EMPOWERING DYSLEXIC STUDENTS IN PRODUCT DESIGN

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ABSTRACT
Dyslexia, prevalent among students in art and design in higher education in the UK, is considered a learning disorder. As such, its treatment in educational environments is commonly reduced to mitigating the student's difficulties derived from dyslexia rather than leveraging the strengths of dyslexic students in key skills for product design. In this paper, informed by the findings published in the literature and initial interviews with two dyslexic students of Product Design from the University of Brighton, a prototype of a 12-week Product Design module is presented, where a diversified array of learning activities and assessments is included to power the strengths of dyslexic students.

Keywords: Dyslexia, assessment, product design

1 INTRODUCTION
Dyslexia is prevalent among students in art and design in higher education in the UK [1]. Studies carried out at the Royal College of Art and Northumbria University suggest that dyslexic students in art and design and architecture might represent around 30% of the student population [2], [3], as opposed to estimations ranging from 3% to 17% in the general population [4], [5]. Dyslexia is included in the neurodiversity concept, and it is usually treated as a learning disorder. As such, the emphasis is on mitigating its deficits rather than leveraging its strengths [6], [7]. This research aims to rethink dyslexia in higher education product design courses, focusing on its strengths rather than limitations. Specifically, the proposal targets non-studio modules, complementing traditional studio-based project modules by incorporating inclusive assessment strategies. It is well-known that people with dyslexia have key skills in product design, such as visualising, imagining, communicating, reasoning, connecting, or exploring [8], [9]**.** With this focus, primary and secondary sources were consulted to rethink how dyslexic students are taught and assessed in a product design course at the University of Brighton. As a result, a prototype of a standard 12-week Product Design module, different from the Studio module, detailing week-by-week activities and a diversified array of formative and summative assessments is produced. The inclusion of new briefs and new assessment formats is expected to match the strengths of dyslexic students and offer neurotypical students a wider set of assessment paths. In doing so, the learning experience of students is envisaged to improve for all.

2 LITERATURE REVIEW
2.1 Dyslexia as a Learning Difficulty
In the UK, the British Dyslexia Association and the National Health Service (NHS) define dyslexia as "*a specific learning difficulty which primarily affects reading and writing skills*" [10] and "*a common learning difficulty that mainly causes problems with reading, writing, and spelling*" [11], respectively.
Given this widely adopted view of dyslexia as a learning disorder, the usual approach to support dyslexic students focuses on strategies to mitigate their difficulties [12]. The most common challenges are reading, spelling and writing [13], [6]**,** with co-occurring deficits in concentration, mental calculation, working memory, time management and argument articulation [14], [15]. Given the prevalence of written coursework and exams in higher education, a common mitigation is offering individual adjustments in the form of additional time to complete the work, as recommended in [16]. However, further support in the form of inclusive teaching, mentoring and assessment practices - demonstrated to be effective for dyslexic students - is seldom on offer across universities in the UK [17], [18].
The situation described above does little to lift the perception of dyslexia as a handicap. The Handicap Creation Theory states that handicaps emerge due to a mismatch between the characteristics of the

individual and the environment [6]. Thus, by changing the environment, a handicap can disappear. However, with the overuse of written material and assessments, academic environments are heavily designed to amplify the weaknesses of being dyslexic rather than the strengths. As a result, dyslexic students suffer from "*higher anxiety, lower self-esteem, problems with coping, dealing with unexpected situations, deficient academic achievement and motivation throughout the lifespan* [and a feeling of shame] *as dyslexia is experienced as a stigma*" [6]**.**

2.2 Dyslexia as a gift

Over the last few decades, there has been a shift in focus from perceiving dyslexia as a learning impairment to perceiving it as a different form of mental processing in the context of the neurodiversity movement [4]. As a result, there is a growing number of publications focusing on the cognitive advantages of dyslexia. The most cited cognitive strengths of dyslexic people are [4], [8], [9]**:**

