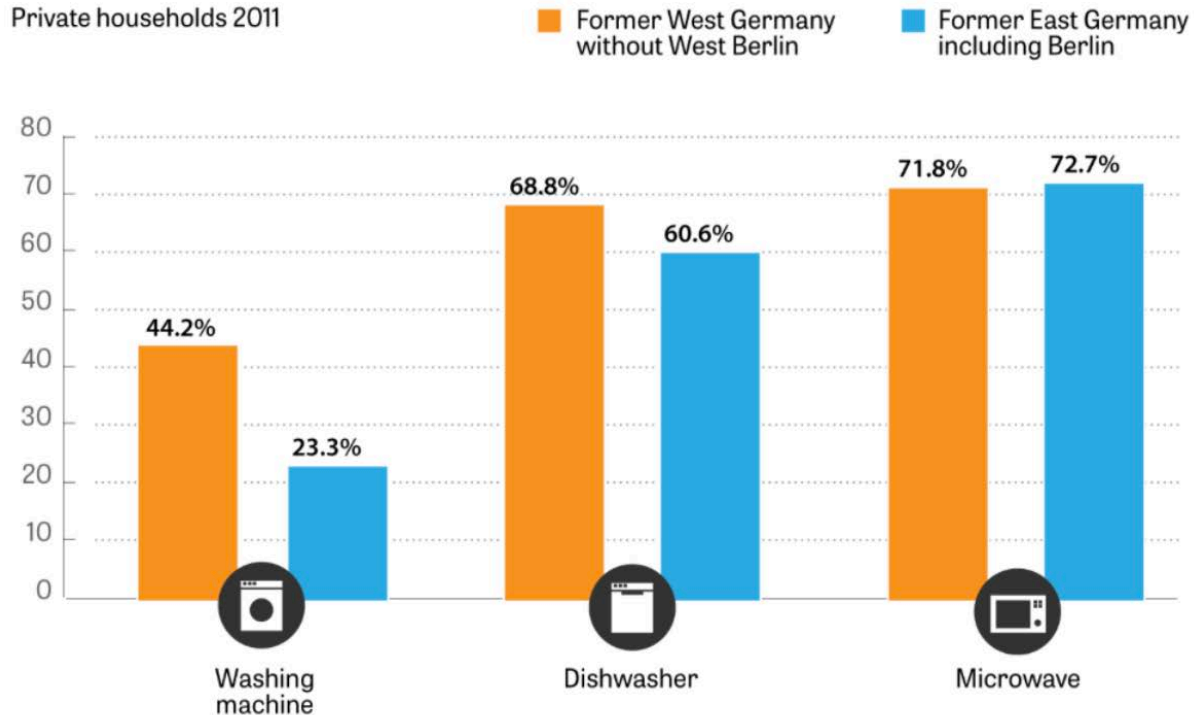


Figure 4. Data visualization in *A Nation Divided* (Bangel, 2014). Copyright 2014 by Die Zeit. Reprinted with permission.

In *Planet Money*, animations and charts help keep readers “engaged in the story, and reward them for continuing” (Kirkland, 2014). Graphical features like maps, graphs, timelines, and charts help enhance the stories and provide learners with more information.

Multisensory

Interactive stories are multisensory, featuring an integration of multiple forms of media including text, graphics, audio, and video to stimulate multiple senses (e.g., visual, auditory, tactile). Comparing photos and video segments of sites in Berlin, taken 25 years apart, highlights the changes since reunification in a meaningful way in *A Nation Divided*. Increasing the modalities of sensory input heightens the learner’s sense of presence and memory of the content (van Gils, 2005). This is evident in the multisensory attributes of the *Planet Money* story: machines whirring and boxcars rattling along the rails help to further capture the attention of the reader. A key aspect of the choice of multisensory tools is their ability to express information that is challenging to illustrate with words. In *Snow Fall*, audio clips of 911 calls help engage readers emotionally, and an avalanche is simulated with real time data juxtaposed against actual footage of the Stevens Pass Ski Area. Journalism makes interactive stories come alive by engaging readers in a multisensory manner similar to that which they are familiar with in simulations, games, and web content. Combining text with visual images leads to enhanced learning (Steslow & Gardner, 2011).

