SCAFFOLDING THE STORY CREATION PROCESS

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Abstract: Comic books provide an appropriate and structured context for education and personal or peer reflection. In this paper we discuss the benefits of comic books and technology in a pedagogical context, including the mechanism of scaffolding and how this interaction impacts upon the child's environment. Our studies into the educational benefits of comic books have lead to the development of an interactive comic book application. The application is being developed for the purpose of narrative inquiry through the creation and completion of a story scaffold. The analysis of the data will help evaluate the child's social and cultural interaction with the story.

1 INTRODUCTION

In comparison to traditional textual narration, it has been seen that the process of completing stories partially defined as comic books or graphical novels provides an appropriate and structured context for eliciting affective and reflective thought (West et al., 2004; Pennington et al., 2011). Comic books have been been used as an engaging and motivational learning activity for both adults and children (Norton, 2003). They are appropriate for the classroom (McVicker, 2007), encouraging the development of critical thinking skills (Birisci & Metin, 2010).

Whilst some research implies that the use of comics in the classroom is most applicable specifically to male students with low attainment levels, there is also some evidence that they can also be used successfully with high achievers (Sabeti, 2011; Lenters, 2006; McTaggart, 2005; Norton, 2003; Cleaver, 2008). Comics have been used in a range of educational contexts, from Primary School through to University level. They have been used in developing understanding of concepts such as Business Ethics (Gerde & Foster, 2007), logic in Computer Science (Cervesato, 2011), science lab safety (Di Raddo, 2006), collaboratively teaching English as a Second Language (Sachs et al., 2003) and teacher education (Herbst et al., 2011).

There is wide use of technology enhanced learning, with applications ranging from the use of multimedia through to mobile devices (Stelzer et al., 2008; Ruchter et al., 2010). The use of technology has been found to be of particular benefit in supporting and developing literacy skills through the use of new practices (Burnett et al., 2006). Such practices inclue peer-based learning activities such as groups of children sending emails in which each participant adds another line of the story to build up a collaboratively written narrative (Figa, 2007); and the use of PowerPoint in allowing the choice of appropriate images and text to help the learner to consider their audience (Abas & Zaman, 2010; Robin, 2008).

The use of comics as a pedagogical instrument removes some of the typical workload involved in story creation. It allows users to draw upon familiar presentation and scene structuring paradigms learned from prior experiences with comics, whilst having a positive impact on motivation (Bitz, 2008; Pelton et al., 2007). Furthermore, the intuitive nature of the comic book style makes it easy to learn for those that lack experience with the medium. Illustrated texts offer a unique perception of the narrative provided to the reader and have been shown to create a more empathic sense, allowing more evaluative and critical responses (Moschovaki & Meadows, 2005; Williams, 2008).

The popularity of community driven comic creation by amateurs on the web has increased in recent years (Lopes et al., 2009). Sites such as Toondoo invite educators to create class accounts which allows for the sharing and peer review of completed stories. Such websites allow users to create simple narratives with predefined content, and

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also allow users to suggest the next stage in the story (Williams & Barry, 2005) in a linear manner.

Research by Jong (2009) found that in tasks in which information is presented as non-linear text (specifically hyper-link connected text) the increased cognitive load of navigating the non-linear structure reduced user retention. This raises concerns about the possible negative impact of making a scenario non-linear. However, as Jong's work focused on information with no narrative or temporal progression it isn't clear if it is entirely applicable. It does seem to suggest that non-linearity should be applied with caution.

The aim of the interactive comic book application described in this paper is to draw upon the advantages of comic books in a pedagogical context. The interactive comic book application provides a scaffold around which users can create a completed story based upon their own experiences and understanding of the subject matter. This is portrayed within the comic in a constructive manner, and later allows self- and peer-reflection upon that content. Children's social interaction with artifacts are culturally mediated (Vygotsky, 1978) and although Vygotsky never used the term scaffolding, the use of comic narratives as a scaffold overcomes criticisms of the Vygotskian approach that it does not take into account a child's cognitive development.

