Using Digital Storytelling to Determine Good and Bad Features for Use in Learning Materials

ARIFFIN ABDUL MUTALIB, WONG YOW KIT, MOHD HELMY ABDUL WAHAB

College of Arts and Sciences (Applied Sciences)
Universiti Utara Malaysia, 06010 UUM Sintok Kedah, MALAYSIA
Universiti Tun Hussien Onn, MALAYSIA

am.ariffin@uum.edu.my

Abstract - This paper reports on an ongoing study that determines good and bad features for learning materials for children through digital storytelling. Since the digital storytelling has attracted research attention, children’s needs should be studied, because they are the generation to utilize the technology. Hence, this study is carried out. This paper starts with some discussions on the background. It highlights infrastructures supporting the digital storytelling for sharing, followed with some general discussions on the digital storytelling itself. Then the activities involved in this study are described, including the development of digital storytelling that adapts the user-centered design approach. Further, a user test of the digital storytelling is elaborated including the results obtained. Next, the features are discussed in relation with the design principles, before the conclusion section follows at the end.

Keywords:- Elementary education, DST, human-computer interface, media in education, pedagogical issues, teaching/learning strategies

1 Introduction

Current digital age has shown that object, information, and transaction can be represented in digital form [1, 4, 5]. In addition, the technology has also supported for the experience to be digitalized [3]. Communication and sharing are also made easy and enhanced sophisticatedly by technologies such as Facebook, Photopages, Flickr, Twitter, MySpace, Tagged, and Youtube which are available freely on the Internet. In fact, Internet users among children are growing. Besides making use of the technologies, children also make use of the Internet for sharing. Not only pictures are shared such as those available in Photopages and Flickr, but also their experiences and stories which are uploaded in Tagged and YouTube. Supports from these technologies enable children to advance themselves as the Net Generation. Previously, storytelling was addressed face to face with various advantages of social values [8, 17, 20, 27]. But now, it is addressed in digital form [16, 29, 31].

1.1 Digital Storytelling

The Digital Storytelling Association [9] defines digital storytelling as “...the modern expression of the arts of storytelling...digital stories derive their power through weaving images, music, narrative and voice together, thereby giving deep dimension and vivid color to characters, situations, and insights...”. Inline with the association, Churchill, Ping, Oakley, and Churchill [6] and Evangelista et al. [10] simplify a digital story as an experience or an activity which is conveyed via technological way. In reflection, digital storytelling refers to the practice of incorporating digital text,
imagery, video, and audio into the aesthetic presentation of a computer-mediated, multimedia story. Like a digital movie or video, a digital story is typically composed of still and moving images, text, sounds, music, and voice narration to depict an important event, person, position, or condition. These multimedia components should be integrated properly so that they complement each other to deliver a story successfully. In addition, Meadow [21] describes a digital storytelling as a short, personal multimedia tales told from the heart. He adds that it is not just a tool but is a revolution [22].

The arguments in the above paragraphs ensure that the DST is able to work efficiently in motivating, envisioning, representing, and validating interaction concept [32], in delivering experience.

In making the DST friendly to the users, certain elements should be designed properly. A DST should have three aspects for consideration i.e. the content, form, and behavior [7]. This means besides the contents and functions, the interface is also important. In terms of the interface, beauty is one of the factors, and how the interaction is design is also very important [26]. This paper aims at determining good and bad interaction features of DST for children. This study chooses to work with children because they are young generation who will be inheriting technologies and experts for many years ahead.

In addition, this study focuses in making the DST usable in terms of 14 design principles including (a) Signpost, (b) annotated navigator, (c) hybrid navigation, (d) obvious between clickable items and decoration, (e) metaphors, (f) various media elements, (g) visual alert in supporting mental model, (h) user control, (i) linear navigation, (j) aesthetic values, (k) standard, (l) avoidance of cognitive overload, (m) minimize user tasks, and (n) information visualization. These design principles are selected because they are among the most basic in designing interactive products. They are incorporated in various places in a DST developed specially for use in this study. Samples of the DST are depicted in the next section.

