Deaf Students and Comic Hypermedia: Proposal of Accessible Learning Object

Raul Inácio Busarello[1], Vania Ribas Ulbricht[2], Patricia Bieging[3], and Vilma Villarouco[4]

[1] Universidade Federal de Santa Catarina, Brazil
raulbusarello@gmail.com
[2] Universidade Federal de Santa Catarina e Universidade Federal do Paraná, Brazil
vrulbricht@gmail.com
[3] Universidade de São Paulo, Brazil
pbieging@gmail.com
[4] Universidade Federal de Pernambuco, Brazil
villarouco@hotmail.com

Abstract. This article presents the perceptions of deaf users that had participated in an experiment about the use of comics as hypermedia learning object of descriptive geometry. The methodology used was exploratory research, applied based on qualitative method. From that the prototype was created and subsequently tested with the sample of the public. This article presents: an approach to the profile of the public searched; the structure of the prototype created; and the results of applying through perspective of deaf students. As a result it was observed that: the comic's structure and adapted to the hypermedia presentations facilitate the content's assimilation by the deaf student. The participants had been adapting quickly to form navigation proposed in learning object. Moreover, the media creates an emotional appeal to the audience, which contributes to their learning.

Keywords: deaf, comics, hypermedia, accessible, learning object.

1 Introduction

This experiment has as theoretical foundation a studies series that shows the difficulty in learning deaf students because difficulty of them reading written texts. The ideal for learning deaf students is the emphasis on graphics and visual learning environments [7] [15]. Hypermedia environments contribute to the education of the deaf students as they allow access to multimedia that make easy learning various content [19]. Similarly researchers who advocate the use of storytelling as a tool for knowledge generation in hypermedia environments shows that the nonlinearity of the medium allows the student to define and control the browsing process and reading of data. It enabling the user knows the story through comfortable and convenient way [5] [16] [18] [20] [21]. Comics are a storytelling form formed by text and image that facilitating the process of representation of reality by students [6] [10]. Comics structure

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consists of interconnected images in sequential frames enable greater integration of content with the imagination of the reader. It making possible to reader impose the same pace of reading and therefore learning [9]. Besides comics are being readily adapted to environments hypermedia [13].

In that context the aim of this paper is to present the perceptions of deaf users who participated in the experiment on the generation of knowledge through the use of learning objects in comic hypermedia [4]. This learning object has focus on learning the concept of Orthogonal Cylindrical Projection.

The methodology is exploratory based on qualitative research. The implementation took place from the use of the prototype with the target audience where it was possible to collect the student's opinions. Data were collected from: 1. Questionnaire completed by the volunteers before they have contact with the prototype; 2. The activities results while the volunteers using the prototype; 3. Researcher written notes while the volunteers were using the prototype and activities; and 4. Focus group data obtained by researcher from the transcript of video record. The target audience was research volunteers members of two educational organizations for deaf people in Florianopolis city, SC, Brazil.

This paper is restricted to present the profile of the research public. It presents too the structure of the comics hypermedia prototype learning object. In the end the paper presents the results of prototype applying search through the perspective of users.

2 The Research's Deaf Students

Volunteers from two educational organizations for the deaf people of Grande Florianopolis City, SC states, Brazil, had participated to the research. One of these organizations is *Institute for Hearing and Language Therapy*: it is a non-governmental organization. It have a goal of developing the potential of deaf communication and educational focus in oralism and the need to recognize the use of – Brazilian Sign Language – LIBRAS [11]. Another one was *Deaf Association of Grande Florianopolis*: "is a civil organization focused in areas as an socio cultural, educational, vocational, recreational and healthcare nonprofit that attending the deaf and their families" [1]. The association acts as though assisting together with an official bodies and public power, public, whose goal is to promote education, professionalization and the inclusion of the deaf in the labor market. All it through agreements and contracts with public and private sector. Among its objectives this organization offers several levels of LIBRAS course, orientation and support to parents of deaf people. Additionally, the organization offers events about deaf culture and lectures in the areas of health, education, justice, work and psychology to society.

The research was conducted in the beginning of September 2011. As a requirement volunteers should: 1. Being over age 15, because the content of graphical representation of a learning object is usually taught in high school or higher and requiring certain instructional luggage; 2. They could be men or women, of any race, belief, social class, provided they had some kind of hearing disability; 3. The students needed had minimal familiarity with computer. That because the prototype's construction purpose is to develop a tool for online learning.