The comic book provides a medium that is widely used and accessible to all children. Comics can match tasks to the child's zone of proximal development, bridging the gap between what the child can do without help and what they can do with help. With this application, the scaffold is provided as a scene graph: a conceptual node graph that defines all possible scenes and the choices that must be made to move between these scenes. Users simultaneously interact with this scene graph node-by-node, defining a specific scenario through that graph by the choices they make during the interaction; and fill in content to complete the story (for example by writing dialog or narration entries).

2 PEDAGOGICAL CONTEXT

In order to give the scenario content a theoretically valid basis the groups of characters in the scenario and its plot were designed to reflect aspects of the cultural model proposed by Hofstede (Hofstede, 2010). The Hofstede model defines all cultures as a combination of five Cultural Dimensions: Power Distance, Identity, Gender, Uncertainty, and Virtue.

The use of these cultural dimensions is the basis for assessing the effectiveness of the comic as a pedagogical tool. To achieve this users were given a separate questionnaire instrument, the Inter-group Anxiety Scale (Stephan & Finlay, 1999) to measure their level of inter-group cultural sensitivity and empathy directly. The IAS is a validated psychometric test that examines children's disposition toward out-groups, formalized as a level of anxiety.

The users were also asked to complete an 'interactive' comic. The content the users choose to add to the scenario, in response the inter-group situations presented in the story, would in effect be an indirect measure of the user's inter-group sensitivity and empathy. For example, the way the user chooses to have a character respond verbally to a situation or how they portray the character's state of mind reflect the user's inter-group sensitivity. By comparing the direct and indirect measures the efficacy of the comic book could be established. Further the general level of engagement with the process was assessed qualitatively.

A single cultural dimension was selected to simplify the task of implementing a scenario based on Hofsede's cultural dimensions. The selected dimension was Uncertainty Avoidance. This was incorporated into a story, entitled CampFire, which involves two groups who each manifest an extreme of the uncertainty avoidance dimension. One group focuses very much on the rules of play and micromanaging each other. The other focuses on a more carefree attitude where the rules mattered and group dynamics were important, but with more flexibility in how the game was played.

3 DEVELOPMENTAL STUDIES

Building on evidence in literature, that the use of comic books in a pedagogical context is itself effective, a preliminary study was conducted in order to validate the approach as a means to facilitate reflection on inter-group relations. For this study an 'interactive' comic book was used, which can be seen as a low-fidelity prototype of the final application, to establish that a comic book could elicit valid pedagogical impact.

3.1 Initial Study

The pilot study involved 2 groups of children aged 9-10. The children were given the comic book along side various activity sheets (containing the questionnaire instruments). The activity sheets were themed in the style of a childrens' activity magazine

(rather than as sterile research instruments) and included a variety of activities based upon the subject matter of the narrative portrayed. The activity that was of particular importance to the piloting of the comic book was the inclusion of the Inter-group Anxiety Scale (IAS).

3.1.1 Pilot One

The test group (20) received an interactive version of the CampFire comic in which speech bubbles and thought bubbles in the last pages of the comic were left blank. The comic was bound together with the IAS questionnaire and all the other activity sheets as a single workbook. A front cover and contents page were added and the documents were styled in a way that resembled a comic book annual.

3.1.2 Results

Results from the pilot study confirmed the comic book approach to be an effective means to engage children in inter-group reflection, and also an enjoyable and engaging experience for the children. When compared, the results of the two groups showed that the test group was able to comprehend the storyline of CampFire and add relevant and meaningful content to the storyline.

Further, the completion rate for the IAS in the test group was 85% compared to 10% of the IAS from the control group (all aspects of the workbook were intentionally optional so that level of engagement could be estimated). Qualitatively, the test group worked through and completed all activities contained in the annual requesting less help, where as the children in the control group struggled more with the activities.

In addition the pilot also provided results that had not been anticipated. The children provided more content than was expected or requested of them. For example, in both versions of the CampFire comic some of the faces of the characters were left blank, this was a design decision intended to enhance the minimalist look of the CampFire comic. In both groups the children drew in the missing faces to show emotions that were appropriate to the current scene.

3.2 Narrative Mode Study

In this experiment we aimed to identify whether children could complete a story based upon a story abstract concept and what the baseline for such an abstract story is. The problem is how to define a 'story' to an extent that participants have enough information to build a story but leave enough out of the definition such that the participants are being creative and not just adding to a predefined story.