Interactivity

In interactive storytelling, interactivity allows readers to tactilely use their keyboards to control the direction of the story. Interactivity allows users to have power over the content and connect at different levels with different parts of the story (Wagner, 1997). Interactivity helps learners build their own knowledge in a productive manner. Active learners incorporate knowledge more quickly than passive learners (Ohler, 2006). For example, in *Snow Fall* readers make a series of decisions as they read the story. Readers can choose to click on dynamic presentations of the avalanche, recordings of 911 calls, and slide shows of survivors (Figure 5).

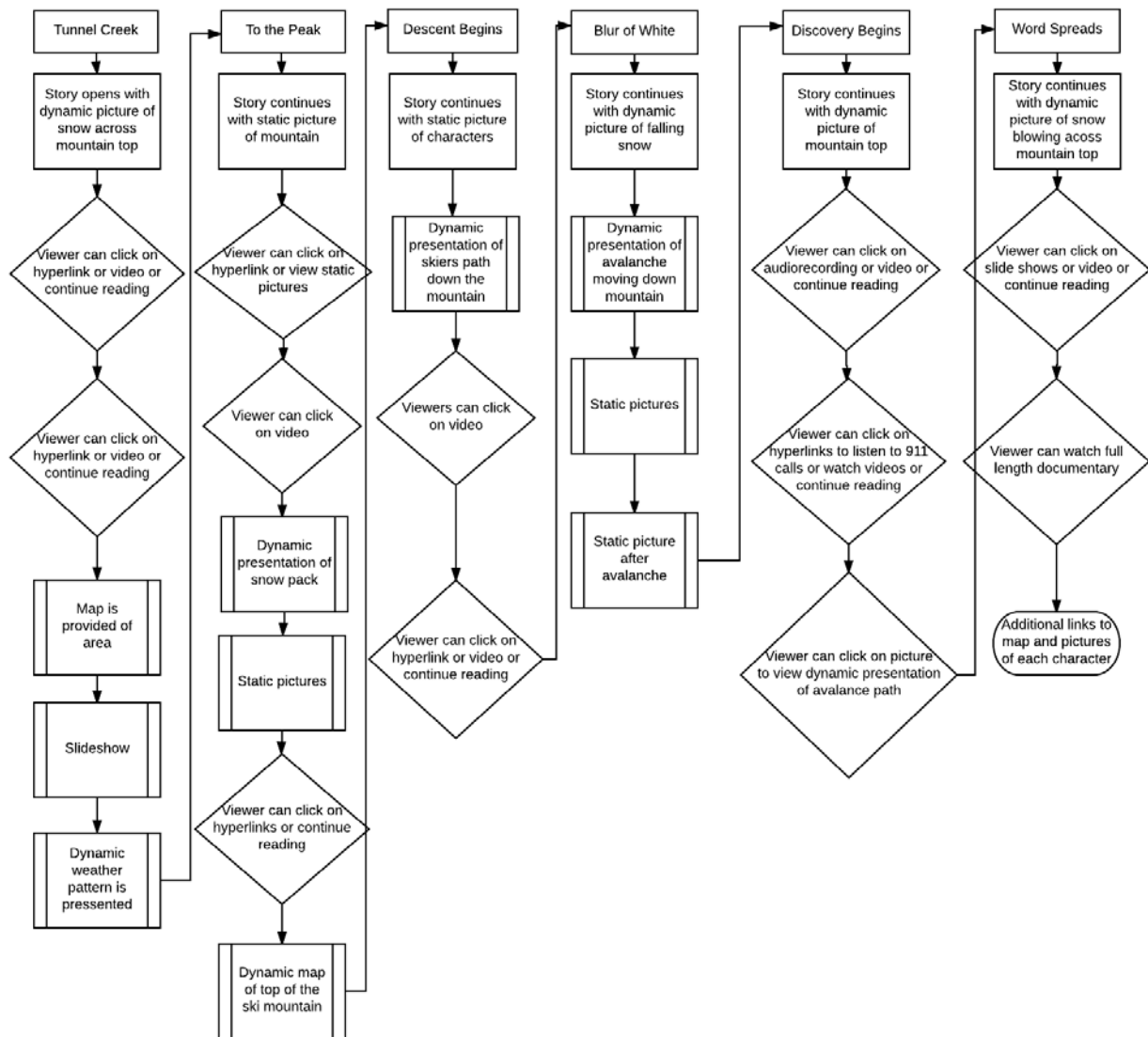


Figure 5. Snow Fall flowchart illustrating interactive components.

In the NSA Files, readers can expand information on a bubble chart that shows the type of data the NSA can access by interactively toggling their screen. This action causes the information to expand, thus literally and visually showing the breadth of the NSA’s reach, in a way that is much more illustrative than text alone could depict. Through their involvement with the story, readers become more engaged in the content. The NSA Files blends narration with interactive features and video clips in a manner that explains a complicated story more effectively than static text. As readers scroll down the story, video players and interactive elements are progressively loaded. This aspect gives the reader control of the story while also making the action seem to come alive as the viewer continues to read. Likewise, videos stop once a reader scrolls forward through the story. The stories are laid out in a manner to sequentially introduce