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Dyslexic Students: Success Factors for Support in a Learning Environment

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Dyslexic students: success factors for support in a learning environment

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Abstract

This study examines possible success factors when developing technical solutions for dyslexic students. Findings in the literature, a web survey answered by students and experiences from the development process at the Medical Faculty Library, Lund University, were used to find out potential success factors and difficulties. The literature found describes what dyslexia is, the situation for dyslexic students and available technical compensatory devices. One conclusion is that it is important to recognise the needs of individual student's and choose flexible technical solutions.

Introduction

The number of dyslexic students in need of support is increasing at many universities. This place demands on libraries to provide access to talking books and other technological devices, in order to give equal information service to dyslexic students. There is no standard technical solution for dyslexic students, and although multiple technical devices are available, there is a lack of testing and evaluating them. At the Medical Faculty Library of Lund University, Sweden, we found that an evaluation of the technical resources in use was motivated, to determine which of these works well and which should be reconsidered, to better meet the needs of these students. This article describes the evaluation, and also contains an investigation of relevant research concerning support for dyslexic students. The results presented can help increase the awareness of librarians, teachers and staff in higher education regarding support required for dyslexic students.

Method

In this study, a literature review serves as a background consisting of relevant examples of the research in the area. A comprehensive literature search was conducted in the databases PubMed, Cinahl, ERIC, PsycInfo, ACM Digital library, Inspec & Compendex, and ELIN (Electronic Library Information Navigator, Lund University's portal to electronic resources) as well as local and national library catalogues. The databases were chosen to cover both the specific conditions of being a dyslexic student in higher education and dyslexia in general, as well as assistive technology and educational aspects in that context. Examples of search terms used include students, dyslexia, dyslexic students, university, higher education, adapted computers, and assistive technology. The problem with synonyms and lack of uniform use of terms often made it difficult to find all documents of interest when using combinations of specific terms. In such cases, the approach was changed to include broader searches and browsing of the extensive results, which provided more documents of relevance.

The processes of selecting and implementing the adapted computer support at the Medical Faculty Library is described in the section headed “The support structure at the Medical Faculty Library”.

A web survey of dyslexic students enrolled at the Faculty of Medicine was performed to investigate how frequently these individuals used the available computers, and how they experienced using various computer aids that are provided. A cover letter and a link to the survey were sent by e-mail to 25 of the dyslexic students who had an e-mail address registered at the department Service for students with disabilities, SSD. This was done with the help of the SSD staff. In light of the respondent’s reading disabilities, the questions included in the survey were designed to be easy to answer (i.e., not too long, complicated or time consuming). The survey contained both open-ended questions and space to write comments, (see Appendix).

Literature review

The research that has been done concerning dyslexic students and adapted computers is limited with regard to both the number and the design of the studies conducted. The strategies used to determine the number of dyslexic students have varied. Some investigations have included all students with any disability, and therefore it is not always possible to compare the results of different studies. Many of the investigators have used a descriptive approach, involving discussion of different ways to use adapted computers, which can serve as a background or context, but not as evidence or general guidelines for best practice. These factors may indicate that this field of research lacks consistency and clear empirical evidence of efficient technology and support for dyslexic students.

Considering dyslexic students and assistive technology or adapted computers made available to students, the reports in the literature consists mostly of case studies, small-scale studies, personal stories, and discussions.

There is also a lack of usability testing of computer programs and applications developed for dyslexics.¹

The studies found were conducted primarily in the United Kingdom, but also Greece, Cyprus, the Netherlands, France and the United States, and they describe research that was done in the mentioned countries as well as international comparisons. The legislation, policies and attitude to dyslexic students and assistive technology, are in some of these countries similar to those that exist in Sweden. For example, an ambitious legislation can be combined with vague practical guidelines, and there can be problems in applying the laws and policies in daily practice by providing technical equipment. The most important finding reported in the literature is that the way that dyslexia is manifested varies with individual, and students with dyslexia have disparate and complex needs. Therefore it may be necessary to use a mix of assistive technology to support these students.²

What is dyslexia?

