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Title:

How Does Dyslexia Impact on the Educational Experiences of Healthcare Students? A Qualitative Study

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Abstract:

Aims: To explore the impact of dyslexia on the educational experiences of undergraduate students in medicine, dentistry, dental therapy and biomedical sciences

Methods: It was a qualitative study based on semi structured interviews. The study was conducted at the Faculty of Medicine and Dentistry at a University in the South West region of the United Kingdom. Purposive sampling was used, and the participants included undergraduate students from the schools of medicine, dentistry and biomedical sciences.

Results: The sample consisted of fifteen undergraduate students including five from medicine; four from dentistry; three from dental therapy and three from biomedical sciences. All students had a formal diagnosis of Dyslexia. The students shared their views and experiences regarding disclosure, transition into the university, learning environments, assessments, and challenges after graduation.

Conclusions: This is the first study to explore the impact of dyslexia on the educational experiences of healthcare students from multiple programmes in a variety of educational settings. The findings show that the students were confident regarding disclosure of their dyslexia and had a formal diagnosis of dyslexia established during their school years. Although the participants experienced typical academic difficulties associated with dyslexia, problem-based learning (PBL) was perceived to be enjoyable and less stressful than traditional lectures and no specific challenges were reported in acquisition of clinical, communication and team working skills.

Introduction

Learning disabilities (LDs) is a generic term and comprises a heterogeneous group of disorders which manifest with an impairment of intellectual or social functioning and affects the way an individual learns new things in any area of their life (1,2). Specific LDs include conditions such as Dyslexia, Development Coordination Disorder (DCD), Dyscalculia, Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD) (3-4). Dyslexia constitutes the most common form of LD and affects up to 10% of the population globally (5). Dyslexia is associated with difficulties in word-level decoding and affected individuals find it hard to recognize printed words, have great difficulties 'sounding out' unfamiliar words, and often also read slowly (6). An estimated 6% of students enrolled in Higher Education (HE) in England have a formal diagnosis of specific LDs, and the numbers appear to be on the rise. (7). Figures from medical schools show that approximately 2% medical students disclose dyslexia (8). Importantly, a significant number of students in HE may not have a previous diagnosis of dyslexia and they are often investigated when students tend to struggle in medical schools (9).

Legislation in the UK protects disabled students from being treated "less favorably" and LDs should not be considered a barrier as doing so may obscure talent that may be mutually beneficial to both HE and the individuals (11). However, the representation of students with disabilities remains low in HE. This is also observed in healthcare professions such as Medicine, despite a trend toward expansion of the HE sectors and promotion of an inclusive culture (11, 12). There are noticeable variations across Europe and rest of the world with regard to issues related to dyslexia (13, 14). Different countries adopt different definitions, have different norms concerning diagnosis and different regulations regarding support measures for dyslexic pupils and students.

Such variations often contribute to delayed or missed diagnosis and inadequate support for dyslexic students.

A few studies have explored the impact of dyslexia on students in Medicine and Nursing (15-19). There is a need to contextualize the perceptions and experiences of the students with the design of the curriculum and assessments. It is recognised that undergraduate programmes with a problem-based learning (PBL) curricula represent unique challenges for the students, in part due to increased emphasis on active participation and self-directed learning (20, 21). Therefore, the impact of learning disabilities on the educational experiences of healthcare students enrolled on programmes with PBL curricula merits further investigation.

The Faculty of Medicine and Dentistry at our university runs several undergraduate programmes including: a five-year Bachelor of Medicine and Bachelor of surgery (BMBS) programme, a five-year Bachelor of Dental Surgery (BDS) programme; and a three-year Bachelor in Dental Therapy and Hygiene (BDTH) programme. In addition, the School of Biomedical Sciences (SoBS) runs several Bachelor programmes in Biomedical and Human Biosciences, Nutrition, Exercise and Health.