In the first *Institute for Hearing and Language Therapy* nine people were willing to be research volunteers. In *Deaf Association of Grande Florianopolis* three people were willing to be volunteers. In total the survey was conducted with twelve volunteers. To ensure anonymity, they were being identified from the naming, such as: Volunteer 1, Volunteer 2 to Volunteer 12 [4].

At both institutions was requested the interpreter assistance to make communication between researcher and volunteers. By the number of participants in the first organization two interpreters assisted in communication and in the second one just one. The surveys were recorded on video and made on different days.

2.1 Profile of Volunteers Search

As the profile of research volunteers through a structured questionnaire [4] it can be seen:

- Five of the volunteers were aged between 15 to 20 years; one between 21 a 24; two between 26 to 30; two between 31 to 35 and two between 36 to 40;
- Seven volunteers are female and five male;
- About the deafness degree: four volunteers are partially deaf and eight completely deaf. Two of the partially deaf volunteers declare that are completely deaf in one ear and partially deaf in the other one;
- About the period in which lost hearing, six were born deaf. Three said they lost their hearing before learning the Portuguese language oral and written. Three lost their hearing after learning the Portuguese language oral and written;
- All volunteers communicate using LIBRAS;
- Five stated that they use and communicate through writing. However, all twelve volunteers filled out a written questionnaire. It suggests that all volunteers read and write though some with more difficulty than others;
- One of the volunteers told not to use the internet. Of the other volunteers that use the Internet: eight access content related to sports and leisure and five seek journalistic information;
- Nine of the volunteers declare use Facebook or Orkut, social networks where communication is through text. Seven said they use MSN, tool that beyond the text can add the video too. Only one volunteer said using the tool OOVOO. It also enables communication throygh video. However to communicate in social networks eleven of the volunteers said using text for do this. Eight said they also use the webcam to communicate on the Internet;
- Nine of the volunteers using the internet as a study tool, where the biggest practice is research for school work and access to University's ambient course or others who have disciplines in On-line learning;
- About comics contact: two of the volunteers said they did not enjoy reading this media. However ten of them like it;
- All volunteers said they had never have contact with the contents of Orthogonal Cylindrical Projection.

3 The Prototype Learning Object in Comic Hypermedia

To the storytelling building first the researcher crossed data gender and age of audience with research data of the readers profiles comics [22] [23]. From this data it was establish that the comic book created as learning object, must have as style references the work of Brazilian comics designers. It must be emphasis on a light storytelling flow and a subtle humor.

The second topic to be considered before the design and development of the comic screenplay is that any media object to be considered learning object should be added to other learning objects. It must approaches two basic requirements: learning and reuse [12]. That means this object must have the ability to be reusable by different developers and different instructional contexts. Furthermore, this object should allow greater interactivity-with the student. It must encouraging the student reflection and culminated in the formation of new concepts by the individual.

The object built stresses the nonlinear character. It organized on small learning objects put in a coherent and logical context according the storytelling. It contributes to forming a learning object larger. The comic is based on a nonlinear storytelling where the students should have a single entry and exit of the object, but with several links possibilities within the story [17]. The output successfully depends of the student's answer into the system with positive return during the final evaluation.

It is necessary that the story has a logical storytelling with a defined beginning middle, and end. In this way was used as the basis for the dramatic structure of the storytelling paradigm that divides the story into three acts [8]: Act I is the character and story presentation; Act II corresponds to the character's confrontation and obstacles to character arrive on him/her goal; and the Act III is the resolution of the story. Turnpoint is the situation that changes a Act to another. It could be incident requiring a certain character's action.

The entire storytelling consists of individual pieces that are arranged and unified story. It enables that in the story designing could be structured nonlinear form despite it needs complies with the consistent storytelling development. A hypertext storytelling can be structured both linearly and non-linear [3]. However how the screenwriter will work the language structure elements it gives the storytelling pace. Moreover, a comic series embedded in other comic series creates a sense of depth in story [14]. Links can be a resource that encourages the reader to know aspects that complement the main storytelling. It contributes to greater student interaction and possibility to he/she reviews the content presented by another way [16].

