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Learning and study strategies in university students with dyslexia: Implications for teaching

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Abstract

This study examined how dyslexia affects students' ability to benefit from higher education, the strategies that successful students with these problems use, and the support offered by the higher education institutions. Results from interviews, self-reports and testing of 53 university students and 42 lecturers from 3 Swedish universities showed that students with dyslexia have problems with a number of skills and academic tasks, e.g. note taking and expressing ideas in writing. Many of the students described that their difficulties were long-standing and had been experienced already in elementary school. The students seemed to compensate via additional time for examinations, access to dyslexia tutors and support by information technology. The results indicate that there are significant knowledge gaps in the educational institutions regarding students who have dyslexia.

Keywords: Adult dyslexia, higher education, compensated dyslexics, learning strategies;

1. Introduction

Broadened recruitment to higher education is on the agenda in many countries. The aim that recruitment to higher education should be widened has been discussed by the EU's ministers of education within the framework of the Lisbon Process and similar recommendations can be found in resolutions from meetings in the Bologna Process. Increased access to higher education usually means both increasing recruitment generally and increasing recruitment from under-represented groups in higher education. The Swedish Governments Propositions 2001/02:15 stated: "Open higher education welcomes everybody equally, regardless of background, ethnicity, place of residence, gender or functional disability."

The Swedish Discrimination Act, implemented on January 1 2009, comprises the content of the previous Act on Equal Treatment of Students in Higher Education. Academic institutions are enjoined to work actively for all students' equal rights and to counteract discrimination due to functional disability, among other things. At nearly all universities and colleges in Sweden there is now a special coordinator for students with functional disabilities. Functional disability refers to permanent physical, mental or learning-disabled limits of functional ability caused by an injury or an illness that existed at birth, has arisen later on, or may be expected to arise. The most frequent type of functional disability is dyslexia, also called specific reading and writing disorders. The aim of the present paper is to

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describe the learning and study situation for students with dyslexia based on several kinds of information from both students and lecturers.

Studies of adults with childhood reading problems is a new and still developing research area which lacks standardized tests and sample selection (see e.g., Siegel & Smythe, 2006; Venezky & Sabatini, 2002). However, the results from studies converge on the persisting phonological deficit. Although many adult dyslexics seem to be able to cope with their reading deficits by relying more on context and top-down information, difficulties can still be found on speeded word decoding tasks which put higher demands on rapid phonological processing or tasks that tap an exact knowledge of orthography. They may well have reached normal reading level but they have developed a qualitatively different word decoding ability with a less specific orthographic knowledge and show difficulties in lower level decoding and spelling. The core problem, a phonological deficit, can still be detected when using tasks that measure phonological awareness, pseudo-word reading, rapid naming and verbal short term memory.

Recent research has found that participants in adult literacy programs have problems in using decoding and phonetic strategies and compared to children they more often have to rely on visual cues in demanding word recognition tasks (Greenberg, Ehri & Perin, 2002; Miller-Shaul, 2005). Sabatini (2002) found that participants in adult literacy programs had phonological processing problems and they were slower on phonological processing tasks and on word and pseudo word recognition tasks. The importance of phonological variables also held for a group of university students with diagnosed childhood dyslexia (Hanley, 1997) and for students diagnosed at the university level (Everatt, 1997). Fink (1998) was able to find evidence for specific deficits in lower level decoding and spelling skills in a group of successful adults with dyslexia.

The present paper presents results from mixed methods and the aims are; to survey the study behavior and support needs of a sample of university students with dyslexia; to describe the reading and reading related skills of university students with dyslexia and to describe the university teachers' view on students with dyslexia.

2. Method

2.1. Participants

The participants were recruited mainly from the teacher and the nursing program in three of the five universities in the northern half of Sweden. The student sample also included a minor proportion of students from a few other undergraduate programs.

2.1.1. Teachers

In total 42 teachers (28 females and 14 males) in the three universities were interviewed. Umeå University **(**13 teachers**):** 10 teachers in teacher education (six females and four males) and three teachers in training for nurses (all females). Mid Sweden University (15 teachers): 10 teachers in teacher education (five females and five males) and five teachers in training for nurses (all females). University of Gävle (14 teachers): 10 teachers in teacher education (five females and five males) and fours teachers in training for nurses (all females). They were recruited in a rather informal way among teachers with primarily five years of teaching experience at the actual undergraduate program and some of the participating teachers also acted as director of studies and study counselor.

