Digital Divide and Learning Disabilities - Counteracting Educational Exclusion in Information Society -

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Digital Divide and Educational Divide

A 1998 inquiry by the U.S. government showed that 42% of all U.S. households had a computer and 26% regularly used e-mail or more far-reaching Internet-based services. More recent but not fully comparable studies have revealed, that gradually, the originally extremely remarkable differences in Internet use between men and women and young and elderly have decreased, which is probably due primarily to the increasing user-friendliness and controllability of graphical user interfaces. But at present, income-caused, educationally conditioned differences in Internet use are increasing dramatically.

Public/Private Partnerships to counteract Educational Divide (Examples from Germany)

In the mid-1990s, German society and politicians became aware of the important role of the educational sector for the development of the information society. Consequently, a large variety of activities have been started to prepare pupils for this future. Most of these ongoing actions are performed in public/private partnership. The first bundle of actions, to a large extent publicly acknowledged because of many government publications and PR activities, is focusing on IT infrastructure in schools, e.g.:

- Virtual schools: sponsoring Internet access and activities. Very recently, the German Ministry of Education communicated the successful completion of this program; since the end of 2001, 99% of German schools have had access to the Internet (vs. only 15% 3 years before).
- Market place for schools: sponsoring second-hand PC equipment. There is still a wide gap between the large demand from thousands of schools and the small number of used PCs offered for free by private companies.
- Electronic classroom initiatives: various actions, often limited to a few selected sites or only one school; e.g., equipping a school with mobile units consisting of four PCs or with a notebook for every pupil.

A second bundle of actions, less known to the public and even to teachers, is orientated towards software equipment and applications, e.g.:

- SchoolWeb: an Internet portal for all types of schools offering learning materials and communication features;
- NetDays: a competition and exhibition of school projects, organised as a virtual event on the Web but until now limited to some of the Bundeslaender (German states);
- Learning software development and distribution: also very recently, the German Federal Ministry of Education stated that this will become the focal point of future actions; more than 300 million euros have been allocated for this purpose. Current evaluations of these ongoing actions show impact predominantly on graduate schools. Special schools like those for the learning disabled are largely neglected. The reasons for this disadvantageous development might be diverse:
    a. Public awareness of special schools for the learning disabled is smaller and they are not so attractive for education politicians as well as for private companies whose sponsoring activities often depend on image aspects.
    b. Community members of special schools for the learning-disabled (administrators, teachers, parents) have internalised a modest role of a "silent minority" and don't assert their needs in the same way as the community members of graduate schools.
    c. Even if special schools reach the normal hardware standard, they cannot make use of the offered software because it is not adapted to the special educational needs of the learning disabled.

Thus the well-meant measures for promoting IT at schools contain the risk to intensify the digital/educational divide, to the detriment of the learning disabled. To avoid this risk, it is necessary to examine their special situation and needs.

Cognitive and Learning issues

In order to reduce educationally caused differences in the use of computer systems, further research efforts are thus required in order to be able to offer ability- and talent-adapted help systems as well as accordingly adapted dialogue interfaces. A major prerequisite that as a basic architectural principle determines systems design in this respect demands support of target-achieving "evolutionary learning"[1, 2].

Evolutionary learning basically differs from design, circumscribing potential learning pathways desired by humans, while evolution describes the pathways actually taken.

Learning disabled pupils thus have to be supported to learn within a flexible framework of their own design, which encourages them to initiate and formulate educational needs growing out of their own experiences, intuitions and common sense. The role of the teacher must be reshaped to that of mentor and consultant. In this respect, media competence must be enriched stepwise based on previously acquired knowledge in accordance with individual learning speeds.

Learning disabilities occur more frequently than assumed and affect different cognitive and sensory-motor skills, e.g.:

- perception
- memory
- concentration
- motion
- reading/orthography
- math skills, etc.

Often a learning disability becomes a complex problem when several of these handicaps bundle in one person, and nearly as often other (social) problems contribute to, or result from, learning disabilities, e.g.:

- low-income household or unemployment
- lower-class neighbourhood
- broken family
- foreign cultural origin (language/religion)

Regularly, learning disabilities have a negative impact on:

- school career
- social acceptance
- chances on the labour market
- self-confidence of the young person

It is obvious that, under the circumstances and demands of the upcoming "knowledge society," the learning disabled suffer from a key handicap to which the society must pay more attention than ever.

In order to overcome the special obstacles for the learning disabled, computer and Internet use has to offer opportunities to:

- individualise learning processes in order to achieve maximum optimisation with respect to individual knowledge states and learning speeds of pupils;
- illustrate abstract learning contents;
- provide and distribute content-wise and formatively high-quality training aids, e.g., instructional information resources and appropriate test forms, which would not be possible to deal with otherwise due to learning disabilities;
- develop and extend communicative structures, from the local school network up to worldwide communication over the Internet;
- concretely apply acquired knowledge, e.g., pupils send e-mails and immediately get replies from their communication partners;
- gain access to an enormous, constantly updated store of knowledge in the context of special instruction where school books are occasionally not up to date;

- engage in social learning by group work with computers, requiring co-operation and communication; and
- increase the learning motivation of the pupils and make pedagogic use of already available interests, curiosity and readiness for instruction.

Future scenarios of technology-based solutions

It is important that single distinctive learning steps have a limited amount of educational content and that well defined training objectives are attainable and recognisable for the pupils. This kind of evolutionary target-achieving learning is very valuable for learning disabled pupils with many frustrating learning experiences. However, the advantages of evolutionary target achieving learning become effective only if the tutorial system complies to appropriate software ergonomic standards, which apply to instructional education of learning disabled pupils in general. First, these design standards refer to the dialogue structure and HCI modalities, e.g.:

- easy operability of the entire program
- consideration of childlike learning modalities
- clear task description
- easy-to-understand examples for exercises
- economic use of animation programs for additional assistive instructions only
- multimodal content representation (image, text, speech)
- clear (multimedia) instructions
- context-sensitive help
- UNDO/REDO anywhere and anytime
- INTERRUPT (pausing) anywhere and anytime
- adjustable length of the learning sequences
- adjustable learning speed
- different degrees of difficulty
- immediate feedback after (sub-) task accomplishment
- personalised achievement protocol/achievement-related enquiry options
- conventional instruction handbook to the program

For the special target group of learning disabled pupils, it additionally turned out to be of relevance that user interface design of tutorial systems be compliant with certain standards for display ergonomics and content adaptation, e.g.:

- clear and unique screen layout
- cleared-up desktop organisation
- neutral, eye-friendly colours of the background

- large enough fonts
- reader-friendly, short texts
- clear paratactical sentences, no hypotactical sentence structure
- no terminology or other understanding barriers

It is thus necessary to return to simplicity in software and user interface design. Each additional bit of by limited mental flexibility, poor vocabulary and limited ability to understand sentence syntax and semantics. Much of the multimedia possibilities that fascinate an average user are thus wrongly applied in learning environments for learning disabled pupils.

References

1. Schön DA (1991) The reflective turn: case studies in and on educational practice. Teachers Press, New York, Columbia University

2. Shneiderman B (2000) Universal usability. Communication of the ACM, May 2000, 43(5): 85