An e-Learning Environment for Deaf Adults

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Abstract. The objective of this paper is to present a learning management system (LMS) which offers German Sign Language videos in correspondence to every text in the learning environment. The system is designed notably for deaf adults who want to maintain and improve their mathematical and reading/writing skills. The described LMS offers deaf students a new paradigm of learning: For the first time they will be enabled to learn self-determined in their own language, the sign language.

Keywords: Bilingual learning environment, deaf adults, German Sign Language (GSL), German Sign Language videos, inclusive design, interactive learning, learnability, peer group learning, template based content structuring, user interface adaptation

1   INTRODUCTION

The presented system is developed in the context of the AILB-project (Aachener Internet-Lernsoftware zur Berufsqualifizierung von Gehörlosen) supported by the Federal Ministry of Health and Social Security (2003-2005). The aim of the AILB project is to develop a bilingual web based learning system for deaf adults who want to maintain and improve their mathematical and reading/writing skills.

In this project, the special needs of deaf learners are taken into consideration, as e.g. bilingual information (text and sign language), a high level of visualization, interactive and explorative learning, and the possibility of learning in peer groups via video conferencing.

AILB is a joint project of Aachen University (content development), Fraunhofer Institute for Applied Information Technology FIT (software development), and bureau42 GmbH (specification and consulting).

2   PEDAGOGICAL CONCEPT

2.1   Educational Background

The reading/writing and mathematical skills exhibited by deaf people are well below that of hearing people, although their mental capabilities are basically the same. These results were obtained in the project ATBG[1]. The AILB-project takes exactly these findings as point of departure. The main reason for the huge discrepancy between the skills of hearing and deaf people is due to in the socialization of the deaf. In Germany most deaf children have hearing parents who have little or no command of GSL. This means that during the critical period of

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[1] The ATBG-project (*Aachener Testverfahren zur Berufseignung von Gehörlosen*) at Aachen University was funded by the Federal Ministry of Work and Social Order from 1995 to 2002. ATBG consists of 26 computer assisted tests which investigate the skills, abilities, and personality features of the deaf job seeker. Each and every test instruction and the tasks are presented in GSL and written language.

language acquisition, i.e. from the age of 2 to 7 years, the deaf child has little to no exposition to GSL. For most deaf people their first contact with GSL is in school during break with their deaf peers. This fact plus the inaccessibility of information through radio and television (due to few subtitles) turn into a vicious cycle which is difficult to break. Without a fully developed first language – spoken language cannot be acquired due to deafness and GSL cannot be acquired due to the lack of exposition – learning how to read and write becomes an almost impossible task to master. Therefore reading level of young deaf adults is comparatively low, namely at the level of hearing fourth graders. This makes book learning nearly impossible.

However, the ability to read is regarded as a key skill which serves as a prerequisite for the expansion of knowledge [Schnotz 94] – inter alia in the areas of writing and mathematics. This coherence was confirmed by the PISA study, that shows that students with good reading competence are also good at mathematics [OECD 03].

2.2   Current Educational Offers for the Deaf in Germany

There are few further education programs for the deaf to make up for this. The ones that exist specialize in furthering the knowledge in special areas, such as home economics or woodwork and do not use sign language as means of knowledge transfer. There a several vocational training centers and specialized integration services which use self-made concepts for furthering the deaf. These concepts, unfortunately, are designed without an integration of GSL. Generally, within a vocational context the reduced reading/writing and mathematical skills impede equal participation.

2.3   Work Life of Deaf Adults

Even though there have been enormous developments in the area of multimedia use, such as the internet, CD-ROMs, video conferencing, e-mail, etc., this does not guarantee a satisfactory work life. A satisfactory work life includes a considerable increase in self-esteem and an immediate contribution to life quality. At the same time, a fulfilled work life is neither something that can be taken for granted. Many deaf people are unemployed. If they do find a job it is usually a remedial action. Those deaf people who hold jobs find that these have recurring and standardized operations. With these the deaf worker often feel unchallenged and misplaced [Bungard et al. 95]. Two main reasons can be identified for these special socialization conditions. One, an inadequate estimate of the performance abilities of the deaf, and, secondly, the communicative problems between deaf and hearing colleagues.

2.4   Educational Offer of AILB

Based on these problems and findings the LMS is adapted to the specific learning problems of the target group, i.e. deaf adolescents and young adults. Essentially, this software presents a specific after-school enhancement for the preparation for working life [Jäger et al. 03]. The provided content is bilingual. Bilingual experiments (spoken and signed language) in schools for the deaf and hearing impaired have shown that the use of sign language in the classroom furthers reading competence significantly [Opper 95, Günther et al. 99]. The content does not resort to a systematic building up of language but employs a functional approach, i.e. working with texts and tasks which are oriented at everyday life and demands and not merely drill the learners. Above and beyond that, the learners are introduced to working with references and dictionaries.