Dyslexia is defined as a disability that is both genetic and neurological in origin. It is characterised by difficulties in language processing, phonological awareness and decoding written text and it is manifested as problems with reading, word recognition, writing and spelling. This general description is referring to developmental dyslexia, which means that a person is dyslexic from birth and will remain dyslexic throughout life. In other words, dyslexia is permanent, but can be compensated for in different ways.³ Dyslexia is not related to intelligence, in the sense that dyslexics would be less intelligent than others, but dyslexia can also be defined as a discrepancy between an average or above-average score on an

intelligence test and a low score on a reading test.⁴ Dyslexia can also be defined on a behavioural level, with biological and cognitive sublevels. Biological conditions, for instance the genetic abnormalities that occur in dyslexics, can lead to poor learning of reading and writing systems on a cognitive level, which is manifested behaviourally in deficient literacy skills. Dyslexia is then defined as a specific learning difficulty.⁵

People with dyslexia have not automated the reading process, and the great effort they must make to decode a written text often places a significant burden on their working memory. Similarly, dyslexics frequently find it hard to handle phonological and orthographic decoding and this is manifested in problems with connecting the sound of a word with the letters in the written word, and what the written word means and hence, spelling is problematic.^{3;5}

As a consequence of the mentioned problems, dyslexics often develop ways of compensating for their disability. According to Corkett, Parilla and Hein, examples of creative compensation strategies include association techniques or mind mapping used to organise studies and to facilitate reading and writing, and text-to-speech devices, such as talking books and computer hardware and software that combine sound and text to improve the reading capacity of the user.⁶ Gabrieli has reported that phonological awareness may be improved by training, for instance exercises in which dyslexic children try to associate written words with the corresponding spoken word correct. Such approaches may help the dyslexic develop a better decoding capacity and reading speed but it is likely that the most substantial improvements will be achieved primarily in children who are beginning to read.⁴ Ecalle, Magnan, and Calmus obtained good result using computer-assisted learning and synthetic speech to achieve phonological training of children, with good result. In short, the synthetic speech was used to help the children match the spoken and written word, and to increase their reading capacity and word comprehension.⁷

Studying with dyslexia

The manifestation of dyslexia varies with the individual. Accordingly, university students with dyslexia have disparate and complex needs, that may require a mix of assistive technologies.² Some students are already aware that they have dyslexia when they apply to a university, whereas others do not discover their disability until after starting higher education. Facing the diagnosis of dyslexia can be emotionally and psychologically challenging.³ A common finding in the literature is that many students are hesitant in disclosing their disability to other students and university staff, for several reasons. They may not be aware that support is available or they assume that they will be at a disadvantage and stigmatised if they reveal that they are dyslexic.⁸ Armstrong and Humphrey developed a resistance-accommodation model which describes the psychosocial process of two different ways of reacting to the diagnosis of dyslexia. Some people show resistance and does not see themselves as “being dyslexic” because they consider the word “dyslexic” as a negative label. In contrast, others display an accommodation reaction, which involves accepting the diagnosis and being more willing to seek support and compensate for the disability. Armstrong and Humphrey also pointed out that a person can exhibit both resistance and accommodation, depending on the social situation. For example, a dyslexic might accept the diagnosis and accept support, but at the same time be uncomfortable about disclosing him/herself as a “dyslexic” in public.⁹ Taylor, Duffy, and England have reported that dyslexic students often have higher anxiety levels and a lower academic self-concept compared to their non-dyslexic counterparts, which may affect their performance.¹⁰ In general, students in higher education are expected to accomplish extensive reading and writing on an academic level, often within a limited period of time. When dyslexic students feel stressed or anxious, their usual strategies for handling reading and writing might fail, for instance this might occur when it is necessary to take an exam under a limited amount of time, or to write a report with a short due date.

