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Participation problems and effective accommodations in students with dyslexia in higher education

Wim Tops[a,b], Dorien Jansen[c], Eva Ceulemans[d], Katja Petry[c], Nanna Haug Hilton[e] and Dieter Baeyens[c]

[a]School of Educational Studies, Hasselt University, Hasselt, Belgium; [b]Revalidation Research Centre (REVAL), Hasselt University, Hasselt, Belgium; [c]Department of Parenting and Special Education, University of Leuven, Leuven, Belgium; [d]Department Quantitative Psychology and Individual Differences, University of Leuven, Leuven, Belgium; [e]Faculty of Arts Centre for Language and Cognition Groningen (CLCG), Groningen, The Netherlands

ABSTRACT

Students with dyslexia face particular challenges in higher education. Individuals with disabilities have a right to accommodations to guarantee equal opportunities and participation in education. The present study addresses (1) the frequency of functioning and participation problems of students with dyslexia in higher education, (2) the teaching and evaluation methods during which the functioning and participation problems emerge, and (3) the effectiveness of accommodations perceived by students with dyslexia. Results showed that students with dyslexia primarily have problems with reading comprehension, reading speed, spelling and text writing. Furthermore, most students with dyslexia experience more problems during classical teaching (e.g. lecture) or classical evaluation methods (e.g. written exam with open questions) than during dynamic or activating teaching methods (e.g. excursion or internship) or alternative evaluation methods (e.g. peer evaluation). Finally, perception of the effectiveness of accommodations depends strongly on the individual functioning and participation problems students with dyslexia experienced.

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Introduction

Thanks to better guidance and remediation programmes in primary and secondary education, more students with dyslexia enter higher education (HE). Students with dyslexia often face particular challenges in HE. These challenges comprise both individual and environmental factors.

Individual functioning and participation problems

Individual functioning and participation problems are defined as problems a student may experience in involvement in school and learning situations (MLA 2001). The profile of (young) adults with dyslexia is different from that of children (Rouweler

CONTACT Wim Tops wim.tops@uhasselt.be
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et al. 2020). Reading and spelling problems continue to be the core deficits in HE students with dyslexia (Hatcher, Snowling, and Griffiths 2002; Callens, Tops, and Brysbaert 2012; Pirttimaa, Takala, & Ladonlahti, 2015). Reading problems in this group manifest themselves as a slower reading speed compared to non-dyslexic peers (Tops et al. 2012). The spelling problems of this group are part of a more general writing problem that is reflected in syntax and punctuation errors, but also in text structure and word choice (Mortimore & Crozier, 2006; Tops et al. 2013). Besides their severe reading and/or spelling problems, young adults with dyslexia experience problems with executive functioning like short term or working memory problems (Szmalec et al. 2011) and difficulty with planning and organisation (Hatcher, Snowling, and Griffiths 2002). Next, they show attentional deficits (Hatcher, Snowling, and Griffiths 2002), reduced processing speed (Callens, Tops, and Brysbaert 2012), and retrieval problems, for instance with fast arithmetic (De Smedt and Boets 2010). Additionally, individuals with dyslexia seem to have less elaborated vocabulary skills (Rose and Rouhani 2012; Swanson and Hsieh 2009) as well as problems with reading comprehension (Simmons and Singleton 2000; Swanson and Hsieh 2009). Dyslexia is also associated with less sophisticated study strategies and metacognitive skills (Kirby et al. 2008; Sideridis et al. 2006), higher anxiety, lower self-esteem, problems with coping, dealing with unexpected situations and deficient academic achievement and motivation throughout the life-span (Carroll and Iles 2006; Pirttimaa et al. 2015; Trainin and Swanson 2005). Some students feel ashamed of their dyslexia and experience it as a stigma (Stöber and Rountree 2020).

Environmental factors

According to the Handicap Creation Theory (Fougeyrollas 1995), functioning and participation problems (or a handicap) emerge due to a mismatch between characteristics of the individual and the environment. More recently, the International Classification of Functioning, Disability and Health or ICF (World Health Organization 2009) has followed the same reasoning. As such, a comprehensive overview of the functioning and participation problems of HE students with dyslexia has to take into account characteristics of the learning environment. These characteristics can be situated on different levels, for example on the policy of the institution, the pedagogic competences of the lecturers, but also at the level of the methods used to educate and evaluate students.

Since the 1970s, a social model on dyslexia has become more and more important in which disability is considered a form of social oppression rather than a medical condition (Goode, 2007), leading to an adequate response in the Convention on the Right of Persons with a Disability (CRPD; United Nations 2006), which is ratified by about 90% of the UN member states.