- **Visual & spatial reasoning,** *"the ability to perform movements of various two- or three-dimensional figures and to mentally combine, transform, and move these figures to produce a new design*" [19].
- **Creative thinking,** the intellectual "*process underlying the production of creative products"* [20]**.**
- **Interconnected Reasoning,** the ability to create associations between concepts, ideas, and events not obviously related to each other.
- **Holistic thinking**, the intellectual process that allows one to acquire the entire perspective of a situation as a whole and detect patterns.
- **Emotional intelligence,** the "*capacity to reason accurately with emotion and emotional information*" [21].
- **Intuition and insight.** Intuition is "*the ability to understand immediately without conscious reasoning* ", whereas insight is "*the capacity to gain accurate and a deep understanding of a problem[...] often associated with movement beyond existing paradigms*" [22].
- **Hands-on skills,** the ability to acquire knowledge through direct experience and practice.
- **High resilience,** the capacity to resist and recover from difficulties.

2.3 The strengths of dyslexia and Product Design skills

The left part of **Fig.1** lists the strengths of dyslexic individuals discussed above. The right part shows the knowledge and skills of Product Design graduates, according to the UK's Subject Benchmark Statement for Art & Design [1]. The lines identify which dyslexia strengths support the development of the product designer's knowledge and skills, showing a good alignment between both.

- Dyslexic students use **visual and spatial reasoning** to visualise designs, transform 3D concepts, and experiment with shapes, structures, and layouts, improving functionality and aesthetic appeal, which supports **technical proficiency**, **creative thinking**, and **problem-solving**.
- **Creative thinking** allows dyslexic students **to solve problems** with a creative mindset, often exploring unconventional solutions. This ability is essential in developing products that stand out in the market because they are effective, but also memorable and impactful.
- **Interconnected Reasoning** supports **contextual understanding** and **critical thinking**. By linking cultural, social, and historical factors, students design meaningful products for diverse audiences, addressing multi-dimensional needs while fostering creativity through unusual connections.
- **Holistic thinking** aligns with **contextual understanding** and **sustainability**, enabling dyslexic students to consider the societal context of a product and its full lifecycle, including its environmental and social impact and promoting sustainable design choices.
- **Emotional intelligence** helps dyslexic students understand and empathise with users **during primary** research. Recognising emotions and preferences aids in designing intuitive, engaging products while also enabling **effective communication** of design ideas to clients and collaborators.
- **Hands-on skills** match perfectly with the area of **materials and processes**. A practical approach is essential in product design, where iterative testing and refining can significantly improve the functionality and durability of products.
- **Intuition and insight** relate to **critical thinking** and **entrepreneurship,** allowing dyslexic students to make quick decisions and anticipate user needs effectively, which is crucial for identifying new market opportunities and developing forward-thinking and commercially viable products, a key issue for entrepreneurs.

- Finally, **high resilience** helps dyslexic students persevere through design challenges, adapt to feedback, and refine their work. This quality is crucial in a process requiring revisions and problem-solving, and supports all aspects identified in the benchmark.

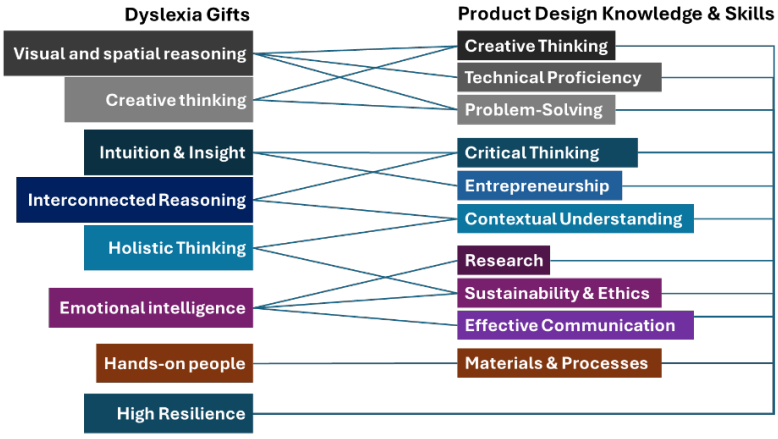

Figure 1. Matching the strengths of dyslexia with the knowledge and skills required in Product Design

3 METHODOLOGIES

Primary and secondary sources allowed us to identify **a) challenges** & **strengths** of dyslexia for Product Design students, **b)** preferred **activities** & **assessments**, and **c) new approaches** for teaching and assessments.