Investigations have examined whether providing appropriate support, technical or other such as more time on exams, can fulfil the reading and writing requirements in higher education. Hatcher, Snowling and Griffiths states that there can be a difference in cognitive assessments between dyslexic and non-dyslexic students, and that support of different sorts is required for compensation.¹¹ Other studies report special computer support, extra time on exams and study strategies as examples of efficient support so that the students can fulfil the educational requirements.^{6; 10} Being able to compensate for the dyslexia can be a key to success in university studies. Mortimore and Crozier found that the difficulties dyslexic students may encounter can be related to aspects such as reading speed, spelling, note taking, and organising essays. Some of the students in that investigation obtained good result by using different types of support, for example special computers, scanners, and voice activated technology.¹²

Assistive technology and adapted computers to compensate for dyslexia

Two different perspectives on technical solutions for dyslexics in higher education can be distinguished: one describes the use of general technology, such as PCs or laptops, and the other consider application of specific technologies, such as scanners, text-to-speech devices, and spellchecker software. Two investigations that distinctly illustrate these two perspectives are discussed below.

Taylor, Duffy and England explored the use of general technology in a four-year case study of dyslexics in higher education, and their results revealed a number of adjustments in the study environment and teaching methods that may be suitable to meet the needs of these students.¹⁰ On the whole, a virtual learning environment can facilitate the students' situation, by providing lecture notes in advance, so that it is not necessary to take extensive notes during the lecture. A more specific adjustment is for the students to use laptop computers during lectures, tutorials, and laboratory sessions.¹⁰ Only general equipment was considered in the case study, that is, no mention was made of any specific hardware or software. An obvious advantage of employing general technical equipment is the inclusion perspective, meaning that no students can be distinguished as dyslexics simply because they use special equipment, since laptops are common today. In addition, general equipment, such as laptops, may be useful to non-dyslexic students as well.

The perspective of specific technology was examined by Draffan and co-workers in the largest study found in the present literature search.² The aim of the study was to identify types and mixes of technology offered to disabled students in the United Kingdom which revealed hardware and software for general use as well as technology developed specifically for dyslexics (e.g., speech synthesisers, spellcheckers, scanners, text-to-speech programs and recorders). A telephone survey was conducted with 455 students who were assumed to be dyslexics due to the type of computer programs that they had chosen to buy from a particular software company. The results indicated that the technology available to the participating students varied, but in general it had been accessible to the respondents for about a year before the survey was conducted. The majority of these students were satisfied or very satisfied with the special technology offered, such as text-to-speech devices and spellcheckers. The text-to-speech software were generally considered very helpful, and the specific software was regarded as more beneficial than the general hardware and software. Some students also expressed satisfaction with the training that was offered, to help them better utilise the functions of the equipment. However, the authors mentioned being concerned about the possibility that the students did not seek or want such training, and hence might not acquire sufficient knowledge about the best way to use the equipment.² This study

has two limitations: first, the selection of participants was uncertain, since it did not guarantee that all respondents were dyslexics; second, only one company or supplier was included. On the other hand, a definite advantage of the study was the large number of respondents. In any case, it seems that Draffan and co-workers did obtain credible results, such as identification of a range of assistive technology that can be suitable to dyslexics and the observation that training is needed.

Another important aspect is the difference between programs used for training and those used to compensate for dyslexia. Studies investigating how to use technological devices such as speech synthesisers to improve the phonological awareness and reading capacity of dyslexics have focused primarily on children or younger students, and thus the technology have served as a training function for children who are learning to read. By comparison, programs designed for adults concentrate more on compensation for dyslexia or other learning disabilities, but the principle of text and sound together seems to help improve the reading capacity of students in higher education, similar to the above-mentioned way that children can be helped. It is plausible that decoding a text, the reading speed and text comprehension can be more successful when technology, such as synthetic speech, is used to complement the written words.^{4; 7; 13} Other important technological issues have been identified in several studies. According to Williams, Jamali and Nicholas, a number of technical solutions and initiatives have been taken, but there is a lack of research and usability testing regarding the various applications that have been developed.¹ Furthermore those authors claim that assessments have not been done to determine whether the use of general technology actually benefits students with dyslexia or other disabilities.¹ Another aspect that should be considered is that a number of solutions already exist, and many which may help students by improving their educational achievements, reducing their anxiety and stress, and helping them compensate for their dyslexia. However, as already mentioned, the manifestation of dyslexia differs between individuals, and therefore, even if a wide range of technical solutions is available, modifications must be made to meet the needs of each individual student. Price has pointed out that success factors can be flexibility of the accessible technology, the option to use the technical equipment in different manners at different times, and the possibility to use the technology in creative ways.¹⁴ Price also emphasised the problem of “technology overload” that can occur if a student is confronted with too many facilities, or if the technology does not meet the actual needs of the student. In such cases, the technology itself becomes a barrier to learning and educational achievements, and it can also obstruct the coping strategies that the students use to manage their dyslexia.¹⁴ It is likely that if the appropriate technological equipment is provided, and the students do use it, they can feel in control of their learning and know how to benefit from technology to promote effective studying. Anderson-Inman, Knox-Quinn and Szymanski have proposed that such a positive impact on educational results and the notion of empowerment can be regarded as indicating a successful use of technology, even if it does not help all students.¹⁵ Students may also experience the uncertainty of “what works”, and thus be reluctant to try new and untested technical solutions. This reaction can be consequence of already having used the often time-consuming methods in attempt to compensate for their dyslexia.¹⁵