One main objective of AILB is enhancing self-directed and explorative learning. The learners find guidance and are introduced to strategies which support these methods of learning. Therefore, the LMS is not a mere substitute for books but also a meaningful and necessary addition for the expansion of world knowledge.

In detail the AILB system provides the following features:

- GSL is used as the language for explanations. The use of GSL in the AILB software, however, is not confined to a mere translation of the German texts but the GSL videos are adapted by deaf researchers to the needs of the deaf user, the modalities of GSL, and the Deaf culture. This aims at improving the mediation of the content and serves as a strategy to enhance the learners' motivation.
- Wherever possible, the content is clarified by special forms of visualizing structures and processes. This is very important with a group of learners who are strongly visually oriented due to the mediality of their language, i.e. sign language.
- Video conference and chat rooms enable learning in peer groups and help building a learning community.

Working with this LMS, deaf students will have the possibility to learn in a self directed way. Using the sign language videos they can concentrate on the content rather than getting lost while trying to understand written texts. And they do not need a teacher or interpreter for learning – they can learn independently. Furthermore, by using the medium internet many more deaf adults can be reached than with conventional teaching methods.

In all these aspects AILB is innovative and new, because currently there are no other LMS which are adapted to the needs of the deaf.

2.5 Related Projects

The research in deaf education using ICT has diversified over the last years. In this paper only some projects from the European research context are presented.

2.5.1 EVIDENT: Multimedia tools for deaf language learners[2]

The main goal of EVIDENT is to develop interactive educational software that can be used in a bilingual educational setting, and which is not restricted to any one particular (sign) language. The final product of EVIDENT will be a CD-ROM containing information both in sign language (Swedish, Dutch, Greek and British sign languages) and in written/spoken language (Swedish, Dutch, Greek, English) about a specific topic.

2.5.2 SMILE: A Sign Language and Multimedia-based Interactive Language Course for the Deaf for the Training of European Written Languages[3]

The SMILE project aims to create a prototype language course application delivered on CD-ROM during the course of this research. Various other modes of delivery are under consideration, including online delivery. Accompanying this prototype version, a general platform is being developed in order to allow easy and straightforward implementation of the learning materials in different European languages.

2.5.3 Signing Books for the Deaf[4]

The project will explore how information should be presented to deaf people on video; where the sign presenter should be located on screen; what the most suitable camera set-ups are; how subtitles should be used.

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[2] http://www.ecotec.com/mes/projects/evident.html
[3] http://www.ecotec.com/mes/projects/smile.html
[4] http://www.sign-lang.uni-hamburg.de/signingbooks/

2.5.4 Thetos[5]: translate text into sign language automatically

The task of the Thetos system (formerly: TGT–1) is to translate texts written in Polish into animated sequences of Polish sign language gestures displayed on the screen.
Though it is not an educational project itself, the this project is of high relevance for all ICT supported educational programs for deaf people: If the Thetos project succeeds, it will not be necessary to provide bilingual content any more, because the translation into sign language can then be done automatically. Furthermore all written texts would then easily be accessible to deaf people.

2.5.5 Conclusion

Currently there are several projects aiming at creating bilingual learning materials for deaf people. Most of them rely on CD-Rom-delivery and do not provide a learning management system that allows easy authoring as well as easy learning. In this aspect, AILB offers a new approach. Furthermore, the results of Signing Books for the Deaf will be used for improving the user interface design of the AILB platform.

3   ADAPTATION OF A LEARNING MANAGEMENT SYSTEM

For the AILB project the learning management system ALE (Advanced Learning Environment), developed at the Fraunhofer Institute for Applied Information Technology FIT, is adapted to the special needs of deaf people:

- The information presentation is bilingual (written language and sign language). Sign language videos may optionally be retrieved for each text block. This makes the imparting of the learning content easier and increases the motivation of the learners. It allows independent learning and gives the deaf learners the feeling that they are being taken seriously in their cultural and linguistic identity.
- The user interface (user interaction, functionality and screen design) was developed according to the requirements of the deaf researchers in the AILB team. The icons for that symbolize the different templates were designed by the deaf researchers themselves, who know of deaf people's high need for visualization.
- Different kinds of exercises and tests allow for a high amount of possible interactions. Graphically oriented exercises, such as hotspot or drag and drop tests, support the explorative learning process.
- For a group of learners, for whom the modality of their language, i.e. sign language, is oriented at the special dimension of visual presentation, a high amount of visualization is needed. This is achieved by the simple integration of standard multimedia formats.
- An integrated communication module consisting of video conference and chat enables the users to learn in peer groups.
- The use of templates for pages, exercises, and tests makes the creation of the learning content much easier and guarantees a homogeneous and clearly arranged design.