2.1.2. Students

In total 53 (38 females and 15 males) students in the three universities were interviewed. Umeå University (28 students): 13 students in teacher education (nine females and 4 males), five students in training for nurses (all females) and 10 students in other professional programs within the university (nine females and one man). Mid Sweden University **(**17 students**):** eight students in teacher education (six females and and two males) and nine students in training for nurses (five females and four males). University of Gävle (eight students): five students in teacher education (three females and two males) and three students in other professional programs within the university (one female and two men). They were recruited through letters sent by the university's student support services, through announcements in undergraduate classes, and through posters advertising the study. The mean age

was 27 years (range 19 – 49). Seven of the students reported some kind of immigrant background but these students are included in the present report because they were judged fluent in spoken Swedish.

2.2. Procedure

All students completed the questionnaire and were individually interviewed. The students who volunteered for testing were assessed individually in a dedicated room. The assessment took about 1 to 1,5 hour and the interview 30 to 40 minutes.

2.3. Measurement instruments

The problems in assessing dyslexia in adults in well recognized. (See e.g.; Sabatini, 2002; Re, Tressoldi, Cornoldi, & Lucangeli). The tests were selected among the few Swedish ones suitable for the age group. Well standardized tests with appropriate norm data could not be found so for several of the tests the results has to be compared to norms for younger students. Results from eight tests are reported here but the battery also included three additional tests.

2.3.1. Tests

2.3.1.1. Oral word decoding (Johansson, 2004)

The test required the participants to read isolated words aloud. The 50 words were increasing in difficulty from primer to adult level and presented on paper in twelve lines with seven short words (3 and 4 letters) on the first line and two 7-syllable words (21 and 23 letters) on the last line. The number of correctly read words was scored as well as the total reading time.

2.3.1.2. Oral non-word decoding (Johansson, 2004)

The test required the participants to read isolated pseudo-words aloud. The 49 words were presented on paper in nine lines with six two-letter words on the first line and four 3-syllable words (7-9 letters) on the last line. The number of correctly read words was scored as well as the total reading time.

2.3.1.3. Word-chain decoding (Johansson, 2004).

For this task the participant had to silently read "chains" of words that were concatenated by deletion of the inter-word blank space. Each chain consisted of two to four words, randomly ordered, and the reader had to mark each word boundary with a pencil. The chains were composed of unrelated high frequency words. The number of correctly marked chains in three minutes was scored. Maximum score was 120. (This test is very similar to one of the measures in Miller Guron, 1999).

2.3.1.4. Phonological choice task.

This task was a paper and pencil Swedish adaptation (see Olofsson, 2003) of the computerized phonological coding task used by Olson, Forsberg, Wise, & Rack (1994). The task was to decide, and underline with a pencil, which pseudo-words is a pseudo-homophone of a real word. (That is, "sounds" like a real word). There were four lists of 20 groups (rows) each of three or four word alternatives. Subjects were given two minutes to complete the task. The score was the number of words correctly chosen. The maximum score was 80.

2.3.1.5. Orthographic choice task.

This task is a Swedish adaptation (see Olofsson, 2003) of the computerized orthographic coding task used by Olson et al. (1994). The participant had to underline the true word in true word-pseudo homophone pairs. Stimuli were presented on six lists of 20 pairs each. Note that the phonological codes for the pairs are identical so both the word and its pseudo homophone would be pronounced the same in Swedish. Thus, in order to make a correct

response the reader must use word-specific orthographic knowledge. The score was the number of correctly chosen words in two minutes. The maximum score was 120.

2.3.1.6. Rapid automatized naming (RAN)

The participant had to read aloud a list of 50 randomly ordered digits. This was repeated once again. The score was the mean reading time in seconds for the two readings. Typically, very few errors were made on this task. The test is similar to the digit naming task used by Snowling et al. (1997).