This section elaborates the background of study, in which the definitions and concepts of storytelling in digital form are outlined. Also, the aim of the paper is addressed. Next, the methods of carrying out the study are explained at length. Further, the results of testing are addressed. Discussion of the results relating other studies follows in the next section before the conclusion part containing planning for future works follows.

2 Method
This study involves two phases, first the development works of a DST. This part adapts the user-centered design (UCD) approach, in which each artifact is evaluated with the users [14]. UCD refers to a design approach in which the potential users are involved in the designing team, especially in evaluating all artifacts at each designing stage. Second, user test follows. Even though all artifacts at each design stage are evaluated by the users, the finished interactive DST must be evaluated so that the users get and experience the actual representation of the developed DST. The activities involved in both phases are outlined in Figure 1.
Figure 1 explains that the development of DST was begun with script writing. The script is very important to convey the storytelling to the users. After the script has been confirmed and accepted by the users, the storyboarding began. Storyboard represents the storytelling in graphical illustrations [15]. It also represents how the storytelling looks in digital form when fully developed. The storyboard has also been approved by the users. This is to ensure that users are satisfied with the flow design of the DST.

Having confirmed the storyboard, the process proceeded with digital editing. This refers to preparing elements for the DST. The elements include all audio, pictures, text, video, animation, and buttons. Users involved in agreeing upon the elements by analyzing each element in groups. This was a long process. Also, the transition behaviors were analyzed by the users. Finally, the elements were composed into a working prototype. It involved integrating all elements as described in the storyboard. When the DST was ready, it was assessed by the users in a proper user test.

In the user test, 15 preschool children were involved in natural setting. They were observed closely when interacting with the DST in their normal environment at school. In addition, the children were also interviewed for additional data. The user test was focused at gathering information and feedback on features the users prefer and confused.

2.1 The Development
This section presents the DST developed in this study, with design principles incorporated. Tarzan was chosen to suit the children, because it is a famous character among children. The social values in the story include sincerity, caring, love, challenge, and happiness. Figures 2 to 7 depict samples of snapshots of the developed DST.
Figures 2 and 3 show the interface for the main page. Everything is similar except the page number. Figure 1 shows the page number for the current page, which is page 1 – signpost. When the cursor is moved among the pages available in the page selector, the page indicator changes accordingly. When the cursor stops at page 5, the page indicator shows number 5, telling that the cursor is to select page 5. This annotation tells the exact location – annotated navigator and provides hybrid navigation. In addition, when the cursor moves among pages over the page selector, they react physically, telling that they are clickable items – obvious between clickable items and decoration. The metaphors in this DST inherit the original context of Tarzan in the forest.

Figure 4 depicts page five, indicated with its page number. Users could also identify their current page by looking at the available pages on the left or right (Figure 5). There are texts telling the story, supported with picture – different media elements. Also home and audio buttons are available. The buttons will change their color when the mouse rolls over as shown in Figure 5 – visual alert in supporting mental model. In each page, there are narration reading the texts and background music. Users could choose either to hear to the audio or not by pressing the audio button – user control. Picture 5 also shows next and previous buttons which provide linear navigation; This enables users to navigate the pages linearly, which is always preferred when first time reading the DST.
When users click certain page, the page will change accordingly. Animated transition behavior as shown in Figure 6 is applied during the page change to add aesthetic values to the DST. In the mean time, the background metaphor remains unchanged in the whole application to make the DST standard from start to finish. Also, it avoids cognitive overload. Besides text, pictures, and audio, the DST also utilizes videos as...
shown in Figure 7 to convey the story. The video is equipped with pause and play buttons only to avoid confusion. When the page loads, the video is automatically plays, to minimize user tasks. The various media element is important to visualize the story.

The paragraphs above describe the DST developed in this study with descriptions of design principles it applies. Those principles are made used to suit the children’s needs. The next section explains about the user test, to determine features good and bad for the children.

3 User Test and Results

3.1 Procedure
There were 15 children aged between 5 and 6 years old involved in the study. They were employed from two kindergartens. All children were selected among those who have a computer at home and use computers daily. This is to ensure that they have good computer background, so that their feedback can represent also those who are not used to computers.