A study by Griffin and Pollak (2009) however shows that students with disabilities still experience insufficient support in HE. To meet the specific needs of these students, HE institutions should invest more in inclusive learning environments to minimise the need for individual adjustments (Sumner, Crane, and Crane 2021). Quick (2013) argues that HE staff needs to learn how to deal with students with dyslexia. There is a dire need for increased awareness training for lecturers, according to Griffin and Pollak (2009). The

authors put forward a socio-cultural view on disability. Dyslexia should not be seen as a deficit, but as a neurological or cognitive diversity that comes with specific strengths and challenges similar to any other form of neurological or cognitive functioning (Griffin and Pollak 2009)

Accommodations and aids

Based upon the CRPD (United Nations 2006), students with dyslexia are eligible for accommodations in HE. Accommodations include adjustments of the learning environment or the curriculum format, or the use of aids and tools, which allow students with a disability to access the learning content and/or to complete assignments and exams. Evidence of accommodations for students with dyslexia is still scarce and focusing mainly on children (Fletcher et al. 2006; Fuchs, Fuchs, and Capizzi 2005; MacArthur 1996, 1999; MacArthur and Cavalier 2004). What helps students in primary or secondary education, is not necessarily helpful for students in HE.

Nielsen (2011) argues that most HE students need more time and space for assignments and exams compared to non-dyslexic peers. Although the focus of their study was not primarily on accommodations, Callens, Tops, and Brysbaert (2012) recommend up to 30% more time and extended deadlines since students with dyslexia are disadvantaged under time constraints.

Callens, Tops, and Brysbaert (2012) encourage students to use text-to-speech software (also during exams), spellcheckers and a calculator (e.g. for problem solving) to compensate for their reading, writing and fact retrieval problems. Elkind, Black, and Murray (1996) argue that the use of text-to-speech software positively affects both reading rate and reading comprehension of students with dyslexia, enabling extended reading time. Moreover, text-to-speech software enhances slower readers, and worse comprehenders, more than faster readers and better comprehenders.

Students with dyslexia acknowledge to have problems with written examinations causing anxiety and stress (Webster, 2016). In a study by Tops et al. (2013) where teachers had to mark written essays of both students with and without dyslexia, students with dyslexia systematically received lower marks. According to Webster (2016), lecturers should make learning material more inclusive instead of 'one size fits all'. Students, for their part, need to be aware that they have a preferential learning style that can be different than that of peers. When lectures become more aware what difficulties students encounter, they can develop courses in flexible and multi-layered ways (Pino & Mortari, 2014) and tailor them to students' specific needs (Webster, 2016). For that, lecturers need to have an extensive knowledge about both learning difficulties and teaching methods suitable for students with specific learning disabilities (Quick, 2013). Also, flexibility in adjusting teaching methods to fulfill the individual needs of students with specific learning disabilities seems crucial (Nielsen 2011).

In a study by Pino and Mortari (2014) students positively evaluated other, less traditional teaching approaches than straight lecturing. Students prefer to have free choice in the way they can demonstrate their knowledge and competence. In this way, they can use communication and expression skill that suit their learning style to achieve success. The

overuse of written assessments by definition excludes students with serious reading and writing difficulties such as those with dyslexia. Inclusive learning environments based on Universal Design for Learning (UDL) can address some of the challenges faced by students with dyslexia, for example by offering course content in different formats (auditorily and visually). However, there must also be scope for individual adjustments and accommodations because not all students need extra support and not in all courses (Pino & Mortari, 2014).

Extra help for students with dyslexia sometimes comes from unexpected sources. Social media, for example, can be a useful tool for students with dyslexia to keep abreast of deadlines, group assignments, etc. According to Barden (2014) social media enhances metacognition and helps students with dyslexia to gain control over their learning.

Impact of educational system on research findings

Empirical evidence about academic outcome in students with dyslexia comes predominantly from English-speaking countries (e.g. Adelman and Vogel 1990; McGuire, Hall, and Litt 1991; Richardson 2009; Trainin and Swanson 2005; Vogel and Adelman 1992). It is important to note that the HE is organised differently around the world. English-speaking educational systems are often based upon a master-apprentice model (Callens, Tops, and Brysbaert 2012). This means that HE institutions set high entrance standards for students, resulting in a selective group of students with a high success rate, including that of students with disabilities. Results from these contexts cannot automatically be generalised to other educational models, and seem too optimistic for HE students in other (West-European) countries. In Belgium, where this study took place, HE is accessible to a large group of students but less than half of the students succeed in their first undergraduate year. However, in Belgium, and by extension in most West-European countries, it remains unclear how often students with dyslexia encounter functioning and participation problems, and under which circumstances.

Aims and research questions

Our research questions are as follows:

- RQ1. *How frequently functioning and participation problems occur in HE students with dyslexia?*

Since HE students continue to encounter serious reading and writing problems and other (cognitive) problems (such as attention, fact retrieval, phonological awareness and vocabulary) that we discussed earlier in this introduction (Callens et al., Swanson and Hsieh 2009), we hypothesise that most students with dyslexia also encounter participation difficulties in HE.