2.3.1.7. Spelling (Johansson, 2004).

In this task the participant had to write dictated words on a form with numbered spaces. The examiner first read a short sentence in which the target word was embedded, and then repeated the target word aloud. The task consisted of 50 multi-morpheme words varying in length from two to seven syllables but the final word was the verbal expression for the number 8627 which in Swedish is a ten-syllable word. The maximum score was 50

2.3.1.8. Reading comprehension.

The test consisted of the three continuous texts Flu, Police and Runners selected from PISA 2000 (OECD, 2002) with totally ten multiple choice questions and three open questions. The lengths of the texts were, respectively, 342, 583 and 348 words. No time limit was imposed. Norm data is available from a sample of more than 4000 Swedish 15 year-old pupils (Skolverket, 2000). The maximum score was 15.

2.3.2. Questionnaire for students

All students answered a questionnaire with 26 questions covering the following areas: demographic data, attitudes to special education and other subjects at school, for how long they had planned to study at a university, reading habits, use of computers and dictionaries, self-evaluation of reading, self-evaluation of other skills and the existence of dyslexia in the family (4 and 5 grades Likert scales were used).

2.3.3. Student interview

A semi-structured interview addressing the following areas: experiences of difficulties in the university studies, course literature, lectures, written assignments, compensatory strategies, available support within the university and available support outside the university and ability to organize the studies. The interviews were recorded and transcribed into written form.

2.3.4. Teacher interview

A semi-structured interview addressing the following areas: extent and identification of students with dyslexia, changes over time of the education and how the existence of students with dyslexia has influenced the teachers and the teaching.

3. Results

First the results from the diagnostic testing are reported, followed by some results from the student questionnaire and finally findings from the student interviews and teacher interviews are presented.

3.1. The students test-results

Thirty seven out of the fifty three participants volunteered to do the diagnostic testing. One of the participants preferred to do only some of the tests because he had recently been tested and diagnosed as having dyslexia. Since there also were a few occasions of missing data most of the reported test results is based on 37 cases but for a few results the number of cases is 36 or 35.

3.1.1. Word-decoding

On the oral word decoding test the university students scored 46,7 (SD=3,26) which can be compared to the mean value 47 for the Swedish standardization sample in high school (15,5 years old) reported by Johansson (2004). The mean reading time for the university students was 99 seconds compared to 64 seconds for the standardization sample. Thus, the present sample has normal oral word decoding accuracy but their word decoding speed is slow, on the average not better than Stanine 1 when compared to the norm for upper secondary school (age 16,5) (Johansson, 2004). The mean number of correctly read non-words was 42,4 (SD=7,5) which is slightly lower than the mean value for 15 year olds (Johansson, 2004). The oral reading time for non-words was 105,4 seconds compared to 62 seconds in the standardization sample. Compared to the secondary school norms (Johansson, 2004) the oral non-word decoding accuracy equals Stanine 1 and the decoding speed is at the very low end of Stanine 1.

The mean score on the Word-chain decoding test was 26,7 (SD=11,06) which can be compared to 41,8 (SD=9,4) for 15,5 year olds in the standardization sample (Johansson, 2004). The mean for the present sample is within the interval corresponding to Stanine 2.

On the phonological choice task the mean score for the university students in the present study was 15,2 which is below but very similar to the mean for the 28 year old adults with well documented childhood dyslexia presented in Olofsson (2002), see Table 1. (The comparison is not completely fair because of in the 2002 study a slightly more strict scoring procedure was used). It should be noted that despite the low number of participants in Olofsson (2002) the differences between the means were statistically significant, implying that the magnitude of the difference is large. The results in Table 1 are supporting the conclusion that the vast majority of the university students in the present study are suffering from phonologically related word-decoding problems. The validity of this conclusion is further strengthened by the comparison to the results from a normal sample of 16-year-old pupils. See the last column in Table 1 (Olofsson, 1988).

3.1.2. Rapid Automatized Naming (RAN).

As can be found in Table 1 the mean RAN-time was very slow, 27,2 seconds, for the university students with dyslexia.

Table 1. Descriptive data for two word decoding tests and Rapid Automatized Naming (RAN) for the presents sample and data from two earlier Swedish samples. The participants in the second and third group were all 28 years old (Olofsson, 2002). The participants in the fourth group were all 16 years old.