The programmes in Medicine and Dentistry are based on student-led problem-based learning (PBL) spiraling curricula. Patient-centered case scenarios are used to stimulate students' curiosity and promote problem-solving. Every element of teaching and learning is delivered in the context of clinical scenarios. Students are signposted to essential topics relevant to each scenario with the aid of plenary lectures and small group life science sessions. Topics introduced in Year 1 are developed sequentially in successive years of the programme to enhance the breadth and depth of student learning, helping students build layers of knowledge, skills, and attitudes in a spiraling

manner to achieve horizontal and vertical integration. The students in Medicine and Dentistry gain clinical exposure in primary and secondary care settings throughout the respective programmes. Innovative assessment methods including progress testing and integrated structured clinical examinations (ISCE) are utilized for assessment of students in Medicine and Dentistry. Progress testing is a form of longitudinal, feedback-oriented assessment of the development and sustainability of applied knowledge at regular intervals over the course of an educational program (22-24). Each progress test is based on single-best type multiple choice questions and is benchmarked to the level expected of a newly qualified graduate for the relevant programme. Multiple diets of progress tests are administered each year and progress of each student is indexed by a steady increase in scores achieved. The ISCE is employed for assessment of clinical skills and is similar to a traditional OSCE in some ways (25). However, in contrast to an OSCE, which often tests individual skills at separate stations (e.g., history taking, examination), the ISCE aims to represent the real clinical situation more authentically by having longer stations at which students must demonstrate complex combinations (26).

In Contrast to Medicine and Dentistry, undergraduate programmes in SoBS are based on traditional curricula and didactic teaching methods. Assessments in SoBS are varied and include research guided oral and poster communications; portfolios and written essays as well as multiple-choice and short-essay questions.

The aim of this study was to explore the impact of dyslexia on the educational experiences of undergraduate students in four programmes i.e., medicine, dentistry, dental therapy and biomedical sciences.

Methods

Conceptual Framework:

The theoretical framework for this research was underpinned by the theory of *situated learning* (27). Advances in medical education have influenced educators to view health-care education through the lens of sociology and anthropology in order to capture all the influences and interactions that transpire in the learning environments through active engagement of the learners. Situated learning asserts that learning is a transformative process and always intricately tied to its context and to the social relations and practices therein. It emphasizes the social nature of cognition, and the importance of authentic situations and activities to facilitate learning (28).

In the context of medical education, the healthcare profession represents a community who come together in pursuit of a shared enterprise. The role of a student may be viewed as one of legitimate peripheral participation (27). The newcomers begin learning at the periphery of the community, initially by observing and later by performing basic tasks. As they become more knowledgeable and skilled, they move centrally. Through participation, active engagement and assuming increasing responsibility, the newcomers acquire the roles, skills, and values of the community. As learners are transformed through participation and social interactions in the community, they in turn influence to transform the community.

Study Design:

Given that the purpose of the research was to gain a deeper understanding of the impact of dyslexia in healthcare education to interpret the meanings people attach to

their experiences of the social world, qualitative semi-structured interviews of the participants were used to collect the data.

Study Setting:

Faculty of Medicine and Dentistry, University of Plymouth

Participants:

The study population consisted of undergraduate students in four separate programmes namely, Medicine, Dentistry, Dental Therapy and Biomedical Sciences.

Recruitment:

Purposive sampling technique was employed for this study. A generic e-mail was sent to all students inviting students with dyslexia to participate in a one-to-one semi-structured interview. The invitations were sent through by the Faculty administrator who also acted as the gate keeper. The invitation was accompanied by a participant information sheet with details regarding the purpose of the study, the format, location and expected duration of the interview. In addition, posters were also used to invite the participants.