3.2.1 Pilot Two

Users were put into groups of five and given a large sheet of paper on which a nine-tile empty comic strip was printed. The groups' task was to fill in these squares with illustrations, speech bubbles and thought bubbles (see Figure 1). The 'abstract story' was defined by considering a generic story arch about two friends who fall out, experience some important incident and then become friends again. This was defined and presented to the participants by, taking each box as a scene, specifying what the *purpose* of that box (or scene) is with respect to the story. For example, the purpose of the first box is 'to introduce the lead character.' Each of the nine boxes was given such a purpose, leaving the task of turning these abstract scenes into a specific story to the participants.

Figure 1: Shows a section from one of the large comics.

The groups were encouraged to discuss and create a plan of what they would create. To do this they were given a small version of the empty boxes sheet onto which they could write short notes about what they would put in their final story. Once the plan was complete the groups were left to self-organise and complete the larger version comic in their groups.

3.2.2 Results

The results of the second pilot showed that the children found no difficulty in the task of completing an abstract storyline and grasped the concept of developing a story from the scaffold provided with ease. Each of the groups developed entirely unique storylines with coherent narratives

that depicted a variety of experiences on subjects ranging from sport to damaging the environment to Lady Gaga. The children were so highly engaged and enjoying the session that they complained when it was over. In the design of their comics the children also included conventional comic book visuals such as large red letters to visually express angry voices, without being prompted or advised to do so, supporting the principle that comic book are a natural and familiar environment for children.

4 THE INTERACTIVE COMIC BOOK APPLICATION

For the purposes of clarity while describing the application it is necessary to define some key concepts. Familiar terminology will be used, but used in a way that is specific to this paper. The first concept is that of a *scene graph*: a network graph in which each node represents a scene and edges represent choices. This graph defines all possible scenes and choices available to the user and as such all possible scenarios, in a sense this could be said to encapsulate a meta-scenario. We will use the word scenario to refer to precisely one valid and complete path through the scene graph. The word narrative will be used to refer specifically to the content generated by the user (although the content the user provides isn't necessarily strictly narrative this word does seem to summarise roughly what the user creates.) The scenario graph provides the scaffold; the user assembles a scenario and 'fills in the gaps' with narrative. The interactive comic book application must provide two distinct but related functionalities to the two user groups, for easy distinction the user groups will be referred to as the *developers* and the *users*. The developer will use the application to construct an underlying scene graph. This scaffold will define the structure of the story and the form of the user interaction and will encapsulate whatever meta-scenario the developer wishes to deliver. The user will be presented with an interface with which to navigate through the scene graph, thereby defining a scenario, and adding a narrative to that scenario. Data capture will be used such that the result is a single defined scenario and a narrative dataset.

4.1 Functional Requirements for Developers

A requirement for the developers is an interface into which the non-linear plot nodes of the scene graph are defined. In the construction of each plot node the developer of the scene graph can include an image, informative text and a text box for data entry. These items can be used individually or combined, depending on the needs of the scene graph being developed. The software must present these nodes to the user as a panel from a comic book, and include whichever elements the developer has chosen to include. Additionally, functionality is required that will allow the developer to link plot nodes to one another to provide the branching, non-linear basis of the story which will be formed by the user.

4.2 Functional Requirements for Users

The user of the application will build upon the scaffold provided by the developers. The first requirement is a method of presenting to the users the contents of the scene graph designed by the developers prior to the users interaction. An interface is required to display the content of each plot node as a cell, showing the images, text and an input area for the user to type in the narrative content. Secondly, once the user has completed one cell/plot node they must choose what happens next, constrained by options defined by the developers.

4.3 The Software

The application at its most basic level is a story node viewer; Figure 2 shows how the user interface is organized.

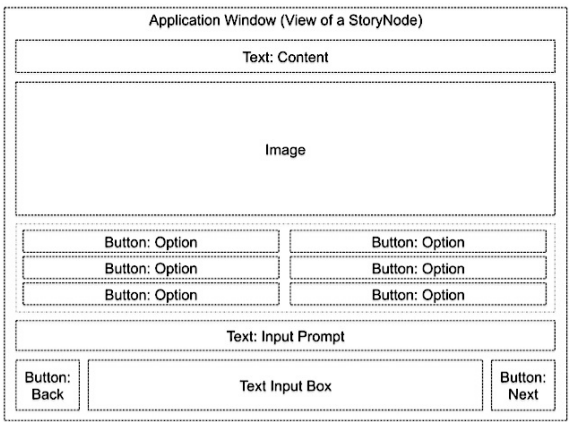

Figure 2: The application layout.