Measure	University students with dyslexia N=37	Non-students with dyslexia N=10	Control, without dyslexia N=15	Standardization sample, N=304
Phonological Choice	15,2 (6,8)	17,1 (8,3)	27,1 (8,6)	32 (9,5)
Orthographical Choice	52,5 (20,7)	68,6 (20,5)	87,6 (19,6)	91 (20)
RAN	27,2 (8,9)	18,3 (2,7)	15,4 (2,2)	

3.1.3. Spelling.

On the word dictation task the mean score for the 37 university students was 29,8 (SD=9,9) which can be compared to the mean score 34,2 (SD=9,6) for the 15 year old students in the standardization sample (Johansson, 2004).

3.1.4. Reading Comprehension.

The mean score on the reading comprehension test was 11,5 (SD=2,7). The comparable sub-result for the Swedish national sample of 15 year-olds was 10,5 (Skolverket, 2001).

3.1.5. Correlations between reading tasks.

The highest correlation found for the phonological decoding task was with the oral non-word decoding composite score ($r = 0,72$ $p < .001$). The orthographic choice task correlated 0,79 with word-chain decoding and 0,72 with the oral word reading composite score. The results on the reading comprehension test did not correlate significantly with any of the word decoding measures (maximum $r = 0,21$ with the phonological choice task, $p = .222$). The

spelling test results correlated between 0,50 and 0,62 with the word decoding measures. RAN showed highest correlation with oral reading, -0,56 with oral word reading and -0,47 with oral non-word reading (composite scores). The correlation between RAN and the phonological choice task was -0,39.

3.2. Questionnaire for students

The students with dyslexia reported having a longer period of college studies before university compared to typical university students. However, the present sample reported having more foreign language courses in comparison to the non-students with dyslexia in Olofsson (2002). They reported more positive preferences for school subjects than students with dyslexia who do not go to the university. Never the less, 22 percent of the students reported that the school subject "Swedish literature" was very boring (lowest rating on the scale) and 26 percent reported the lowest rating for Swedish writing. Nineteen percent gave the highest rating to these school subjects. Only school mathematics received lower ratings. The students reported normal amount of leisure reading but read less in English, 62 percent reporting that they never read any English on their leisure time. They reported to be frequent users of dictionaries and computers.

Half of the students reported that they probably or most likely would continue to studying at the university even after finishing their basic program. Eighty five per cent of the participants reported having dyslexia in the family, most frequently the father (reported by 21%).

The students reported having most problems with reading English course literature and with taking notes during lessons (See Table 2). Slightly less problems were reported for reading Swedish literature, Spelling and Writing short reports and examination tasks.

Table 2. Mean and Standard Deviation for students (N=53) self-reported skill in six study tasks. (Rating scale 1 to 4 with high values corresponding to more difficulties).

	Internet	**LittSE**	**LittENG**	**Spelling**	**NoteTaking**	**Writing**
Mean	1,7	2,3	3	2,3	3	2,4
Standard Deviation	,65	,63	,96	,62	,90	,72

3.3. Student interviews

The results are structured according to four central themes partly emerging from the interview guide and partly from the content of the answers. The themes are here expressed in the form of simple questions, although the actual wording during the interviews did not have this straightforward form.

3.3.1. What kind of compensatory strategies or tools for students with dyslexia are available in higher education?

The compensatory facilities offered to students with dyslexia in higher education are: copies (data files) of power point presentations (in some cases with oral comments on the web), handouts, recordings of books and lectures, notes written by students without dyslexia who get paid by the university and different arrangements at examinations: extended time, a separate room, the student is writing the answers on a computer, someone reads the questions aloud to the student, the student may answer orally and the possibility to divide the exam into two halves.

3.3.2. What kind of facilities do the students with dyslexia appreciate?

All of the interviewed students are using *computers* and Internet. They use word processing programs to write and Google and Wikipedia to look up words. The students prefer to use Google or Wikipedia before dictionaries to look up words. To use Google is much easier since many of the students have problems with using the alphabetic principle. They quickly get lost when looking for a word in a dictionary. When writing most of the interviewed students use word´s spelling check but rather few are using the syntax check without being able to give a reason to why they don´t use it. Many students report that they are summarizing the texts from books on the computer.