Data Collection:

The research team consisted of three full-time academics in the faculty of medicine and dentistry who were also responsible for data collection. Each academic interviewed participants from their respective school. A provisional topic guide for the interviews was developed by the research team which consisted of a few open-ended questions. A mirroring technique was used to explore the responses of the participants in further detail with a focus on meaning and experience of individual

participants rather than generalised patterns of behaviour. Prompts were used if the initial responses of the participants were brief. Following an initial look at the data gathered during each interview, the provisional topic guide was refined in successive interviews in order to gain an in-depth understanding of the emerging themes. An inductive approach was used for the interviews i.e., the themes were data driven and were not categorized based on the topic guide used for this research. Each interview was conducted in a quiet room and an informed, written consent from each participant was obtained prior to commencing the interview. The interviewer made their role and professional capacity clear to each participant. Participants were given complete freedom to express their views with the interviewer consciously avoiding any interruptions. . Each participant was allocated an interview-time for up to one hour. The average interview time was approximately 48 minutes.

All interviews were recorded using a digital audio device and transcribed verbatim. The transcripts were anonymized using pseudonyms to protect the identity of the participants. The transcripts were reviewed by six participants to confirm the accuracy of typed transcripts prior to data analysis.

Ethics Approval: Ethics approval for this study was obtained from the institutional ethics committee (Application No. 16/17-721).

Data Analysis

The interview data were imported into NVivo 12 (QSR International Pty Ltd) and analysed by listening to the audio recordings repeatedly along with reading the transcripts to allow deep immersion and engagement with the data. Data analysis was aimed at situating the impact of dyslexia within the narratives of stakeholders emanating from their understanding, experiences, and expectations and capturing the

context and meanings of the rich imagery shared by the participants. Systematic reading through the entire data set, sentence by sentence, was carried out for an initial coding of the data. Further analysis and reflection helped to establish linkages between nodes, which facilitated development of tree nodes from free nodes. Finally, an inductive *thematic* analysis was undertaken to identify broad areas which captured the views and experiences of the participants. Data verification involved member checking and debriefing dialogues with three random participants to share the analysis and interpretations.

Results

The sample consisted of fifteen undergraduate students including five from BMBS; four from BDS; three from BDTH and three from SoBS. The sample represented 25.42% of students who had disclosed specific LDs in the Faculty of Medicine and Dentistry. The demographic characteristics and educational profile of the participants is depicted in Table 1. All students had a formal diagnosis of Dyslexia; one participant had a positive family history of Dyslexia (Student 1). Fourteen students had a formal diagnosis of Dyslexia before coming to the university and only one student was identified after joining the university (Student 13). Most students were diagnosed due to poor examination results during their high school. The participants shared their generic experiences during transition into the university as well as more specific issues and challenges related to their respective educational programmes. Generally, the participants felt more settled as they progressed through their respective programmes and felt more comfortable in seeking advice and help. However, no association could be identified between the educational experiences of the participants and their gender or ethnicity. The main themes identified during data analysis are summarised below along with relevant verbatim quotes by the participants.

Diagnosis, Disclosure and Personal Morale

A diagnosis of dyslexia did not seem to affect the morale of the participants adversely and majority of the participants felt comfortable in disclosing their disability to academic staff and peers.

“I’m quite open about it and do not feel there is any need to hide a disability from staff or students”.

Student 7 BDS

“I don’t really see it as a massive disability, I think my mind works differently than others, I struggle with spelling, reading, but I work quite well scientifically”.

Student 1 BMBS

However, some students were reluctant to disclose their disability in their application for admission thinking it may jeopardize their chances of securing a place at the University

“Coming to university, I did not want to disclose that I am dyslexic, because I didn’t want it to hinder my chances of getting into medicine... but I had to disclose it”.

Student 4 BMBS

“When I applied, I felt a bit nervous about it, but then when I realized that disability was actually considered in the application, I wasn’t too worried about it”.

Student 2 BMBS

Participants also highlighted the benefits of getting a diagnosis of dyslexia as it may provide an explanation for challenges experienced by struggling students and also open doors to access support services.

“Relief, that I had sort of a name to the issues, rather than just, oh God, am I like clever enough? Am I good enough to get through 5 years of medical school and then all the other training afterwards? I know I am dyslexic; it will take me longer than everyone else. Obviously, it doesn’t take away the fact that I struggle, it just puts a name to the struggles, which is good, I guess”.