Accordingly it the researchers structured the comics through a linear main storytelling. It presents a fictional storytelling content Orthogonal Cylindrical Projection and ends in a student evaluation. Depending on the student answers he/she is able to advance in content where he/she will accessing another learning module or continue with the same story reviewing the educational content in other ways.

The second part of the storytelling has the same learning content but with different story. It is accessed after the assessment if the student had incorrect answer. The content of the storytelling links also has a linear character. Its nonlinearity in fact may or may not be accessed from a particular time in the story. These little side stories are returned to the point where the student accesses it.

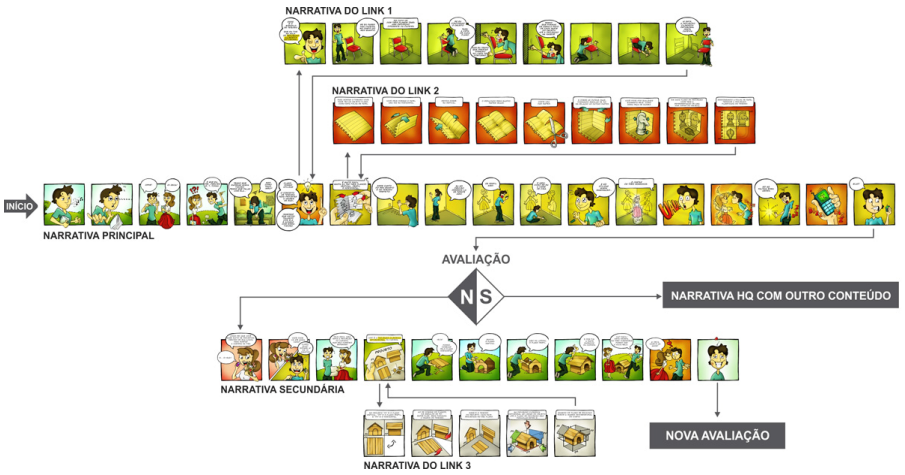

Fig. 1. Nonlinear comics structure - theme cylindrical projection orthogonal [4] (based on [17])

3.1 Browsing in the Comic

From the building of the story the researchers created an interface designed where deaf student could navigate by storytelling. Thus the prototype is structured: on a neutral background; it has an identification in the storytelling upper left corner with the content of the learning object; the text and design of the characters action is centered on the screen into a frame; browsers to access the frames before and after; and a map at the bottom with the structure of storytelling.

Fig. 2. Layout of the interface navigation of the learning object prototype [4]

Based on guidelines for the adaptive web interface design [2] the aspects of the prototype structure which help user navigation are: use of arrows; description links; map navigation; and use arrangement of elements on screen to prevent the student distraction.

Lodgment of comics: despite the comics language was structured from reading between frames in the digital environment the manner of presentation of these elements may include various forms [14]. Browsers facilitate the frame visualization and between previous frame and later frame. The space between frames is marked by effective student action on the environment by student clicks at the arrow.

The map is used as medium to full story view. This map shows all the frames that make up the storytelling in linear order. It indicating which frame is being shown at the moment. Despite the linear format it is possible to the student a non-linear navigation between frames. The student only must click on the picture that he/she want to be see.

4 Application Result with the Public

The researcher sought information about volunteers' perceptions using a focus group tool to do it. Those students' perceptions were about the comics' language as a way viewing way the content and the proposed use this storytelling in learning. This discussion took place in an open where participants were free to do comments and questions. The researcher's role was to lead the discussion into the theme. But he did it without neglecting any other issues that might arise.

4.1 The Comics Language

The learning proposed presented through the use of the comics language was well accepted by the study volunteers. The images contributed to the deaf volunteers could better understand what content should be taught. The volunteers stressed that it is important to use pictures to help the deaf people in text comprehension.

The Volunteer 12 stated that until the application had not seen a learning tool with a focus on deaf that uses the comics' language. It stressed that experience is valid and that the use of image helps them in understanding the subject. The volunteer reports that at the beginning of the content found reading a little difficult, but then managed to assimilate. Moreover the Volunteer 12 surprised about the presentation of the content.

Likewise the Volunteer 10 also was surprised by the proposal. He had some difficulty in understanding the content, but just on beginning.