Audio books were used by about half of the students. However, many students complain that it takes such a long time to listen to them and that if they don´t understand and make a pause there is no one who can explain to them. Some students find it difficult to get the whole context since the person who is reading on the tape is reading very slowly and also tells when there is a full stop and a new paragraph which students found irritating. In some cases the books are made up of synthetic speech which is very tiresome to listen to because of the monotonically speech. To listen to audio books in English is particularly difficult. Another problem with audio books is that they have to be ordered a long time in advance which not all students remember to do or cannot do because they do not know what book they will need during the next course. Furthermore, the students cannot order an audio book too long in advance since then they may not have access to it just before the exam when they need it most.

Daisy-books, where students also listen to someone reading but where there is a possibility to increase or decrease the speed, are preferred by some of the students. Not all students knew the advantages with Daisy-books though.

Recording of lectures is very appreciated of some students. However, it takes a lot of time to listen. Other drawbacks are that the students have to ask each teacher for permission to record the lecture and some students find that to be embarrassing

Power Points are very common. However, in order to prepare themselves before the lectures in particularly students with dyslexia need access to the Power Points in advance which is not always the case.

Note-taking. Remarkably few students appreciate help with note-taking by a fellow student because not all fellow students are capable enough to summarize and structure the lecture in an understandable way.

A few students report that they are using a so called *translation pe*n when reading books in English and some students report that they are having access to help from a *mentor*

Of the different arrangements at *examinations* the possibility to write in a separate room seems to be appreciated. Some students with dyslexia also like extended time for the exam while others mean that they get to tired and cannot really take advantage of the extra time. Only a few students report that they have been using oral examination and found this to be a good form of support.

3.3.3. Do you have access to someone who can check what you have been writing before delivering the texts to the teachers?

The most common answer is that the students with dyslexia get help from friends. These can be in the same course or friends from outside the university. However, many of the students also mention someone from the family: the mother, sister, husband, wife or someone they are living together with. Boy-friends and girl-friends are also mentioned as persons who are checking spelling and other language aspects.

3.3.4. What strategies have the students with dyslexia used to deal with their reading and writing difficulties?

When asked about what strategies the students had used to overcome their reading and writing problems a variety of general and more specific strategies were described.

More general strategies mentioned are to think positively and to pep one-self, to put down a lot of energy and to work hard. Furthermore, some students said that they use to divide the tasks into minor milestones and work only with one little piece of the task at a time.

In addition specific strategies were mentioned like to make notes when reading or to underline important facts or to use post-it notes. A common strategy was to read and to pull out the most important facts and write summaries which the students then used when studying for exam.

When faced with a writing task one student emphasized the importance of preparing himself by thinking about the subject during some days before starting to write.

Especially some of the nurse students mentioned the advantage of drawing pictures as a strategy to remember more efficiently. Another nurse student told about her strategy to use colors for example green symbolized a specific illness or symptom, orange symbolized a diagnose and pink symbolized a treatment. That helped her to organize her knowledge. Another specific strategy mentioned of a nurse student was to write down summaries of important facts with big letters on small cards. Still another nurse student tried to compensate her lack of success on theoretical tasks by trying to be very skilled in the more practical courses of the education.

One of the becoming teachers who had a lot of teaching experience put forward the importance of being honest and open about her difficulties in front of the students at school. We have to be open about our problems and not try to hide them, she said. As a teacher with dyslexia you have an inside perspective that someone who is reading and writing without difficulties never will get.

3.4. Teacher interviews

Most of the teachers told that they regularly meet students who have great difficulties in completing the courses, However, the majority of the teachers meant that extremely few students have dyslexia, and that it was far more likely that student problems were caused by e.g.; insufficient background knowledge, unfamiliarity with university studies, other competing activities (job), psycho-social problems, difficulties with the Swedish language and that some students might just be slow learners.