Student 3 BMBS

Transition into University Education and Support

Transition into University education was deemed to be challenging but the participants felt that accessing support services available at the University promptly was beneficial to facilitate a smooth transition for students with disabilities.

“You come on to a course such intense and you have a learning difficulty but there is so much more than academics; if a person has issue with asking for help or has a difficulty in approaching people, they might find it more difficult”.

Student 7, BDS

“I’m taking as much as help as I can and I’m getting ready for the world, every little helps especially if you’re at a disadvantage”.

Student 14 SoBS

Learning Environments and Coping Strategies

Participants across the board reported typical problems associated with dyslexia including spelling errors; slow reading; difficulties in comprehension of text and interpretation of medical terminology; and difficulties in to keep pace with the lectures and writing notes. A greater degree of organisation and repetition was also required during self-directed learning and this often led to fatigue. Moreover, the participants also felt that it took them longer to gather their thoughts when responding to questions during teaching activities.

The participants shared a variety of strategies to cope including advance preparation for the teaching sessions; working with their peers to consolidate their self-directed

learning; and use of software and gadgets provided by the disability services at the University.

“I sometimes record lectures especially if it's a complicated topic. One of the software I've been given, splits up the activity and instead of one long recording you can cut it down into small slides. If you want to go back and look up the slide to see any key information the lecturer might have said, it is quite simple; you just tap your phone and you can still listen to the lecturer and also take some notes whilst also focusing on the lecture”.

Student 9 BDS

Students in medicine and dentistry also highlighted the benefits of PBL over traditional lectures and felt that small group PBL sessions were much more engaging and enjoyable. Although some participants initially found it challenging to work and present at PBL sessions with their peers, they managed to overcome their anxieties and apprehensions and found PBL better suited to support their learning.

“PBL is easier, because it is more conversational and is much better for my learning style. In my last degree, I had five hours lectures, which, you know, most people would struggle with PowerPoint for five hours”.

Student 1 BMBS

“I was never the biggest fan of PBL, purely because the whole white board thing but it is a lot better than just having kidney does this, heart does this, if you link them, it makes so much more sense”.

Student 4 BMBS

With regards to clinical placements, the participants did not report any difficulties in communicating with patients or learning practical clinical skills.

“At the last operation, they removed the sigmoid colon and he asked me to scrub in and come and help and I was absolutely fine, followed all the instructions, stitched up, burned it off, cut this, etc. I could do it because I am good with practical things and that’s the bit that I like”.

Student 3 BMBS

“I feel my dyslexia does not impact on my performance during my clinical competencies because it’s all practical work”.

Student 11 DTH

The most challenging part for most participants was writing up clinical notes primarily due to difficulties in spelling words correctly and they needed support from their clinical supervisors.

“I do take a bit longer to write my clinical notes because I need to proof-read them because there is no spell check. But in a way it is better for me because it ensures that I read over my notes and make sure that I have got everything down”.

Student 9 BDS

Interactions with Peers and Staff

Professional interactions with peers and academic staff were generally positive for all participants and they did not experience any discrimination. Participants also felt that it was helpful to make their colleagues aware about their disability as it served to moderate and their expectations and enhance mutual understanding.

“My peers in my PBL group know, I told them that my spellings are awful because I’m dyslexic, so that they all know it; I haven’t felt excluded in any way”.

Student 9 BDS

“I don’t think anyone has ever been prejudiced about it, all the staff are supportive, and my queries have always been answered appropriately”.

Student 12 DTH3

However, some participants felt that the staff especially during outreach clinical placements were not always aware about their disability and slow responses by the students when answering questions was sometimes perceived incorrectly as lack of knowledge.

“I pick up less what they say, but I feel they assume I am less clever”.

Student 5 BMBS

Participants also felt their peers did not fully appreciate the rationale for provision of extra time for dyslexic students during assessments.

“I’d say some students, . I wouldn’t say are annoyed, but they say oh how come we don’t get 25% extra time?”