- RQ2. *During which teaching and evaluation methods these functioning and participation problems emerge?*

Based upon the study by Pino and Mortari (2014), we hypothesise that students with dyslexia experience fewer problems during flexible rather than classical teaching and evaluation methods in which there is room for individual adjustments to compensate for their reading and writing problems.

- RQ3. *What accommodations are perceived most effective in dealing with the functioning and participation problems of students with dyslexia in HE?*

Based upon Callens, Tops, and Brysbaert (2012), we hypothesise that – although not exclusive – reading and writing problems are the most prominent problems students encounter in HE and students prefer those accommodations that enable them to overcome these problems independently and without the help of teachers, tutors or fellow students. Students with dyslexia do not want to be different from their peers and want their dyslexia to be as unnoticeable as possible (Stöber and Rountree 2020). Hence, the need to overcome their dyslexia independently.

Method

Participants

HE students with dyslexia, students without a disability and student counsellors were recruited for this study. Students with dyslexia were included as a target group to gain insight in their experience regarding the three research questions. Students without a disability were recruited in order to answer the first research question. By comparing the experienced functioning and participation problems of students with dyslexia to the experienced problems of students without a disability, it is made possible to examine whether the functioning and participation problems identified by the literature review are dyslexia-specific. Student counsellors were included to provide a general perception on the functioning and participation problems of students with dyslexia in HE based on their experience in counselling these students (i.e. research question 1). Student counsellors are professionals who work in an institution of higher education and support students with a disability who encounter different problems (e.g. study skills, planning, reasonable accommodations).

Participants were recruited in seven different HE institutions in Flanders, Belgium. The student counsellors received an email with an information letter explaining the design and goals of the study and an invitation to participate. Additionally, the student counsellors were asked to send this information letter to students with dyslexia, who were registered as students with a disability, and to students without a disability in their HE institution. Students without a disability were also recruited via social media. All participants received, read and signed an informed consent if they agreed to participate in the study.

Students with dyslexia were eligible participants if (1) they were enrolled in an HE institution, and (2) they were diagnosed with dyslexia prior to our study in accordance with the definition of the Dutch Dyslexia Foundation (SDN, 2008). The diagnosis had to be reconfirmed by the student counsellor based on the diagnostic report, which is also necessary for receiving accommodations in HE. Students without a disability were

eligible to participate if (1) they were enrolled in an institution for HE in Flanders, and (2) they had no known disability. Student counsellors were eligible to participate in the survey if (1) they were working as a student counsellor in a HE institution in Flanders, and (2) they were supporting students with dyslexia as part of their counselling assignment.

In total, 166 students with dyslexia, 31 student counsellors and 241 students without a disability participated in this study. When comparing the students with dyslexia to the students without a disability, no significant differences were uncovered. The participating students were on average between 19 and 20 years old (dyslexia: $M = 19.70$, $SD = 1.62$; without disability: $M = 19.84$, $SD = 1.49$; $F(1, 405) = .78$, $p = .38$). Moreover, the majority of the students with and without dyslexia were female (dyslexia: $n = 117$, 70.5%; without disability: $n = 185$, 68.7%; $\chi^2(1) = 2.72$, $p = .10$) and were enrolled in a professional (as opposed to an academic) educational programme (dyslexia: $n = 95$, 57.2%; without disability: $n = 157$, 65.1%; $\chi^2(1) = 2.61$, $p = .11$). The educational programme group the students with dyslexia and without disability were enrolled in, differed significantly ($\chi^2(2) = 9.01$, $p < .05$). The enrolment of students with dyslexia and without a disability did not differ for the educational programme group Humanities and Social Sciences (dyslexia: $n = 86$, 51.8%; without disability: $n = 129$, 51.6%). However, more students with dyslexia were enrolled in the educational programme group Science, Engineering and Technology (dyslexia: $n = 47$, 28.3%; without disability: $n = 45$, 18.0%), whereas students without disability were enrolled more often in the educational programme group Biomedical Sciences (dyslexia: $n = 33$, 19.9%; without disability: $n = 76$, 30.4%). The students were enrolled in their current HE institution for approximately 2 years (dyslexia: $M = 2.19$, $SD = 1.31$; without a disability: $M = 2.20$, $SD = 1.09$; $F(1, 405) = .01$, $p = .92$). In the dyslexia group, ten students (5.88%) had a comorbid diagnosis of attention deficit hyperactivity disorder. Four students (2.41%) had an autism spectrum disorder and 11 students (6.63%) had dyscalculia.