For Volunteers 3 and 6 the images helped them in understanding the text because this feature prevents often get asked what the meaning of a particular word is. They said that in this context the picture was very important because if the content was presented only by text survey participants could not understand. The Volunteer 11 identifies that there are many word meanings that deaf people do not know. In addition the volunteer understands that some words have more than one meaning, so understanding of reading may be impaired. However the image contributes to understanding the text.

In this context the Volunteers 10, 11 and 12 believe that through the use of the comics language was easy to understand the proposed content. Likewise, the

Volunteers 1, 5 and 9 said the picture helped them to understanding the picture. However, the Volunteer 1 in some moments the text reading harmed the content understanding.

The Volunteers 1, 3, 5, 6 report that failed to understand some words written in Portuguese, but in this case the image helped them the content. Beyond it helped in the actual understanding of unfamiliar terms. To the Volunteers 10 and 11 was not very easy to understand a few phrases because terms were unknown. But they said the comics language facilitated the understanding of the story context of the story.

The Volunteers 1, 2, 3, 4, 5, 6, 7, 8 and 9 said had been certain difficulties in understanding written words. But it not detracted the meanings of the history contents.

For instance: the Volunteer 9 explained that when she reads a book , not understands many words and it confuses the story meaning. However through the comics' language it was easy to understand. To this volunteer is easy to understand when a context is presented by some writing text and it is illustrated by a picture. The Volunteer 5 adds that when writing in Portuguese language is simplified, and still accompanied by a picture it turns easy to understand the meaning.

The Volunteer 3 understands that the Orthogonal Cylindrical Projection concept was understood easily because the comics present a little text, pictures and contents used together. This volunteer stresses that just reading the comics was able to understand the learning content. This opinion was divided among all study volunteers. To the Volunteers 10, 11 and 12 the picture and words enabled the complete understanding of the message even when certain words were not understood.

4.2 Learning Particularities

The storytelling in comics proposed has facilitated the visualization of the Graphic Representation specific concepts. Also it provides that this content was shown through a playful storytelling.

The volunteers identified themselves with the drama of the story and the characters. It contributed to the understanding of educational content. The Volunteer 5 liked the story because it was about the character's life. She said feel good read. The Volunteer 12 was surprise by the story and the character's reaction. Volunteer 6 was eager to see the end of story because he twisted by character. Volunteers 1, 3 and 9 were identified with the story because they had lived a similar situation that the character lived. The Volunteer 11 liked reading because it was the love story between boy and girl.

For volunteers the plot and the characters were not displaced didactic content in the storytelling. Both contents were work so that was easy to understand by volunteers. They agreed after interacting with the comics learning object they could understand a little about the concept of Orthogonal Cylindrical Projection. The Volunteer 12 identifies that the comics' prototype helped introduce the discipline. However he emphasizes that needs to do more research on the subject to understand deeply the content.

The Volunteer 10 reported that he had done drawing classes and that what he did was similar to that seen in content of learning object. The volunteer understood the contents, but he said it is difficult. Volunteer can not tell if the difficult is in relation to how content is organized in comic learning object. However he identifies which

also had difficulty in drawing classes in the past too. The participant said that comics helped him better understand the content, but he still identifies that need exercising more the content.

5 Final Thoughts

This article presented a part of the perceptions of deaf users. They participated in the experiment on the generation of knowledge through experience of the student by the learning object hypermedia [4].

As a result it was observed that: the peculiar structure of comics in a hypermedia enviroment is facilitators for the assimilation of the content by the student. All volunteers adapted quickly to the shape of the proposed navigation of learning object. The volunteers agreed that they could understand the educational content through the comics.

Moreover, the presentation of the learning object proposal creates an emotional appeal to the deaf audience. It contributes to the transmission of educational content. First: the presentation of content through sequential images helped the assimilation of concepts by the survey participants. It is constitutes as an important communication tool for these people. Second: the emotional relationship between story and students deepened story helping the learning context. The emotional relationship that story presented the concepts tied to the plot was well accepted by the volunteers. It favored that the volunteers understand the concepts learned from the characters' actions.

During the research the researchers noticed that the written text remains an obstacle to the deaf person communication. However the redundantly between text and image in comics facilitated understanding by the volunteers and that they even learning possible terms - in written form - unknown.

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