Swedish legislation, university policy and support structure

According to a Swedish law, students with disabilities are to be given the same opportunity to obtain a university education as those who do not have such incapacities, and universities are to actively promote students’ equal rights and prevent direct or indirect discrimination. The legislation includes dyslexia among other disabilities. The number of dyslexic students seeking support is increasing at Lund University, as well as at many other universities and

institutions for higher education. Lund University has a policy regarding students' equal rights, which all staff members are committed to follow, and that stipulates that no students are to be discriminated, on the grounds of a disability.

Of the 35 000 students enrolled at Lund University, more than 400 are registered at the department Service for students with disabilities, SSD, as having disabilities, and approximately 300 of them are dyslexics. About 50 of the dyslexic students are affiliated with the Faculty of Medicine.

The support infrastructure at Lund University for dyslexic students consists mainly of the SSD, the student counsellors at the faculties and institutions and the university libraries, see Fig. 1.

[Figure 1 here]

The support process (Fig. 1) can differ somewhat between the libraries, although the types of help offered are generally the same. The Lund University Libraries provide adapted computers and talking books that the students or the librarians can download from the Swedish Library of Talking Books and Braille. Most dyslexic students report that the talking books are a real help in their studies. The adapted computers are available at some of the libraries, and most of them have the same software installed, which include speech synthesiser, spellcheckers and screen rulers.

As mentioned, the legislation and university policy considering students with disabilities do not provide any practical guidelines. Nevertheless, it seems that the support given by the institutions is adequate, since the students are granted at least a minimum level of help when needed. Service beyond that level can differ between the faculties and institutions.

The support structure at the Medical Faculty Library

In 2006 we started investigating what commercial software that was available for dyslexic students in order to find appropriate programs. We also browsed other universities' websites to see what technical solutions they provided for dyslexic students.

A consultant in adapted computer solutions, working part-time at the university at the time, was engaged and also our local IT technicians, to see which technical solutions that were possible to carry out and relevant for our libraries. We wanted to make sure the adapted computers contained the same software and network solutions as other student computers- but with the extra software for dyslexics installed.

Other libraries at Lund University had successfully installed some software at the time, and with the consultants advices we chose some of the same software. We regarded recognition as an important aspect, since the students had access to the same programmes at other libraries at the university.

Since we were not sure of which solutions that worked, we wanted to try different solutions and then evaluate them. The solutions chosen for our two libraries were: a secluded resource room with two stationary computers, an open study area with stat comp, a laptop for use in an open study area. The different solutions were chosen in order to meet different needs, both for students who wished a special and silent room, as well as students who wished to "mingle" with others, and did not want to disclose themselves as "dyslexic" by using a special room.

[Figure 2 here]

Two librarians were trained in using the software to be able to instruct the students. Advertising started, to give students and teachers info about the new computers. We used web pages, e-mailing lists, introduction meetings with students every new term, and later we noticed a spontaneous word of mouth advertising (i.e. student-student, teacher-student). Advertising generally gave a positive response from both students and teachers, and was probably a key factor to getting the students to start using the new equipment.