The student counsellors were mainly female ($n = 25$; 80.65%), with between one and 22 years of experience as a student counsellor in HE ($M = 9.94$, $SD = 7.01$). Only one student counsellor (3.23%) worked in a university, while the other 30 student counsellors were employed in six different university colleges (96.77%).

Design

A self-constructed questionnaire was used for this study, based on a multi-informant survey-based design. The different steps taken in this study were as follows:

(1) Frequently described functioning and participation problems and effective accommodations for HE students with dyslexia were identified in a literature review. The European Credit Transfer System (ECTS; European Commission, Directorate-General for Education, Youth, Sport and Culture, Publications Office 2017) was used to identify teaching and evaluation methods commonly used in Flemish HE. European HE institutions use ECTS to describe the various, *standardised methods* lecturers can use in their colleges. Because of their direct impact on the learning environment of students and because of their comparability between (European) institutions of HE, the current study investigates the

functioning and participation problems of HE students with dyslexia in the light of these teaching and evaluation methods. Other environmental factors, such as institutional policy, teaching style or socioeconomic status (SES) seem less directly linked to the functioning and participation problems of students with dyslexia. Therefore, they are not further considered in this study.

(2) An *expert meeting* with six academic researchers and professionals was held where the selected items from the literature were validated, and minor changes were made to the wording of the questions to enhance accessibility for students with reading problems. The experts ensured questions about particular functioning and participation problems were included.

(3) After the expert meeting, the questionnaire was distributed to all participants. Participants could add items (i.e. problems, teaching and evaluation methods, and accommodations) in an open section at the end of the survey.

Questionnaire

The adaptive questionnaire was administered online and took about one hour to complete for students and one hour and a half for student counsellors. The questionnaire comprised three sections:

(1) Twelve different functioning and participation problems of students with dyslexia were presented. Students with dyslexia, as well as students without a disability were asked whether or not they experienced each specific problem in HE (e.g. '*I experience impairing problems with reading comprehension*'). Students could answer each question with yes or no. Additionally, student counsellors were asked the extent to which the average student with dyslexia experiences these functioning and participation problems in HE (e.g. '*Students with dyslexia experience impairing problems with reading comprehension*') on a scale from 1 (totally not present) to 10 (always present). If the answer of the student counsellor was equal to or larger than 5, the answer counted as a 'Yes'-answer in order to calculate frequencies.

(2) When students with dyslexia reported a specific problem in HE (i.e. when they had given a 'Yes'-answer), they were asked during which teaching and evaluation methods this problem had emerged (e.g. '*During which types of teaching and evaluation methods do you experience this problem with reading comprehension?*'). The students were given 14 different teaching and evaluation methods, which were described in the ECTS, for example a lecture, a closed book exam, or writing a paper. An overview of these methods can be found in the results section (Table 3). Students could choose multiple methods.

(3) A list of accommodations, combined with specific functioning and participation problems, was presented to students with dyslexia. First, students had to indicate if they were offered a specific accommodation to deal with a specific problem. Second, all students with dyslexia had to rate the experienced (when they used the accommodation) or expected effectiveness (when they did not use it) on a 5-point Likert scale (1: very ineffective, 2: ineffective, 3: neutral (not effective, not ineffective), 4: effective, 5: very effective). In this paper we only report

accommodations with a mean cut-off score of 3 out of 5 for perceived effectiveness. Additionally, in order to guarantee representativeness of the findings for the whole population of students with dyslexia in higher education, we only report perceived effectiveness of a reasonable accommodation if at least 10% of the sample indicated making use of this accommodation.

Results

Functioning and participation problems

The frequency of experienced functioning and participation problems can be found in Tables 1 and 2. The results show that difficulty with reading comprehension, lower reading speed and difficulty with spelling are still a problem in more than 4 out of 5 students with dyslexia in HE. When comparing the answers of the student counsellors to the results of the students with dyslexia, five significant differences are found. The frequencies of difficulty with writing texts, problems with working memory, difficulty with planning and organising, difficulty with fact retrieval, and lower motivation to finish tasks are more reported by student counsellors than by students with dyslexia themselves. Both informants are consistent in reporting the frequency of other functioning and participation problems.

Furthermore, most functioning and participation problems are experienced significantly less by students without a disability compared to students with dyslexia. However, difficulty with sustained attention, difficulty with planning and organising and lower motivation to finish tasks show a significantly higher frequency in students without a disability compared to students with dyslexia. Two non-significant differences are found (i.e. difficulty dealing with unexpected situations and difficulty with fact retrieval from memory), meaning that these two functioning and participation problems occur to the same extent in both groups of students.

Table 1. Frequency of functioning and participation problems of students with dyslexia according to the students with dyslexia and the student counsellors.