additional information, as part of the narrative flow, creating a semi-controlled environment that helps to direct learners in the path towards knowledge. In Planet Money, the audio and video presentations begin when the viewer selects “play” but can be stopped at any time, reversed or forwarded, leaving the viewer in control of the pace. Colorful pictures depicting the next part of the story are featured at the bottom of each screen to encourage viewers to click on the next chapter to learn more. There are instructions to “scroll to read” that provide more information regarding the topic, in the form of text and charts (data visualization). Snow Fall’s interactive aspects are linked to the user’s scrolling motion; for example, the skiers’ paths down the mountain. These interactive components help connect

the reader with the story. In *What is Code?* hypermedia, in the form of hyperlinks and links to sound and video, are used to allow learners to navigate to more information. Also in *What is Code?* learners can debug code, and try their hand at writing code. By interacting with the content, the learner's curiosity is reinforced with more information. Examples are provided below (Figure 6). Viewers are encouraged to "Click the boxes to change the circuits" and "mash the key on your keyboard" and are rewarded with changes that occur on the picture (e.g., color changes, letters drifting across the screen). Providing an opportunity for readers to be actively involved in the story increases and maintains readers' interest.

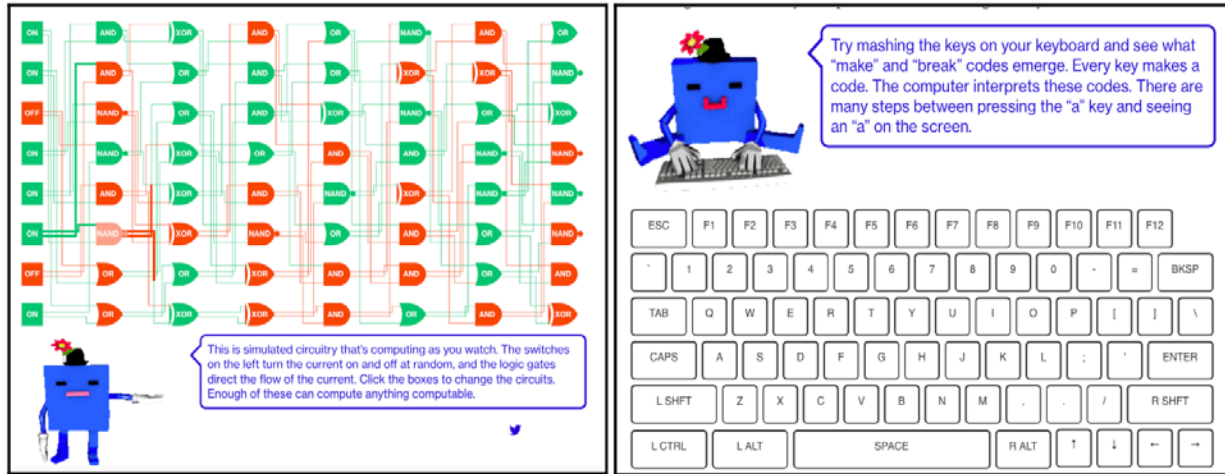


Figure 6. Viewers are directed to click on pictures in *What is Code?* (Ford, 2015). Copyright 2013 by Bloomberg News. Reprinted with permission.