The scene graph, which is defined in an XML file and loaded at runtime, is essentially a list of story nodes. The following example code gives an example of a scene graph definition in which the

user is presented with the beginning of the story "Jack and Jill" and asked to fill in a missing word.

```
<SceneGraph title="Jack and Jill"
identifier="001">
       <nodes>
         <StoryNode identifier="001">
           <target>002</target>
           <image>image.jpg</image>
           <content>1) Jack and Jill went up the
hill to fetch a ____ of water.</content>
           <text-input>What did Jack and Jill go
to fetch?</text-input>
       <nav-options />
       </StoryNode>
              </nodes>
</SceneGraph>
```

The possible navigation routes through the story nodes are defined using two methods. Firstly, each node has a target attribute that either points to another node or points to the 'end' (designating it a terminating node). Secondly, each node can have up to six navigation option child-nodes, each of which targets a node. The user interface converts these XML elements into interaction components. The 'target' attribute is presented as a next button and the navigation options are presented as a set of option buttons. Pressing next or one of the options performs a data capture of the current node, moves the view to the appropriate node and refreshes the view.

In the current incarnation of the software the content of a story node is very basic, containing text and a reference to an image representing the scene. As the image can contain whatever the developers would like to present and the text prompt for text input can be anything, the distinction between the aspects of the 'story' that the developers define and the aspects that the user create is flexible. For example the developers could decide to have the users input dialog and put no dialog in the images, or they could have lots of dialog in the images and have the user write narrative prompts. This flexibility, at this stage of development, is useful as it allows exploration of whatever story constructs that might be applicable for the audience with a complicated authoring process. Future versions of the application will include a more integrated authoring user interface. This will seek to avoid an overly complicated scenario definition convention as this would not only be difficult to develop but is likely to make user interaction more problematic.

4.4 Data Capture

Data capture is entirely abstracted from scenario structure. When the user moves to another node, the current node is taken to be complete and anything the user inputted is captured. A user data object is created and stored in an XML file. This file takes note of the user's identity and references the scenario to which this data applies. By taking this data file and combining it with the scenario definition for that file the scenario the user created can be reconstructed.

While capturing the user inputs other aspects of the user interaction are recorded. The user data mentioned above only captures the final path the user takes through the scene graph, it doesn't capture, for instance, if the user backs up and follows another route. To solve this problem the application keeps a 'complete' history that captures user data for each node but does so for every node the user passes through every time they pass through it, creating an arbitrarily large list of user data objects. For analysis purposes some other aspects of the user's interaction are captured. The length of time the user spends on each node and the number of edits the user makes to the text input box are recorded. These are envisaged as a way to get some insight into whether some nodes get more attention than others.

4.5 Future Development

The current version of the application is a functional prototype. It delivers what was envisaged as its primary functionality: presentation and data gathering. As such, it could be used as a final application, however, its main purpose so far has been for pilot testing.

We hope to improve the usability and functionality of the application by making it a web-based server side application. This would make it platform independent, allowing a unified login system and centralizing the data gathering methods. This would also side-step the issue of access rights on user machines since data can be gathered by the server hosting the application rather than being 'saved' by the client machine.

5 CONCLUSIONS

In all our experiments children fully engaged with the process of completing or creating the narrative of a comic book, with pedagogically meaningful results. The processes that have lead to the creation of the application follow from what children have, sometimes unexpectedly, produced within these experiments. They have shown that it is possible to create an engaging activity that not only promotes literacy and literary skills in the creation of a narrative, but also allows for the development of concepts from other subject areas, in this specific case inter-group sensitivity, in both individual and collaborative contexts.

In this paper we detailed the on-going development of an interactive comic book application for the scaffolding and creation of nonlinear stories. We have shown how the use of comic books and technology are beneficial to children's learning experiences. We also described two pilot studies in which we investigated an innovative approach to story creation through the use of comic book styled instruments.

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