	Students with dyslexia		Student counsellor		Group comparison χ^2
Domain of participation problem	*N*	*%*	*N*	*%*	*Interpretation*
Reading comprehension	143	*86.1*	27	*87.1*	DL = SC
Reading speed	141	*84.9*	28	*90.3*	DL = SC
Spelling	141	*84.9*	29	*93.5*	DL = SC
Text writing	119	*71.7*	29	*93.5*	DL < SC*
Processing speed	83	*50.0*	20	*64.5*	DL = SC
Sustained attention	59	*35.5*	13	*41.9*	DL = SC
Working memory	31	*18.7*	20	*35.5*	DL < SC*
Planning and organising	30	*18.1*	13	*41.9*	DL < SC**
Dealing with unexpected situations	22	*13.3*	5	*16.1*	DL = SC
Fact retrieval	19	*11.4*	9	*29*	DL < SC*
Feeling differently	18	*10.8*	3	*9.7*	DL = SC
Motivation to finish tasks	6	*3.6*	5	*16.1*	DL < SC**

*p < .05; **p < .01

Table 2. Frequency of functioning and participation problems of students with and without dyslexia.

	Students with dyslexia		Students without dyslexia		Group comparison χ^2
Domain of participation problem	*N*	*%*	*N*	*%*	*Interpretation*
Reading comprehension	143	*86.1*	5	*2.1*	DL > NDL**
Reading speed	141	*84.9*	51	*21.1*	DL > NDL**
Spelling	141	*84.9*	34	*14.1*	DL > NDL**
Text writing	119	*71.7*	41	*17.0*	DL > NDL**
Processing speed	83	*50.0*	47	*19.5*	DL > NDL**
Sustained attention	59	*35.5*	110	*45.6*	DL < NDL**
Working memory	31	*18.7*	26	*10.8*	DL > NDL
Planning and organising	30	*18.1*	102	*42.3*	DL < NDL**
Dealing with unexpected situations	22	*13.3*	47	*19.5*	DL = NDL
Fact retrieval	19	*11.4*	31	*13.0*	DL = NDL
Feeling differently	18	*10.8*	10	*4.2*	DL > NDL*
Motivation to finish tasks	6	*3.6*	28	*11.8*	DL < NDL**

*p < .05; **p < .01

Functioning and participation problems during teaching and evaluation methods

In order to investigate to what extent functioning and participation problems of students with dyslexia occur during specific teaching and evaluation methods, we used two-mode partitioning. Specifically, since both the functioning and participation problems and the teaching and evaluation methods contained a large number of items, we first excluded those problems that occur significantly less in the students with dyslexia compared to the students without a disability (i.e. difficulty with sustained attention, difficulty with planning and organising, lower motivation to finish tasks). Next, the number of items was reduced by simultaneously clustering both variables using two-mode partitioning. In this approach, two functioning and participation problems are assigned to the same cluster, if they show up as equally likely during the teaching and evaluation methods. Similarly, two methods are classified in the same cluster, if they elicit different functioning and participation problems to a similar extent (Schepers and Hofmans 2009). In this study, the number of clusters in the solution had not previously been determined. Therefore, we looked at different models and selected one based on interpretability on the one hand, and goodness-of-fit versus the complexity balance on the other hand (i.e. using the CHull procedure; Schepers, Ceulemans, and Van Mechelen 2008). Next, the two-mode partitioning yields a so-called core matrix which reflects the strength of the relationship between each cluster of problems and each cluster of methods. In the literature, no rule of thumb had been described to interpret these core values. Here, we decided to interpret these values in terms of a probability. This means that, if the core value is .50, then students with dyslexia have a 50% chance of experiencing this specific cluster of functioning and participation problem during the specific cluster of teaching and evaluation methods.

Using the CHull procedure, two-mode partitioning shows that the 1 × 2 model has the best goodness-of-fit versus complexity balance. However, as this model accounts for only 46.14% of the variance and is difficult to interpret because of low differentiation in problems and methods, we selected the statistically second-best model. Here, the two-mode partitioning yields a model using three clusters of functioning and participation problems (see Table 3) and five clusters of teaching and evaluation methods (see Table 4).

Table 3. Clusters of functioning and participation problems.

Cluster 1Reading and spelling	Cluster 2Executive functioning	Cluster 3Social functioning
Reading comprehension	Processing speed	Dealing with unexpected situations
Reading speed	Working memory	Feeling differently
Spelling	Fact retrieval	
Text writing		

Table 4. Clusters of ECTS teaching and evaluation methods.