Results of the web survey

When the technical solutions had been in use for some time, it was considered relevant to evaluate the opinions of the dyslexic students regarding the adapted computers. Did the computers offer a good support? Were some solutions considered better than others? A web survey was conducted. Only seven of 25 students answered the survey, and these seven respondents were enrolled in different educational programmes, which did not represent all educational programmes offered by the faculty. There are several possible explanations for the rather low response rate. The group of prospective respondents may have felt anxious about participating in the survey despite assurances of anonymity, and about the reading and writing they would have to do to answer the questions. Also, the survey was sent by e-mail near the end of the term, which may have coincided with due dates for papers or projects. Nevertheless, the results gave us some idea of the students' reactions to the service (Fig. 3).

[Figure 3 here]

The results of the survey can be summarised as follows:

- The most popular computer programs were the speech synthesiser and the spellcheckers.
- The students wanted access to programs from off-campus computers.
- The students wanted more computers.
- The students wanted more laptops.
- The adapted computer in the open study area caused frustration, since the dyslexic students felt that they had to disclose their disability if the computer was occupied by another, non-dyslexic student, in order to gain access to the special software on the computer.

It was also mentioned that the scanner was difficult to use. Other comments recorded in the survey indicated that the "24/7- access" computer was sometimes occupied by other, non-dyslexic students, and in such case the dyslexic student had to wait, or disclose their disability, which was not an optimal situation. The students suggested that this problem could be solved by providing an additional laptop to ensure more flexibility. Good headphones were considered to be important, and the students felt that the headphones provided were of high quality. They also indicated that the silent and relaxed environment, especially in the separate resource room, was a valuable asset.

Conclusions

The literature on dyslexia is rather uniform in describing the manifestations of dyslexia as, well as the psychological and emotional aspects of being a dyslexic student. These findings correspond in general with the findings in the survey, despite the low response rate. A conclusion that can be drawn from the literature review and the survey results, is that the need of dyslexic students may differ regarding what types of technical support that is most relevant.

The manifestation of dyslexia is individual, and the way the students experience the need for compensation may vary.^{10; 14}

The literature confirms the assumption that providing appropriate technological equipment can help dyslexic students to feel in control of their learning, if they know how to use the technology for effective studying.¹⁵ Similarly, the results of the survey suggests that the software and hardware employed gave good results. Furthermore, the environment that the dyslexic students described as “silent and relaxed” represents another success factor to keep in mind, when for future development.

The possibility to choose between different solutions seems to be appealing both to students who wish to sit in a separate room and to those who prefer to “mingle” with others and use a laptop. It seems that students, who choose the separate resource room, were not reluctant to do so because they felt that the benefits of the quiet environment and the available technology helped them in their studies. In agreement with the literature, the survey findings indicated that dyslexic students may not be reluctant to use a special room or a laptop, if they can easily integrate with other students.⁸ The laptop users can easily blend in with other students and do not have to feel stigmatised, since such computers are common.

The “24/7-access” computer in the open area was apparently not regarded as successful as the laptop or the resource room. If the students had to disclose their disability to others to gain access to the computer, if it was occupied by another non-dyslexic student, it obviously created a situation that caused anxiety and stress. This is also in line with the resistance-accomodation model proposed by Armstrong and Humphrey, because the dyslexic student may feel comfortable enough about using special technical equipment but not about disclosing their disability in public.⁹ This pitfall should be avoided in the future.

Another conclusion is that the speech synthesiser and the spellchecker programs were successful. The approach of using text and sound together as in both these types of software can be similar to the concept of phonological training that Gabrieli and Ecalte have described as being helpful for dyslexics.^{4;7} In addition, such software has been found to be popular and regarded as very useful among students included in other investigations described the literature.²

The results of this study show that it is important enable dyslexic students to choose what kind of support they need, in order to avoid technological overload or mismatches between need and available support. This investigation has also demonstrated that the technical devices that are chosen in a specific study environment should be tested and evaluated to find the most relevant solutions for the students. Importantly, the survey also served as a dialogue between students and staff, which will influence future development of adapted computers in the libraries.

Further research is needed to investigate dyslexic students’ experiences of adapted computers, and there should also be more extensive testing of hardware and software. Additional, evidence must be obtained before general conclusions can be drawn about what technical solutions can provide the best support for students.

As a final remark, it should be kept in mind that laws and policies place considerable demands and expectations on educational services to provide support for disabled students. Consequently, it is essential that university libraries stay updated on this issue, both legally as

well as technically, and that they ensure that giving relevant support to dyslexic students is one of the many services they offer.