Each user used the DST in their natural setting individually in their kindergarten, but their friends were allowed to entertain them. They control the DST and were communicating with their friends while using the DST. Think-aloud protocol was applied, in which the participants were encouraged to speak-aloud all their ideas about the DST while using it [23]. Data were collected by taking notes over participants’ comments and body languages. Also, they were interviewed after using the DST.

As this study focuses on design principles as stated previously, hence, only data related to the 14 specified design principles were considered in the observation and interview. Further, results of the test are discussed in the subsection in the following.

3.2 Results
Data gathered in this study are in qualitative form. From the observations through the think-aloud protocol and body language, the data as listed in Table 1 have been gathered.

<table>
<thead>
<tr>
<th>Design principle</th>
<th>Gathered data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signpost</td>
<td>The signpost really helps the participants be aware of their current location. When they have identified the location, it eases them to revisit the location.</td>
</tr>
<tr>
<td>Annotated navigator</td>
<td>The participants were observed interact well with the annotated navigator. They know exactly the location they want to visit.</td>
</tr>
<tr>
<td>Linear navigation</td>
<td>First time reading the story in the DST makes the participants utilize the linear navigation. They were happy using the linear navigation in absorbing the story. However, the buttons for the linear navigation in the DST are too small for children, and it was found that many of them did not realize that they have that option.</td>
</tr>
<tr>
<td>Hybrid navigation</td>
<td>When they have absorbed the story, they prefer to use the hybrid navigation. They are happy to have control over the DST.</td>
</tr>
<tr>
<td>Metaphors</td>
<td>The participants have no question regarding the metaphor used. All of them have some associating knowledge between the character and the context.</td>
</tr>
<tr>
<td>Various media elements</td>
<td>The various media elements support participants’ preferences differently. It was observed that they enjoyed different element differently which is inline with the theory of multiple intelligence [13].</td>
</tr>
<tr>
<td>Visual alert in supporting mental model</td>
<td>The visual alerts notify participants about the buttons. Although the buttons are small, but when they change their color on-mouse-over, the participants know their status.</td>
</tr>
</tbody>
</table>
The data show positive feedbacks from the participants. Based on the gathered data, the following section further discusses on the impacts to designing DST for children.

4 Discussion

From the user test, this study found that all the 14 design principles are important in supporting children interaction with DST as listed in Table 1. The benefits of the 14 design principles include reducing cognitive load, optimizing fun and pleasure, minimizing excise, minimizing learning curve, intensifying ability of memorizing, and increasing efficiency and effectiveness. Besides the outlined design principles in Table 1, this study intends to address some weaknesses found during the user test. Next paragraph discusses the additional principles in designing the DST for children.

Buttons should be obvious, whether in terms of size or visual clue. Buttons are important, so users must be notified to further avoid mental efforts and confusions that lead to excise. Second, in terms of user control, users want to have maximum control over the DST. So, if there is any audio element, allow the users to control the audio volume.

The 14 design principles are supported by the established design guidelines by Nielsen [24], Schneiderman [28], Cooper, Reimann, and Cronin [7], Preece, Rogers, and Sharp [26], and other HCI gurus. Results from this study reveal that the design principles are useful in guiding DST development, assisting children enjoying their electronic reading materials. The DST will not only be read by the children for its contents, but also it is fun and entertaining to the users as the results of the benefits as discussed earlier.

5 Conclusion

In short, a good DST and learning material should incorporate the 14 design principles as outlined in previous sections. This study found that they are good features for DST and learning materials. However, small buttons are bad because children have shallow motor skill to make use of small buttons. Also, long and small texts could result in frustration because children tend to enjoy the story, not to read the words [2].
The DST developed in this study has been specifically developed incorporating the 14 design principles. However, there are many more design principles addressed by the HCI gurus. They are somehow incorporated in the developed DST, but have not been specifically observed. This study expects to focus on other design principles in future in making the DST more usable to the users besides being fun and entertaining [33]. Also, this study anticipates to examine the power of DST in encouraging social interaction [18] among children and its roles in making reading fun and entertaining. Also, works in making DST viewable on mobile devices as carried out by Frohlich et al. [12] should be followed-up. Furthermore, DST could be developed for disabled people like other interactive applications [19, 11, 25, 32] and in education [30].

6 References