Student 13 SoBS

Dealing with Assessments

Participants across the board appreciated the adjustments for students with LDs. However medical and dental students expressed their frustration at long and wordy stems for multiple choice questions in progress tests.

“Sometimes the questions are very wordy, and it relates to the last sentence, like jane was approached with sore arm.... and the question relates to the nerve supply of the biceps and you have to read the entire paragraph”.

Student 1 BMBS

Some participants also indicated a preference for progress tests on paper as opposed to a computer-based test.

“It was a bit daunting when they changed the tests from a paper to a computer. I tend to work better on paper just because it’s easier to write things around the question; process it and drop down your thoughts”.

Student 2 BMBS

Written assignments were deemed to be particularly challenging due to difficulties in identifying spelling mistakes and typographic errors.

“I have a software which reads it all back to you, so you can listen and correct any errors, but I actually spend more time proofreading than the time I spend writing the actual assignment”.

Student 7 BDS

“In my first assignment when writing “starting university” I just wrote “starring university” and it is mistakes like these which are difficult to pick up with a spell check. And then I have to get other people to read it, because I can't see it as starring even if I've checked it multiple times, until someone spots it.”

Student 10 DTH

Nevertheless, the participants also shared some strategies to cope with the challenges of written assignments including proof reading by peers and use of technology.

“I use my finger, or a pen to go through every word line by line. And when I am writing, I tend to think over what I am writing rather than just I've got it in my head. I tend to segregate each word, so rather than a Wednesday, it is wed nus day. I use computer a lot more than writing on a paper because it helps with the spell-check and my Mac book has a program which recognises what I want to say and turn that around quite quickly”.

Student 12 DTH

Improved Educational Experience for Students with Learning Disabilities

The participants made several suggestions to further improve the educational experiences of the students with disabilities. The participants preferred online lecture handouts in power point format rather than pdf as it is easier to amend and add notes. Moreover, they expected the staff to ensure online availability of teaching resources and lectures in advance to help them prepare for the sessions.

Two participants also emphasized the need for improved awareness of staff marking written assignments and further adjustments for dyslexic students during assessments.

“I do not know if there is a system to flag students with learning disabilities in essay-type assignments. I feel it should partake in your decision-making because as much help as people can get, it is all about what you can do... not that you should be more lenient but you should be more understanding about certain areas that may be impacted upon by learning disabilities”.

Student 6 BDS

“I prefer a smaller room as it takes me longer to process, longer to read the question, understand, and formulate an answer. In a room with more people, there is disruption when people leave, so you need the small room”.

Student 13 SoBS

Other suggestions included awareness sessions for all students regarding LDs during induction so they can better understand the challenges experienced by their peers

with LDs. Also, it would be helpful to share information about dyslexic students with outreach clinical staff so that they can be supported appropriately.

“During placements, it would be positive if the people that we are interacting with could be more aware about our disabilities. The school can inform them saying, you may have a dyslexic student coming to you next week.”

Student 3 BMBS

Finally, the participants also felt that it would be helpful if their allocated academic tutor had additional experience in supporting the learning needs of dyslexic students and perhaps, they could have a dedicated tutor throughout the programme for continuity of support.

Challenges after Graduation

The main challenges identified after graduation for medical and dental students were related to time constraints and writing clinical notes and prescriptions for patients. Some participants were also concerned that clinical record keeping may take up their free time. Students also appeared to be less keen on pursuing a career in research due to difficulties with spellings, interpretation of words and written assignments

“Drugs is what I struggle most. There are a lot of very similar sounding and very complexly spelled drugs, writing the clinical notes and trying to spell them correctly is difficult”.

Student 1 BMBS

Students were also concerned that employers may prefer graduates without any disabilities

“They would recruit someone without any disability, because they would not want the extra hassle”.