Cluster 1Classical teaching	Cluster 2Classical evaluation	Cluster 3Alternative written evaluation	Cluster 4Alternative non-written evaluation	Cluster 5Alternative social non-written
Lecture	Writing a paper	Portfolio	Internship	Excursion
Practicum	Closed book exam	Bachelor or master thesis	Oral exam	Self or peer assessment
		Open book exam	Practical exam	Process evaluation
		Multiple choice exam		

The arbitrarily chosen cluster names reflect the shared content of either problems or methods. The 3 × 5 model accounts for 81.82% of the variance in how often particular problems show up during specific methods. The core values that display the strength of the relationship between each cluster of functioning and participation problems with each cluster of teaching and evaluation methods are shown in Table 5.

When looking at the reading and spelling problems, there is a probability of 80% and 54% that students with dyslexia experience these problems during classical evaluation and alternative written evaluation methods, respectively (i.e. 0.8 and 0.54 in Table 5). Chances for encountering these problems are 20% or lower for alternative non-written evaluation and alternative social non-written teaching and testing methods.

Furthermore, the chances that students with dyslexia experience executive functioning problems during classical teaching and evaluation methods are 71% and 67% respectively. Chances of experiencing these problems during alternative methods are about 50% or lower.

Finally, the probability of encountering social functioning problems is 64% during classical teaching methods, while the probability of the occurrence of these problems during all other methods is below 50%.

Table 5. Core values (probabilities) of the two-mode partitioning.

	Classical teaching	Classical evaluation	Alternative written evaluation	Alternative non-written evaluation	Alternative social non-written
Reading and spelling	0.47	0.80	0.54	0.20	0.14
Executive functioning	0.71	0.67	0.50	0.42	0.16
Social functioning	0.64	0.40	0.33	0.47	0.27

Note. No rule of thumb has been described to interpret these core values. We interpret them as probabilities. If a core value is .50, students with dyslexia have 50% chance to experience this specific cluster of functioning and participation problem during the specific cluster of teaching and evaluation methods.

Table 6. Effective accommodations for the functioning and participation problems within each cluster.

Reading and spelling		N used (%)	M (SD)Experienced[a]	M (SD)Perceived[b]
Reading comprehension	Extended deadlines for assignments	20 (14.0)	4.40 (.94)	3.20 (1.41)***
	Extended examination duration	132 (92.3)	4.33 (.95)	3.36 (1.69)***
	Permission to make notes on exam form	26 (18.2)	3.62 (1.24)	2.74 (1.34)**
	Reading aloud exam questions	83 (58.0)	3.40 (1.27)	2.68 (1.41)**
	Using computer or compensation software during classes	62 (43.4)	3.13 (1.35)	2.31 (1.31)***
	Using alternative exam format	39 (30.4)	3.43 (1.29)	2.31 (1.26)*
Reading speed	Extended examination duration	130 (92.2)	4.38 (.98)	3.18 (1.60)***
	Extended deadlines for assignments	21 (14.9)	4.33 (.91)	3.18 (1.43)***
	Reading aloud exam questions	80 (56.7)	3.43 (1.26)	2.59 (1.41)***
	Permission to make notes on exam form	23 (16.3)	3.39 (1.12)	2.65 (1.37)*
	Using an alternative exam format	38 (27.0)	3.32 (1.25)	2.72 (1.42)*
	Peer-mentor	15 (10.6)	3.27 (1.53)	2.32 (1.22)**
	Using computer or compensation software during classes	49 (34.8)	3.24 (1.32)	2.36 (1.63)***
Spelling	No point deduction for spelling errors in non-language related courses/ exams	114 (80.9)	4.68 (.70)	3.63 (1.52)***
	Extended examination duration	122 (86.5)	4.01 (1.20)	2.89 (1.56)***
	Extended deadlines for assignments	21 (14.9)	3.67 (1.46)	3.05 (1.38)
	Using computer or compensation software during classes	55 (39.0)	3.53 (1.36)	2.53 (1.42)***
	Using alternative exam format	34 (24.1)	3.53 (1.21)	2.94 (1.43)*
	Using computer or compensation software during exams	34 (24.1)	3.26 (1.40)	3.05 (1.50)
Text writing	Extended examination duration	107 (89.9)	4.19 (1.06)	2.67 (1.72)***
	Extended deadlines for assignments	16 (13.4)	3.81 (1.11)	3.30 (1.41)
	Using computer or compensation software during exams	27 (22.7)	3.63 (1.12)	2.64 (1.52)**
	Using computer or compensation software during classes	44 (37.0)	3.41 (1.23)	2.41 (1.39)***
	Permission to audio-record classes for use at home	34 (28.6)	3.32 (1.43)	2.52 (1.41)**
	Using alternative exam format	25 (21.01)	3.12 (1.45)	2.78 (1.48)
Executive functioning				
Processing speed	Extended deadlines for assignments	10 (12.0)	4.50 (.71)	3.45 (1.43)*
	Extended examination duration	73 (88.0)	4.49 (.97)	3.00 (1.41)***
	Exam deferral	28 (33.7)	4.32 (.86)	3.49 (1.43)**
	Reading aloud exam questions	45 (54.2)	3.67 (1.21)	2.63 (1.42)**
	Permission to audio-record classes for use at home	23 (27.7)	3.35 (1.23)	3.00 (1.35)
	Using computer or compensation software during exams	18 (21.7)	3.28 (1.41)	2.31 (1.26)**
	Using computer or compensation software during classes	27 (32.5)	3.19 (1.21)	2.46 (1.28)*
Working memory	Extended examination duration	27 (87.1)	4.22 (1.12)	1.50 (1.00)***
Fact retrieval	Extended examination duration	18 (94.7)	4.67 (.77)	3.00 (/)