Students in online courses that provided interactive video achieved significantly better learning performance and higher levels of learner satisfaction than learners in courses featuring non-interactive video or in traditional classroom environments (Zhang, Zhou, Briggs, & Nunamaker, 2006).

Narrative

Interactive stories feature a narrative (i.e., a story) as the structural core of the content. Readers are guided by a chronicle of connected events that form a story. The narrative serves to guide and support learners in problem solving, allowing learners to select, organize, and conceptualize resources (Butcher, 2006). The narrative is key to increasing student engagement and knowledge retention. Journalists have found that readers are more likely to complete the entire interactive story when a narrative is used (Dick, 2014). Interactive narrative allows learners to explore, look at content from different viewpoints, and consider each piece as a part of the whole (Mulholland, Wolff, Zdrahal, & Collins, 2008). The narrative serves to frame experience, helping the learner process the information with less cognitive effort (Bruner, 1990). Well-crafted stories in which information is thematically organized are more memorable (McGregor & Holmes, 1999). *Planet Money* chronicles the making of a t-shirt with narration that is laid out sequentially (Figure 7). *Snow Fall* also uses chapters to structure and organize the content for the reader.

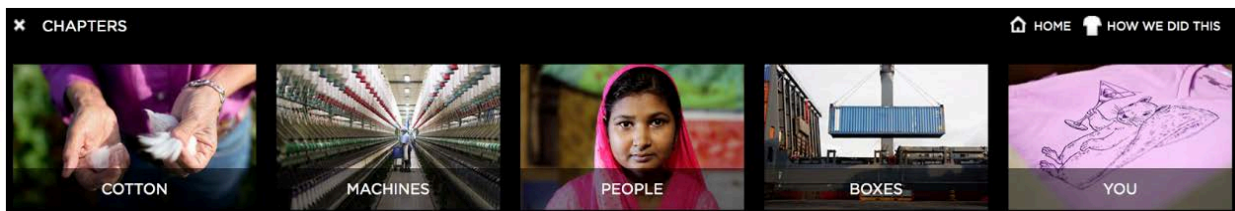


Figure 7. In *Planet Money* chapters are used to structure and organize information (Blumberg, 2013). Copyright 2013 by NPR. Reprinted with permission.

Snow Fall engages the reader by providing personal details about the victims, their personalities, and their families. Stories that include elements that stimulate emotions or interests motivate the learner (Mayer, 2014). Stories provide learners the ability to use powerful narrative memory links (Psomos & Kordaki, 2012). In *What is Code?* narration is used to capture attention and make the subject more personal to the reader. Narration also gives learners a framework to follow and process information. Sticky, engaging media is interspersed in *What is Code?* to help keep the reader engaged for the entire lengthy article. By incorporating reader involvement, interactive stories serve to build knowledge, rather than allow passive knowledge transfer (Psomos & Kordaki, 2012).

In interactive storytelling, an attention to detail and surprising features help engage the reader. A bot in *What is Code?* lets the reader know how long he has spent on the site, and where he left off on his last visit. The same bot guides the reader through the piece. The magic of interactive storytelling appears to be the embedding of the five features in a seamless fashion that supports and encourages the reader to continue through the stories, interested and engaged. Transferring these features to online courses suggests the potential to engage students in a revolutionary format that has already proven to be successful.