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Appendix

Questions and answers from the web-based survey

The survey was sent to 25 students, and seven responded.

The questions were multiple-choice style and also included space for comments.

The original survey is in Swedish but it has been translated here.

The figure after each response option indicates the number of participants who answered that particular question.

Have you used any of the computers at the library that have software such as speech synthesiser and spellchecker programs installed (these are also called “resource computers” or “adapted computers”)?

Yes 4

No 2

Skipped this question 1

If you have used any of these computers, which one/ones? (If you have NOT used any of them, go to question 7)

Stationary computer in resource room 0

Laptop computer 0

Laptop computer at exam 2

Open study area computer 1

Skipped this question 4

How many times have you used these computers?

1-2 times 3

2-5 times 1

5-10 times 0

More than ten times 0

Skipped question 3

Which programs have been most useful to you?

Speech synthesiser 2

Spelling support Swedish 4

Spelling support English 2

Dictionary 1

Screen ruler 0

Scanner with OCR 0

Other, please specify: “The silent and relaxed study environment helped me a lot”

Skipped this question 3

Is there any program or hardware that has been problematic?

Speech synthesiser 0

Spelling support Swedish 0

Spelling support English 0

Dictionary 0

Screen ruler 0

Scanner with OCR 1

Other, please specify: 0

Skipped this question 6

Do you think anything is missing or should be changed in the available computer support?

Different location of the computers 0

More computers 1

Access to programs from home 4

Better headphones 0

Guidance 0

Other, please specify: "Another laptop to supplement the open study area when it is occupied by an 'ordinary' student"

Skipped this question 3

If you haven't used the computers- does any of these statements apply to your situation? (You can skip this question if you have used the computers,)

I can handle my studies just fine without them 0

I haven't used them yet but I might do so later 1

I think it seems difficult to use the adapted computers 1

I didn't know that adapted computers were available 1

Other, please specify: 2 a) "I usually study at home, the study environment is better for me at home" b) "I knew some aids were available but there are programs on the computers that have helped me a lot"

Skipped this question 4

Would you use the computers more often IF...:

More computers were available 1

More laptops were available 4

It was easier to reserve or have access to the computers 2

The programs were upgraded 2

Other, please specify: 1 "The solutions in Lund are very good, they're perfect for me!"

Skipped this question 2

If you would like to make any additional comments on the adapted computer support, feel free to write them here!

Two participants (a and b) wrote comments:

a) "It would be good if you could access the programs via the web, so you could use them at home, if that is possible"

b) "I'm also studying at another university now, the solutions you provide are good! Good headphones are important".

Skipped this question 5

I'm a student in:

Occupational therapy 2

Audiology 0

Biomedicine 0

Speech therapy 0

Medicine 2

Specialist nursing 0

Nursing 2

Separate/eligible course 0

Skipped question 1

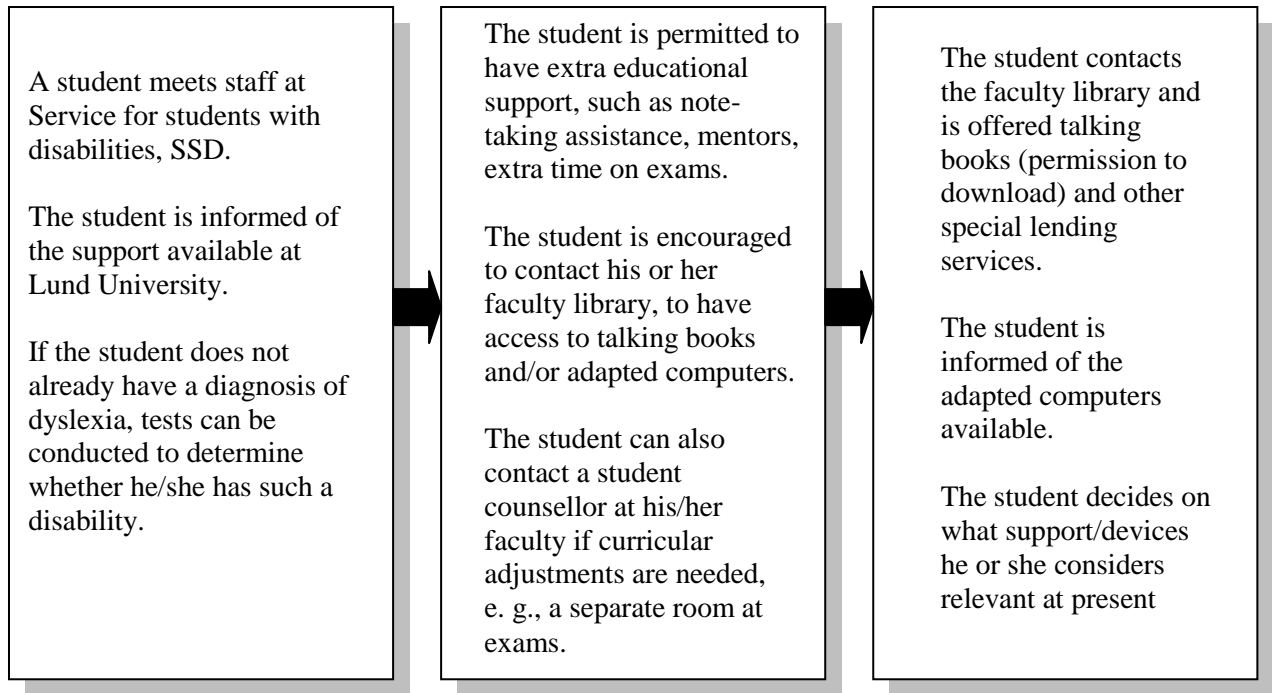


Figure 1. Support process at Lund University

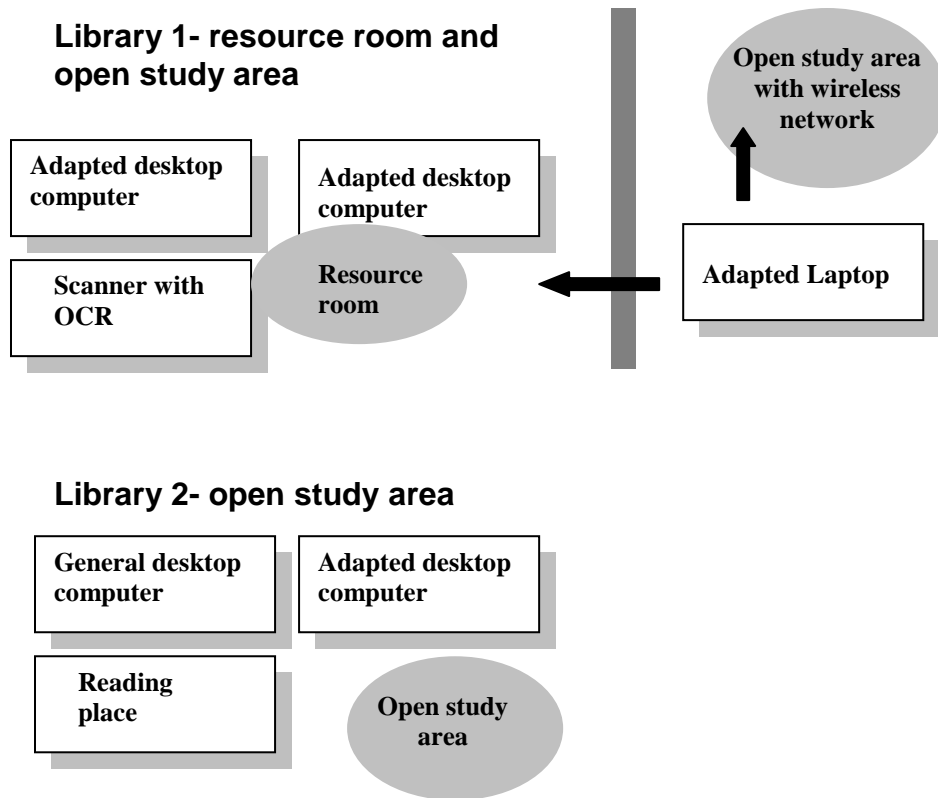


Figure 2. Technical solutions at two libraries

Summary of survey results

