Story-based e-learning as a vehicle for inclusive education

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This paper will present some results from a R&D project which has developed a narrative framework for an augmented interactive learning environment. The software uses assistive technology to facilitate learning for learners with multiple functional deficits. Through the use of the software in blended-learning scenarios the learners are acquiring a new arena for choice-making and communication. The paper will discuss the outcomes of the project in relation to the main target group. It will also consider the implications of this type of story-based learning for inclusive education.

Keywords story-based learning; special needs software, inclusive education

1. Introduction

Augmented and assistive technology may offer learners with multiple functional deficits a new way of learning and communicating**.** By anchoring a learning material in a narrative setting and using stories as a vehicle for learning it is possible to create an interactive learning environment that affords inclusive and differentiated learning experiences.

Stories are fundamental to human communications and understanding of a culture. As such they are valuable as tools for teaching and for creating a sense of cultural background and identity. Through the stories of the culture we are enculturated.[1]as the stories provides tools to help in the creation of meaning, at both personal and global levels. Whyte [2]states that the study of narrative involves: "reflection on the very nature of culture and possibly even on the nature of humanity itself".

Bruner suggests that "it is very likely the case that the most natural and the earliest way in which we organize our experience and our knowledge is in terms of the narrative form" [3] The function of stories may even be prior to language in the development of the child, and that the child may learn the language to express its stories. He also suggests that there are 3 dimensions of learning and acquiring knowledge: Enactive (actions), Iconic (pictures) and Symbolic (words and numbers).

Working with children with multiple functional deficiencies who often have no verbal language, the perspective of story can add coherence, and can make it possible to engage the learners when the story draws on actions, interactions and pictures, thus activating the Enactive and Iconic dimensions.

An underlying design principle which can be found in the analysis of most of the commercial interactive learning programmes aimed at learners with functional disabilities, is to avoid complexity and to limit the number of choices available, in order to facilitate its use by the target group. This paper will report on a R&D project which involved interaction designers, artists and special needs teachers, with the aim of developing a narrative interactive learning environment with augmentative functions such a scanning the screen to make it possible to use with a switch or alternative IO for older learners with multiple functional disabilities The programme is offering interaction through specially designed interfaces which a learner can use with assistive technology, and a content representation relating to the Symbolic, Iconic and Enactive dimensions.

The symbolic dimension is represented through the oral storytelling that underlies the Iconic dimension of the animated sequences and flash games. The enactive dimension is represented through the interaction potentials allowing the learner to choose between different themes, activities and games within the framework of the story.

The software anchors a curriculum relevant material about Medieval life in a story frame, telling one of the stories of King Arthur with a high degree of complexity on a visual as well as linguistic level and also providing the learners with more choices, than those which are usually offered this target group, embedded in a narrative setting.

The project has been developed in an iterative design process, involving teachers and learners from two special needs schools in Denmark, which cater to some of the students with the most severe and pervasive functional impairments. Most of the learners have no language, and most of them have cognitive as well as physical deficits.

The point of departure for the development of the project was an explicit need for age- and curriculum relevant ICT-based learning materials for the older learners aged 12-16, which had a configurable navigation and had augmentative functions like scanning and switch. Most programmes that can be used with scanning and switch are not curriculum relevant, and the programmes, which are curriculum relevant, are not mediating it in a way that makes it accessible to the target group in terms of navigation or the target-group's linguistic or communicative competences

2. Method

The principles for the design have been developed involving users at several iterative stages of the development. Doing HCI-work with learners who do not have a verbal language calls for development of usability-methods involving the use of symbol charts, speech-machines and log-books kept by the teachers, as they usually had developed a great insight into the learners non-verbal communications. The study involved the two major special needs schools in Denmark with 5 teachers and about 5 classes totalling 30 students.

The method used has been based on a design based action-research approach with an iterative design process,
where principles have been tested in a classroom and student/teacher context. This approach is similar to the concept of Design Experiments in Educational Research. [4]. The research has also been focused on evaluating the use of the programme by the target group, in terms of its implications for communication and the construction of meaning and identity for the learners, in order to develop a set of parameters for the evaluation of this of resource and the underlying approach. Since much of the contact with the learners with multiple functional deficits are depending on the interpretation of non-verbal communication, this has been carried out in conjunction in a close co-operation with the teachers involved. A significant part of the data collected to clarify usability issues, has been observations of the learners use of the programme, individually as well as in teams and in a classroom context. Since the learners because of their disabilities often are tired or not able to participate in the activities, the teachers have had an important role in relation to the observation of the learners' interactions with the programme. Typically the programme has been used for very long periods of time. For instance just one single theme in the programme has been the focus point of several weeks of activity, working with medieval music.