Student 13 SoBS

Discussion

This study provides useful insights into the educational experiences of students in healthcare education and provides several unique findings. Firstly, the participants in this study did not regard dyslexia as a stigma and were quite open about sharing their disability with their peers and tutors. Previous studies have consistently highlighted LDs including dyslexia usually have an adverse effect on self-esteem of the students and generally they are reluctant to share their disability with their peers and sometimes also the academic tutors (8). There could be several reasons contributing the positive attitude by the participants in this study: it may reflect improved acceptability of students with disabilities in HE possibly due to a more consistent implementation of legislation on supporting students with LDs; a supportive culture at the institution and a better understanding of the medical basis of learning disabilities; frequent opportunities for role-play and regular interactions with patients in medicine and dentistry may also contribute to the self-confidence of students and translate into more positive attitudes and social outlook; and working in small group may also serve to enhance the mutual understanding and team-working skills amongst students. However, it may also be argued that only those students who were comfortable in disclosing their disability might have volunteered to participate in this study.

Evidence from the literature shows that a high proportion of students with LDs are identified after entering higher education when they tend to struggle academically (9, 17). Only one student in this study was investigated for dyslexia after joining the University whilst all other participants had a prior diagnosis of dyslexia. Although the sample size of this study is small and may not justify broad conclusions, it may reflect

the increased awareness of dyslexia amongst educators in schools which may contribute to its early recognition and diagnosis.

Typical academic challenges associated with dyslexia were reported by the participants in this study including difficulties in spelling words; inability to keep pace with lectures; taking longer to write assignments and fatigue (6). However, students from medical and dental programmes reported positive experiences with PBL. Although some students may have found small group PBL sessions to be daunting, opportunities for active participation, application of knowledge to clinical problem solving were very helpful to support their learning. In contrast, students from SoBS follow traditional curricula teacher-centered learning was reported to be less rewarding. These findings corroborate with the previous studies which have reported merits of PBL curricula (29, 30).

In line with the national guidelines, students at our institution are screened for disability and once a formal diagnosis has been established, "*reasonable adjustments*" are made for students with disability to ensure that they are not disadvantaged (10). Reasonable adjustments are dependent on an individual's needs, but these broadly include specialist tuition support, assistive technology and assessment arrangements, such as extra time, readers, scribes, solo rooms (whenever possible) and papers printed on a coloured paper. We have previously reported that the academic performance of students with LDs is at par with their peers at our institution (31). For the last three years, assessments based on multiple-choice questions are being delivered online using university computers and students have the option to change screen colour, magnification and can also highlight questions with comments etc. Although a few participants in this study indicated their preference for paper-based tests, computer-based delivery offers several administrative advantages including

prompt collection and marking, collation of data and avoiding potential errors when manually scanning the responses on paper.

The results of this study are in accord with the theory of situated learning. Healthcare students in this study view their educational experiences in the context of interactions with their peers and teaching staff. Learning in healthcare requires authentic situations in academic and clinical environments that effectively foster the development of knowledge, skills and professional identity (32, 33).

The academics involved in this research interviewed participants from their respective schools. The potential risk of power relationships between academics as researchers and students as participants was carefully considered. A decision to interview participants from the respective schools of the academics was made as it offered the researchers a better understanding of the background and challenges faced by the students. All potential conflicts were deliberated, and the research team was confident that strict compliance to the codes of research ethics and professionalism was achievable. The impact of “insider” role in research remains a topic of intense debate (34). However, an insider researcher is considered legitimate and may in fact offer several advantages to the quality of the study including familiarity with the research topic and better understanding of the participants to produce richer data (35).

Our results highlight the need to raise further awareness amongst staff and students to provide a supportive learning environment for students with dyslexia. Similar findings have been reported consistently in the literature (36-38). Academic tutors at our institution are provided regular training on supporting students with LDs. In addition, staff members with a special interest in supporting students with LDs are recognised as “Disability Champions”. Although, it is not always possible to organise

training sessions for clinical staff working at multiple outreach sites due to administrative and financial constraints, it remains a desirable goal at our institution.