3.1   Integration of German Sign Language Videos

The students can retrieve a German Sign Language video (GSL-video) for each text block by clicking on the icon in front of the text block (see illustration 1). The GSL-videos are not shown immediately because the learners should first try to read the written text. If they have difficulties with that, they can then see the sign language video.

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[5] http://sun.iinf.polsl.gliwice.pl/sign/main.html

The GSL-videos will be offered in three video qualities: ISDN, DSL, and LAN. So users will get the video quality that suits their internet connection. For playing the videos the users only need a current QuickTime plug-in for their browser.
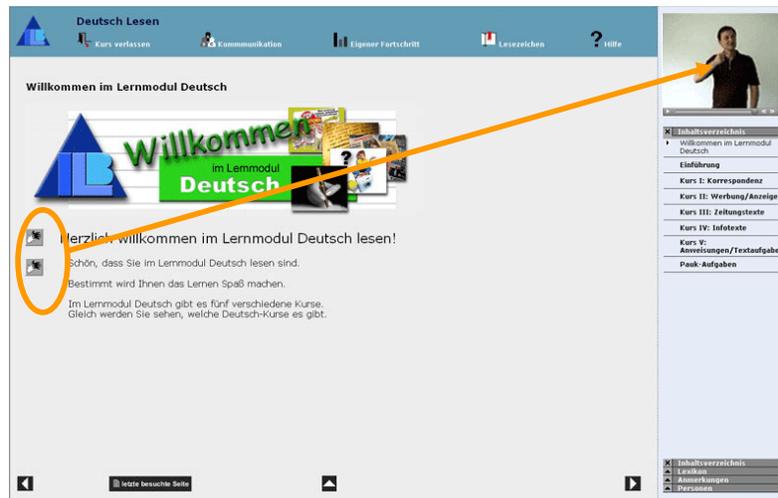

Illustration 1: Viewing a sign language video (learning environment)

3.2 Video Conference and Chat for Communication in Peer Groups

An integrated communication component consisting of chat and video conference enables the deaf students to communicate directly while working on a course. The video conference has three slots in each video conference room. The chat is free for users who do not get a slot in the video conference. The communication component runs in a separate browser window. All the users need is a web cam and a Flash plug-in for their web browser.

3.3 Template Based Content Structuring

The use of templates for pages, exercises, and test makes the creation of learning content much easier and guarantees a homogeneous and clearly arranged design. The author chooses a page layout or test type and fills in the content. Illustration 2 shows an example for the page template "pictures and internal links" in the author's view. In comparison illustration 3 shows the result in the learning environment.
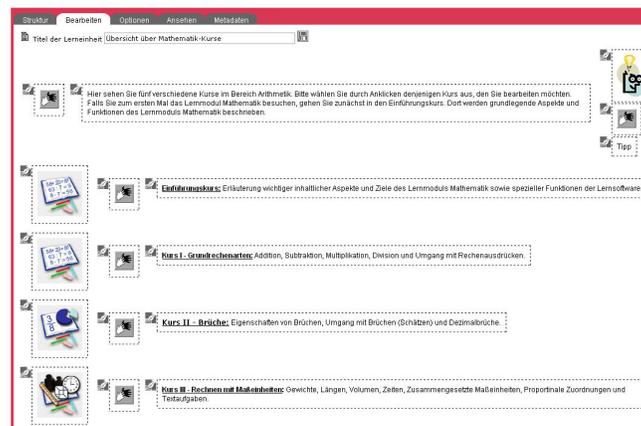

Illustration 2: Page template „pictures and internal links" (author's view)

Illustration 3: Page template „pictures and internal links" (learner's view)

Additionally, the author has the possibility to choose different content block templates to design a page. There are templates for headlines and for content with a specific meaning, e.g. summary, task, definition, solution etc. The content block templates have different layouts for the specific content and a special icon placed in front of the content for easy recognition (see illustration 4). This way the learner is immediately aware of the function of the content block. This content block mechanism improves the readability of the text.
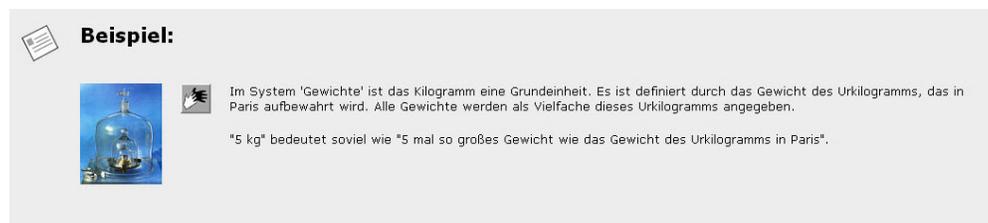
Illustration 4: Example of a content block „example with picture" (learning environment)

4   LEARNER INTERFACE OF THE COURSE PLAYER

The interface of the learning environment has a very simple design enabling the deaf learner to get used to the system easily. Special features are the icons for interactions designed by the deaf researchers and the video area for displaying the translation into GSL.