The teachers' observations, which have supplemented the researchers video-observations, have been written as journal-type entries on a daily base and supplemented with case-studies. The programme went through several prototype-phases in an iterative process in which each proto-type was tested by the learners and teachers, and the results then led to changes, which were implemented.

The teachers were interviewed in connection with the class- room observations. A qualitative methodology was used, in which some representative cases were chosen in order to investigate how the programme may support communication, identity and the construction of meaning for the learners.

3. Narrative anchoring and the construction of meaning

The theme of the programme is Medieval life, and the curricular goal is to give to the learners an understanding of and knowledge about a number of themes that are related to life during Medieval times.

The overarching structure of the software is a frame-narrative, in which we follow the quest of the hero, who has to solve a riddle, in order to save the life of his King. This structure is then used to anchor the six main themes, which offers the learner the possibility of exploring different aspects of medieval

life: They may try to make a shield based on heraldic symbols which are explained in the voice-over which facilitates every choice the user makes, by making a verbal prediction. Or they may explore how to make medieval music, cook soup, or direct a choir.

Fig.1.Example of a menu on the narrative augmented interface where the learners can choose to listen to different instruments or compose music, all choices are guided by highlights and audio predictions.

Even learners who have not developed any verbal language, can have developed narrative competencies. This means that they can have an understanding of causality and canonical relationships, as well as a sense of schemas of the usual and the unusual.

In Jerome Bruner's [5] writings on about how meanings are situated in relation to the culture in which they are created , he points to the need for a cultural system of symbols in order to communicate.
He further points out how these meaning can be negotiated and that learning always is situated in a cultural frame.

In the narrative framework of the Medieval Tale programme, the learners are offered a platform of communication, which draws on the "Cultural symbolic systems" in the form of narratives and an animation story. These narratives reflect a historical epoch, which in this case is the medieval times, and gives the learners the potential to communicate by involving these as cultural and narrative artefacts.

Fig. 2. *The programme used on a touch-screen as tool for communicating preferences through choices.*

Used on an individual basis the learners relate to them relative to their personal preferences and history. While they in the classroom context where the programme is used with a PC projector it becomes a shared context for learning. Through making their choices in programme in the context of a group the programme becomes a tool for communication through preferences and choices, for learners with no verbal language, and few opportunities to express themselves in complex ways.

4. Conclusion

Developing a multimedia programme with augmented functions for this target group is a challenging task, since the target group of learners with multiple functional disabilities spans very diverse abilities and disabilities. Using a user oriented design approach and involving severely challenged learners in the iterative process from the initial stages has led to the development of non-verbal methods for user response. Targeting the software at a larger group makes it possible to use it in an inclusive educational setting, since it has been designed to have a level of complexity and curriculum relevant content which coupled with augmented navigation makes it viable for a much larger target group.

The programme represents a new development in terms of design for the target group and involving severely disabled learners in the design process.

It integrates a curriculum relevant content with an augmented user interface, which can be adjusted to meet the needs of the user, while affording a differentiation, which allows for very different interests, cognitive skills, and aesthetic and musical sensitivity.

Using story as an anchoring and structuring device makes the programme accessible for a wide range of users including both children and adult learners with disabilities like aphasia.

By using a classical story, the intention has been to build a narrative frame-work for learning, which can appeal to and motivate both learners and teachers, [6] and build interest and motivation learning about aspects of life in Medieval times.

The role of the programme in relation to the learners' construction of meaning and their expression of identity can be understood as a hermeneutic field, which primarily has been researched through the teachers interpretation of the learners choices and communicative actions.

An evaluation of the programme further validated by the feed-back from the teachers and special needs consultants concludes that the design principles involved has provided an augmented narrative learning resource with a high level of complexity which is offering new learning potentials to the target group of older learners with multiple functional disabilities.

An independent body, representing experts in the field, has rated the usability for the target group and found it to be good, and the complexity of choices to be an activating factor.

The programme serves as a framework offering new possibilities for learning scenarios for the target group, as it can both enable the individual learner to have independent activities and also serve as a didactic frame around thematic activities in the classroom.

The narrative framework, the use of activities, videos and the level of the programme in relation to the curriculum make it potentially a useful tool for inclusive education, as many different types of learners can use it, but this has to be explored in more depth with additional research.

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