The findings of this study provide a reassurance that dyslexia does not impact adversely on acquisition of clinical and laboratory skills and students feel confident in their communication, and team-working skills. However, the results underscore the need to incorporate medical terminology in software used in clinical practice for maintaining patient records and clinical notes. Record keeping is an essential element and has significant implications in clinical care, research, and medico legal litigation (39). This would not only help those with LDs but would also support clinicians across-the-board to maintain error-free records. Given that notes writing takes up a considerable proportion of clinical time, advancements in the accuracy of computer-based dictation software may be utilised to facilitate more widespread use of dictation for clinical record keeping.

With regards to the limitations of this study, the data reported is from a single University and involved a small sample size and the interpretation of findings may be limited to the study population. Further research based on mixed methods would be helpful to explore the experiences and cognitive, clinical and behavioural attributes of students with dyslexia for generalisability.

Conclusions

This is the first study to explore the impact of dyslexia on the educational experiences of healthcare students from multiple programmes in a variety of educational settings. The findings show that the students were confident regarding disclosure of their dyslexia and had a formal diagnosis of dyslexia established during their school years. Although the participants experienced typical academic difficulties associated with dyslexia, PBL was perceived to be enjoyable and less stressful than traditional lectures and no specific challenges were reported in acquisition of clinical skills and communication with patients. However, these findings may be limited to the study population only. Further research is required to explore how generalizable these findings are, as well as assess academic, clinical and behavioural attributes of students with LDs.

Disclosure

None of the authors have any conflict of interest.

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References

1. Kavale KA, Forness SR. What definitions of learning disability say and don't say: a critical analysis. *J Learn Disabil.* 2000;33(3):239-56.
2. Lyon GR. Learning disabilities. *The future of children.* 1996:54-76.
3. Prior MR. *Understanding specific learning difficulties:* Psychology Press; 1996.
4. MacDougall M. Dyscalculia, dyslexia, and medical students' needs for learning and using statistics. *Medical education online.* 2009;14(1):4512.
5. Pino M, Mortari L. The inclusion of students with dyslexia in higher education: A systematic review using narrative synthesis. *Dyslexia.* 2014;20(4):346-69.
6. Hulme C, Snowling MJ. Reading disorders and dyslexia. *Current opinion in pediatrics.* 2016;28(6):731.
7. Higher Education Funding Council for England (HEFCE). Support for Higher Education Students with Specific Learning Difficulties Available at http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2015/SupportforStudentswithSpLD/HEFCE2015_spld.pdf (Accessed August 2019).
8. Shrewsbury D. State of play: Supporting students with specific learning difficulties. *Medical teacher.* 2011;33(3):254.
9. Rosebraugh CJ. Learning disabilities and medical schools. *Medical education.* 2000;34(12):994-1000.
10. Riddell S, Weedon E, Fuller M, Healey M, Hurst A, Kelly K, et al. Managerialism and equalities: tensions within widening access policy and practice for disabled students in UK universities. *Higher Education.* 2007;54(4):615-28.
11. Pumfrey PD. Moving towards inclusion? The first-degree results of students with and without disabilities in higher education in the UK: 1998–2005. *European Journal of Special Needs Education.* 2008;23(1):31-46.
12. Shrewsbury D. Disability and participation in the professions: examples from higher and medical education. *Disability & Society.* 2015;30(1):87-100.
13. Davis JM, Deponio P. Analysing conflicting approaches to dyslexia on a European project: moving to a more strategic, participatory, strength-based and integrated approach. *International journal of inclusive education.* 2014 May 4;18(5):515-34.