[a]Perceived effectiveness rated by students with dyslexia who used the accommodation.
[b]Expected effectiveness rated by students with dyslexia who did not use the accommodation but did experience the specific functioning and participation problem.
*Significant difference between the experienced and perceived effectiveness of an accommodation, $p < .05$; ** $p < .01$; *** $p < .001$.

Effective accommodations

The perceived effectiveness of the accommodations for each functioning and participation problem is listed in Table 6. Again, we excluded the problems that were less frequent in students with dyslexia compared to students without a disability.

Overall, the results show that 'extended examination duration' is the most used accommodation for most problems experienced by HE students with dyslexia. For three out of four functioning and participation problems within the cluster reading and spelling problems (i.e. difficulty with reading comprehension, reading speed, and writing texts), 'extended examination duration' and 'extended deadlines for assignments' are reported as the most effective accommodations. For difficulty with spelling, the most effective accommodation is 'No point deduction for spelling errors in non-language related courses/exams'.

Within the cluster executive functioning problems, 'extended examination duration' is the only effective accommodation in the case of difficulty with working memory and difficulty with fact retrieval from memory. For lower information processing speed, multiple accommodations are reported to be effective, with 'extended deadlines for assignments' and 'extended examination duration' as perceived as most effective for students with dyslexia.

No effective accommodations were listed for the cluster social functioning problems which includes 'difficulty dealing with unexpected situations' and 'feeling differently than peers'.

Finally, students with dyslexia, who encounter a specific functioning and participation problem but do not use a specific accommodation, had to rate the expected effectiveness of each accommodation. The expected effectiveness was systematically lower than the experienced effectiveness of students with dyslexia who use the accommodation.

Discussion

The broad aim of our study was to identify the support students with dyslexia need in HE, but also to offer an objective framework for the identification of effective and valid accommodations for HE students with dyslexia. Such a framework allows more careful identification of effective accommodations for these students and can also serve as a starting point for future research on this topic.

First, we questioned *how frequently functioning and participation problems occur in HE students with dyslexia*, and second *during which teaching and evaluation methods these functioning and participation problems emerge*. We find that 80% of the HE students with dyslexia have difficulty with reading comprehension, reading fluency and spelling. Student counsellors reported more problems than the students with dyslexia themselves, adding difficulty with text writing, problems with working memory, difficulty with planning and organising, difficulty with fact retrieval, and lower motivation to finish tasks. Our findings correspond well with previous findings (Callens, Tops, and Brysbaert 2012; Hatcher, Snowling, and Griffiths 2002; Swanson and Hsieh 2009; Tops et al. 2013; Webster, 2016). The fact that counsellors report more problems than the students with dyslexia reflects the heterogeneity of dyslexia in HE. Counsellors take into account all possible problems starting from a general image of the average student with dyslexia, whereas individual students report only those problems they consciously experience.

Regarding the second research question, our hypothesis has been confirmed. Students with dyslexia report the most problems during classical teaching or evaluation methods, for instance an ex-cathedra lecture or a closed book exam. Interestingly, it seems less likely that reading and spelling, executive functioning and social functioning problems will occur when alternative but still written evaluation methods such as an open book exam are being used. This finding suggests more diverse evaluation methods should be offered where, in line with the principles of Universal Design for Learning, a student can choose the evaluation method resulting in the lowest functioning and participation problems. Even fewer problems were identified during alternative non-written evaluation methods (e.g. oral exams or internships) and alternative social non-written methods (e.g. process evaluation). The degree to which written language is involved in a teaching method or an evaluation method seemed to impact the functioning and participation problems of students with dyslexia in HE, which is in line with the study of Webster (2016). However, our findings could also be influenced by a so-called familiarity effect. HE students with dyslexia are certainly more familiar with these clusters of methods because they are more frequently used in HE. Other, more alternative teaching and evaluation methods that do not involve written language, such as excursions, self- peer- or co-assessment, and practical exams are simply less commonly used by lecturers in HE. So, the participating students could have had difficulties imagining to what extent their functioning and participation could be jeopardised during these methods.