By what means does a teacher learn that a student has dyslexia? A few teachers told that a student had made contact and showed a dyslexia certificate, some reported that they were informed by the study counselor and other teachers had been informed by the student only after the student had failed on the first written exercise. There were also teachers reporting that they could spot dyslexia by looking at the student's written production and teachers who told that they could notice if the student is very unwilling to read many pages and/or that he/she has great problems in understanding written text, especially in English.

Could they relate any recent changes in the institutions to the amount of student problems seen? The teachers suggested that the content of the courses and the programs have become more theoretical and abstract; that there now are more seminars and a stronger demand for reflections; that the students now have to do more documentation and explicitly relate to details in the curriculum. On the other hand it was also reported that today's teachers are more service minded, make more detailed study guides, publish power-point presentations on the students web even before the lesson and they are designing many different types of examinations. But, the teacher also believed that less time was spent with the students and more time on administrative tasks.

How do the dyslexic student's' problems affect the teacher during supervision of examinations papers? Many teachers told that it takes an awful lot of time and that it was difficult to find out when there is too much support and when there is too little. They reported that they had to give both oral and written instructions ant be very explicit. A general meaning was that there is not time enough to take care of all language problems in the students writing.

In addition to their own efforts many teacher also had recommended students to seek support from persons in the student's family and among friends, their study group, the university language workshop, the study counselor and in some cases a speech therapist.

Among the teachers' suggestions for improvement were ideas about a basic course for all new students, regular (video) recording of lectures and seminars, a fixed number of hours for teacher support attached to each student with dyslexia and a data-base of advises for students with reading and writing problems. It should be noted that several of the teachers highlighted that the support should be designed for independent use, a professional education shall not educate to dependence.

When asked to be specific about actions taken for supporting students with reading problems the teachers mentioned; designing crystal clear instructions, explanations of concepts, dialogue during lectures, opportunities to answer questions, more supportive material on the web and continuous support to students writing examination reports. When asked about the reasonableness of remedial education within university programs it was general

agreement on the need for such actions and a positive attitude toward such initiatives, but the teachers emphasized that the details need to be worked out. However, there were teacher who opposed any such arrangement, meaning that students with problems of such magnitude should be advised to look for another career.

There were several issues mentioned; is it possible to increase the level of requirements in undergraduate programs and at the same time open up the intake; if the students receive heavy support during their training, then what about their future functioning as independent professionals; who is representing the interests of third-parties like pupils and patients?

4. Discussion

This mixed-methodology investigation sought to describe the learning situation for university students with dyslexia. The sample of students was found to score low on most basic reading skills if both speed and accuracy are measured. For the present test battery, the pattern of correlation indicates that the word decoding tasks are reliable and that the distinction between phonological (non-word) and orthographic word reading has validity. This findings support previous research finding that reading measures taping phonological processing and speed are effective in discriminating adults with a history of dyslexia, and that poor results on Rapid Automatized Naming is typical for adults with dyslexia. The lack of correlation with reading comprehension is in line with previous results on adults with dyslexia. However, the problems inherent in designing a reading comprehension test for adults with dyslexia should not be under estimated. Further research is needed.

The results from the student questionnaire and the interviews indicated that pupils with dyslexia who continues into higher education in general have positive experiences from secondary school and a positive attitude toward education. This says nothing about the pupils with dyslexia who refrain from higher education. Here more research is clearly needed.

The picture that emerged shows a university student with dyslexia having major problems with note-taking and in reading English course literature and clear problems with most writing tasks and with reading Swedish course literature

The student interviews revealed that students with dyslexia compensate for their problem. A great variation was found but among the usual methods one was to reduce the amount of reading, to read summaries, to look for alternative and shorter texts and to cooperate with peers. These are methods of low on no cost for the educational institutions. But, many of the students also used available support like audio books and note taking.

The teachers gave several reports on nowadays being more service minded than five to ten years ago. They stated that course structure and teaching procedures probably can be reorganized in rather easy ways to better accommodate students with reading problems. Such changes would benefit all students. A general opinion among teachers was that the problem with students with functional disabilities like dyslexia must be discussed.

This study covers a relatively new topic and there is much research that must be done. So far it can be concluded that higher education institutions should be prepared for students with dyslexia. Actions would most likely involve the organization of teaching, effective and transparent student services and staff training.

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