14. Al-Yagon M, Cavendish W, Cornoldi C, Fawcett AJ, Grünke M, Hung LY, Jiménez JE, Karande S, van Kraayenoord CE, Lucangeli D, Margalit M. The proposed changes for DSM-5 for SLD and ADHD: International perspectives—Australia, Germany, Greece, India, Israel, Italy, Spain, Taiwan, United Kingdom, and United States. *Journal of learning disabilities*. 2013 Jan;46(1):58-72.
15. Majumder MAA, Rahman S, D'Souza UJ, Elbeheri G, Abdulrahman KB, Huq MM. Supporting medical students with learning disabilities in Asian medical schools. *Advances in medical education and practice*. 2010;1:31.
16. Ridley C. The experiences of nursing students with dyslexia. *Nurs Stand*. 2011;25(24):35-42.
17. Newlands F, Shrewsbury D, Robson J. Foundation doctors and dyslexia: a qualitative study of their experiences and coping strategies. *Postgrad Med J*. 2015;91(1073):121-6.
18. Shaw SCK, Anderson JL. The experiences of medical students with dyslexia: An interpretive phenomenological study. *Dyslexia*. 2018;24(3):220-33.
19. White J. Supporting nursing students with dyslexia in clinical practice. *Nurs Stand*. 2007;21(19):35-42.
20. Moffat KJ, McConnachie A, Ross S, Morrison JM. First year medical student stress and coping in a problem-based learning medical curriculum. *Medical education*. 2004;38(5):482-91.
21. Norman GR, Schmidt HG. Effectiveness of problem-based learning curricula: Theory, practice and paper darts. *Medical education*. 2000;34(9):721-8.
22. Freeman AC, Ricketts C. Choosing and designing knowledge assessments: experience at a new medical school. *Med Teach*. 2010;32(7):578-81.
23. Ali K, Coombes L, Kay E, Tredwin C, Jones G, Ricketts C, et al. Progress testing in undergraduate dental education: the Peninsula experience and future opportunities. *European Journal of Dental Education*. 2015;20(3), 129-34.
24. Ricketts C, Bligh J. Developing a "frequent look and rapid remediation" assessment system for a new medical school. *Acad Med*. 2011;86(1):67-71.
25. Ali K, Jerreat M, Zahra D, Tredwin C. Correlations Between Final-Year Dental Students' Performance on Knowledge-Based and Clinical Examinations. *Journal of Dental Education*. 2017;81(12):1444-50.

26. Mattick K, Dennis I, Bradley P, Bligh J. Content specificity: is it the full story? Statistical modelling of a clinical skills examination. *Medical education*. 2008;42(6):589-99.
27. Lave J, Wenger E. *Situated learning: Legitimate peripheral participation*: Cambridge university press; 1991
28. Herrington J, Oliver R. An instructional design framework for authentic learning environments. *Educational technology research and development*. 2000;48(3):23-48.
29. Schmidt HG, Vermeulen L, van der Molen HT. Longterm effects of problem-based learning: a comparison of competencies acquired by graduates of a problem-based and a conventional medical school. *Med Educ*. 2006;40(6):562-7.
30. Koh GC, Khoo HE, Wong ML, Koh D. The effects of problem-based learning during medical school on physician competency: a systematic review. *CMAJ*. 2008;178(1):34-41.
31. Ali K, Zahra D, Coelho C, Jones G, Tredwin C. Academic performance of undergraduate dental students with learning disabilities. *Br Dent J*. 2017;222(3):205-8.
32. Burford B. Group processes in medical education: learning from social identity theory. *Med Educ*. 2012;46(2):143-52.
33. Mann KV. Theoretical perspectives in medical education: past experience and future possibilities. *Medical education*. 2011;45(1):60-8.
34. Corbin J, Strauss AL, Strauss A. *Basics of qualitative research*. sage; 2015.
35. Davies P. Insider research: from a position of privilege. In TASA conference 2005 Dec (pp. 6-8).
36. Björklund M. Dyslexic students: Success factors for support in a learning environment. *The Journal of Academic Librarianship*. 2011;37(5):423-9.
37. Morris DK, Turnbull PA. The disclosure of dyslexia in clinical practice: experiences of student nurses in the United Kingdom. *Nurse Educ Today*. 2007;27(1):35-42.
38. Salkeld J. A model to support nursing students with dyslexia. *Nurs Stand*. 2016;30(47):46-51.

39. Huber MT, Highland JD, Krishnamoorthi VR, Tang JW-Y. Utilizing the electronic health record to improve advance care planning: a systematic review. *American Journal of Hospice and Palliative Medicine*. 2018;35(3):532-41.