Implications for Course Designers and Educators

Course designers may increase the effectiveness of online courses by using interactive storytelling. Narration is the structural core of interactive stories. The narration needs to be developed in a manner that is powerful, focused, and resonates with the target learner. A narration that is concentrated on the key aspects of the content guides the reader. Other features (e.g., dynamic presentation, data visualization, multisensory media, interactivity) should be seamlessly integrated to support the narration. These multimedia features reduce the cognitive load of the student and increase the learner's interest (Mayer, Fennell, Farmer, & Campbell, 2004). Mayer et al. (2004) suggest multimedia features increase student interest when content presents "coherent representations and integrates the pictorial and verbal representations with each other and with prior load" (p. 389). This practice facilitates knowledge retention and transfer.

Dynamic presentation can be incorporated into courses to add visual appeal and help the learners to connect with the story. Course designers can provide learners an opportunity to stop, start, and review content. A survey of 71 online learners reported enhanced student learning in online courses as a result of dynamic presentation (Donkor, 2011). Data visualization distills abstract information and communicates it in a graphical manner. Data visualization can help learners understand content better. The Internet provides support for designers interested in making graphs, charts, and infographics (e.g., sites like Infogra.am, Easel.ly, and Datavisualization.ch). Multisensory information in online courses increases perception, leading to better learning outcomes (Zhang et al., 2006). Graphics, audio, and video should be positioned in a manner that moves the narrative forward and supports learning. The flow of the story can be controlled by paying attention to the scale, positioning, and other design variables of the dynamic presentation, data visualization, multisensory media, and interactivity.

Interactivity enhances agency, the "power of the individual to choose what happens next" (Lindgren & McDaniel, 2012, p. 344), and creates an experience that improves online learning and strengthens students' engagement. Online courses that provide choices for students based on interests and perceived relevance of content offer significant benefits for students in terms of critical thinking and the acquisition of skills (Lindgren & McDaniel, 2012). Dynamic content offers students personalized learning, creating a more motivating environment (Ford, 1992). There is general support that online courses should try to leverage the affordances of personalized learning, rather than replicate traditional classroom practices (Lindgren & McDaniel, 2012).

Course designers can work on editing out components that are duplicative or fail to add value to the lesson. Superfluous media disrupts learning. The focus of interactive stories in online education should be on education not entertainment (Rossiter & Garcia, 2010). After adding interactive storytelling to courses, students' reactions and academic results can be accessed, to ensure learning is achieved. In addition, the students' ages should be considered, as well as their access to the Internet. Interactive features may distract younger students, leading to cognitive overload (Bus et al., 2015). Slow broadband may frustrate learners and discourage them from loading large files or any other multimedia features (Choi & Johnson, 2005).

Conclusions

Interactive storytelling offers an opportunity to present course content in a manner that motivates and encourages learners to construct knowledge in an immersive fashion. Students who are actively involved in online courses report higher levels of satisfaction and learning (Swan, 2001). Adding dynamic presentation, data visualization, multisensory media, interactivity, and narrative to online courses transforms content, making it potentially more effective and engaging. The interactive stories discussed in this paper demonstrate the potential for interactive storytelling to appeal to readers, enliven content, and expand knowledge.

Re-thinking content and delivery demands creativity and challenges all involved. However, as journalism has shown, interactive storytelling changes the experience for readers by increasing interest and inspiring further exploration. While journalists have set a high bar, including even a few of these features can change a course from simply supplying information to becoming a powerful experience in which the student becomes immersed and greater learning may be generated. Changing the tone of instruction from a didactic piece on how coding works to including a narrative with activities transforms the experience for learners. Taking an object that is familiar to learners (e.g., a t-shirt) and introducing information about manufacturing and product sourcing helps learners understand sociology, geography, and economics differently. Course designers can utilize resources from the Internet to help incorporate dynamic presentation, data visualization, multisensory media, interactivity and narration to grab learners' attention and add appeal. Providing an opportunity for learners to click, see, and hear while learning changes online courses to be like other media that learners consume. Interactive storytelling helps encourage interest in content and offers a positive change that can increase student engagement, knowledge gains, and improve the online learning experience.

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