Interface layouts should always be clearly divided into parts according to functionality, because then the learner can easily find the functions he/she needs. Therefore the AILB learner interface is structured in four parts – top, middle, bottom, right (see illustration 5).

The top part defines the interaction control. It includes links on general functions that are needed in a learner interface like "leave the course", "communication", "learning progress", "bookmark" and "help". For every function a special icon has been designed. The icon that is placed in front of the link should maintain the learner's recognition of the function behind.

The middle part is the content area – the learning and working space. The course content is displayed here because it's the main focus of the learner's view.

The bottom part provides basic navigation controls, as "back", "forward" etc.. The right part consists of the display area for the sign language video at the top and the navigation and context modules, as "table of contents", "dictionary", "annotations", "members of the course" and "personal learning folder", at the bottom. The sign language video is displayed in the top right corner, because the line of sight is from left to right and the learners view will normally go there when he/she clicks on the button to display a GSL video. The annotation and

communication functions are fundamental for deaf people, because they are very community oriented.

Illustration 5: Structure of the learner's interface

5   STATE OF THE PROJECT

The pilot study starts in May 2004 with 20 deaf people at a vocational training center in Leipzig. The deaf will be introduced to the LMS AILB by one deaf and one hearing researcher from Aachen who will be present to answer questions for several days. During the pilot study, the deaf students will use the LMS at fixed times at the vocational training center. They are expected to go through a prescribed set of lessons and have recourse to a teacher in case of problems. This ensures a fixed frame for all students who are not used to or who are not capable of self directed learning.

The results of the first evaluation, which include the learning process and progress, the intrinsic and extrinsic motivation, and the learners' self-assessment, will be used for the further development of the concept and the learning environment For the future, the concept of tutorial supervision is taken into consideration as well as an expansion of the learning content to other subjects.

6   CONCLUSION

As described in this paper, the use of sign language furthers the reading competence of deaf people and enhances their acceptance and understanding of learning content presented to them. But most of the German deaf adults did not get school education in sign language and therefore lack basic reading and mathematical skills needed for further vocational training. The low reading skills also restrict their possibilities of information gathering and self directed learning.

Based on these findings, a learning management system is adapted to the needs of deaf people with sign language videos for each text block as the most important feature. Providing

sign language videos will help the users improve their reading skills and enable them to learn more independently.

Adapting a learning management system was given the preference in comparison to proprietary solutions, because using a learning management system facilitates content creation and content adaption and the learners get a wide range of standardized user interaction possibilities.

In the pilot trial starting in May 04 the system will be evaluated.

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An e-Learning Environment for Deaf Adults - CiteSeerX. Applied Information Technology FIT (software development), and bureau42 GmbH. (specification and consulting). 2 PEDAGOGICAL CONCEPT. 2.1 Educational A Virtual Learning Environment for Deaf Children - HPCG Lab. Â We extend our appreciation to both Gallaudet and RIT's National Technical Institute for the Deaf for responding to our requests for assistance. We extend a special thanks to the interpreter supplied by Miami University through the Community Services for the Deaf who enriched my knowledge of interacting with deaf students. Lastly, I [Sobel] cannot thank my co-author [Hill] enough for choosing to attend my section of CS1; I truly believe this experience has improved my teaching skills. Prelingual deaf learners, experiences difficulties in achieving receptive and expressive skills in English Language. We aim to present DELE (Deaf-centered E-Learning Environment), a platform created for the promotion of literacy skills in young deaf learners through cooperative activities, visual easification procedures, visual motivating educational games and Sign Language videos. Â TY - CONF AU - M. Roccaforte TI - AN E-LEARNING ENVIRONMENT TO IMPROVE DEAF PEOPLE LANGUAGE ACQUISITION SN - 978-84-617-2484-0/2340-1095 PY - 2014 Y1 - 17-19 November, 2014 CI - Seville, Spain JO - 7th International Conference of Education, Research and Innovation JA - ICERI2014 Proceedings SP - 3779 EP - 3786 ER