Our final research question was *what accommodations are perceived most effective in dealing with the functioning and participation problems of students with dyslexia in HE*. Our findings show that extended examination duration and extended deadlines for assignments are the far mostly used and effective accommodations for most problems students with dyslexia encounter in HE. This is in line with previous research (Callens, Tops, and Brysbaert 2012; Nielsen 2011). Also reading aloud exam questions is perceived effective (58%). Assistive technology like spelling checkers and text-to-speech software scored surprisingly low (< 50%) and is not entirely in line with previous findings (Elkind, Black, and Murray 1996). There is a big difference between the use of assistive software in class and during exams. The perceived effectiveness of this reasonable accommodation is always considerably lower during exams than in class. Maybe this is due to a lack of practice HE students with dyslexia still have with this kind software. If not (very) familiar with the use of this software, students maybe still want to use it in class, but not during an exam driven by a fear of failure.

Another accommodation that is perceived effective by the students with dyslexia is no deduction for spelling errors in non-language related courses. Webster (2016) already put forward that difficulties with written texts and spelling problems cause stress to HE students with dyslexia. In HE students prefer lecturers taking responsibility by not deducting points for spelling errors, over trying to compensate their spelling problems using laptop with spelling checker or other assistive technology. This is instead of students trying to overcome their problems on their own, by using compensatory aids such as assistive technology. We believe students' reliance on educators is due to the accommodations currently organised in primary and secondary schools. Teachers and counsellors still pay too little attention to making students with dyslexia self-reliant problem-solvers. Whereas they ought to support students overcoming their reading and writing problems. There is indeed a dire need for more awareness among HE lecturers, as was put forward by

Griffin and Pollack (2009) and Quick (2013). Increasing self-reliance should be the main focus in the guidance and coaching of students with dyslexia. This requires involvement on all levels of education from not only teachers but also student counsellors, lecturers, coaches, parents and, of course, the students with dyslexia themselves. In our opinion, this is the best facilitation that can be given for students with dyslexia to achieve their full potential and reach successful and meaningful employment.

In our study the experienced effectiveness (i.e. when the accommodation was used by the student with dyslexia) and the expected effectiveness (i.e. when the student did not use the accommodation) of accommodations are compared. The expected effectiveness is systematically lower than experienced effectiveness of students with dyslexia. This could explain why a considerable number of students with dyslexia does not apply for accommodations in HE. Too often students think that they will not benefit much from these accommodations because they, for example, lack knowledge on how the accommodation can help them or because student counsellors did not point out the existence of specific accommodations, automatically making them think that the accommodations will not be helpful for them (Denhart 2008; Hong and Himmel 2009). Once granted, these accommodations seem more effective than originally thought (Jansen et al. 2017a, 2017b).

Despite our precaution about generalisability of research results from the English-speaking HE context and the differences in educational systems, our results in an open education model correspond surprisingly well. So, it seems these results apply independently of the educational system.

Our study has important practical implications. Fuchs, Fuchs, and Capizzi (2005) has already pleaded for the development of empirically sound tools for this purpose. Together with the available results on the perceived effectiveness of accommodations for HE students with dyslexia, our results make valid and objective identification of accommodations possible for individual students with dyslexia. In addition, this study showed that not all functioning and participation problems experienced by students with dyslexia could be neutralised by the use of reasonable accommodations. Student counsellors have an important task in guiding these students to the appropriate support, for example to speech therapists or specialised coaches, who can help them overcome these specific problems.

Despite important implications for HE practice, our study has to deal with a number of limitations. A first important limitation is the choice of the ECTS system to identify frequently used teaching and evaluation methods. The advantage of ECTS is that it is standardised and internationally used, allowing for comparison in future research. However, an important limitation is that ECTS focuses (too) strongly on traditional teaching methods in which written text material is very important. It is therefore no surprise that these traditional teaching and assessment methods are less appreciated by students with dyslexia. But in a study choices have to be made. Since there is not much evidence in the domain of HE accommodations for students with dyslexia, we felt that this was a good choice to use as a starting point on which to build future research. Second, our results are based on students' self-report and the results thus gave information about the perceived effectiveness rather than the objective effectiveness of a reasonable accommodation. A possibility for future work is to empirically investigate the effect of the various reasonable accommodations on the test scores of students with dyslexia or without a disability. However, other, for example methodological or ethical issues have to be addressed.

Investigating effectiveness of accommodations during real exams, for instance, includes a risk of jeopardising success chances of students, and is therefore not ethical. Designing experiments using 'fake exams', on the other hand, has low ecological validity. Therefore, more research is needed, preferably with combined research methods and designs over different educational systems. Linking results of self-report and multi-informant surveys to empirical evidence on the cognitive profile of HE students with dyslexia could considerably boost validity of the results in this field.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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