Primary Sources. Forty-five minutes of semi-structured interviews with open questions (Table 1) were conducted with two voluntary BSc product design students at the University of Brighton who self-identified as dyslexic. The university ethics committee approved the interview design and procedures.

Table 1. Questions used to guide the semi-structured interviews

A	Challenges	Are you familiar with dyslexia and its potential impact on learning? Have you found any dyslexia-related challenges in your academic journey? What strategies do you use to address any challenges you face because of dyslexia? How do you think dyslexia might influence your experience as a student? How do you approach problem-solving and creativity in your design process, considering any
	Strengths	Are you familiar with dyslexia and its power? How do you think dyslexia might power your experience as a student? How do you think dyslexia might influence your experience as a student?
B	Assess-ment	How do you feel about flexible assessing formats that empower the potential and abilities of all students with dyslexia?
C	New Aproaches	Do you have any suggestions for better-assessing students with dyslexia in product design? Can you share any insights you think are valuable for educators to include the power of dyslexia when assessing students?

Secondary Sources. An advanced Google Scholar search was conducted using the word pairs "dyslexia" and "design" (28 articles), "dyslexia" and "art" (54 articles), and "dyslexia" and "architecture" (17 articles). After filtering out papers unrelated to dyslexic students' training in these disciplines, the five papers remaining [18], [3], [14], [23], [24] were analysed.

4 FINDINGS

4.1 Primary sources

The interviews identified the following strengths and challenges of dyslexia, as well as preferences for learning activities and assessments.

Strengths. Students have strong hands-on skills, finding physical tasks easier and more engaging than theoretical work. They consider themselves highly creative, especially in designing and making things. They also think they are good at visual thinking, which aids problem-solving and creative thinking.

Challenges. Students face challenges processing large amounts of information, often missing key details while reading or listening. Dense texts are hard to follow, and essay-based assessments remain difficult, even with extended time. One student shared that words seem to dance on the page, overwhelming the reading. They're easily distracted during tasks and frequently shift topics. Summarising or extracting key points from texts also requires extra effort, affecting task completion and submissions.
Activities and assessment preferences. Students favour practical, hands-on work over theoretical tasks, enjoy doing physical tasks and making "stuff". One prefers typing for assessments, as it allows focused thinking and reduces distractions. Computers are also preferred during exams. They need to create a detailed plan before writing to stay focused.
New Approaches for activities and assessments. Students did not mention specific new approaches. However, they reinforced their preference for hands-on tasks for session activities and assessment. They agree that flexible formats can be a good option for them. They mentioned the podcast format previously used in a Tech module as a good approach as a final reflection for the module. One interviewee suggests that more spacing in text or visual breaks could help reduce distractions during reading.

4.2 Secondary sources

The right column of Table 2 lists the findings from secondary sources in terms of advantages and challenges of dyslexia in art, design and architecture students, as well as preferences of activities and assessments of dyslexic students in those areas and new teaching and learning approaches. As a way of comparison, the information obtained from the interviews is summarised in the left column.

Table 2. Strengths and challenges of dyslexia in Product Design. Preferences and new approaches to leverage the strengths of dyslexic students in Product Design

	Primary Research	Secondary Research	
Strengths	Creativity Visual thinking Hands on skills	Creative thinking [3], [14], [23] Visual thinking/communication [18], [14], [23], [3] Resilience [3], [23] Holistic thinking [18], [14] Empathy [18], [14]	Non-verbal communication [14] Presentation skills [3] Critical synthesis [3] Self-awareness [3]
Challenges	Reading dense text Essays-based assessments Easilly distracted Missing important details Extract key information Processing large amount of info	Reading [18], [3], [23] Writing [18], [3], [23] Short attention span [24] Retain information given verbally [24] Taking notes [24] Working memory [24]	Personal organisation and time management [3], [23], [24] Numeracy [24] Articulate arguments [24] Negativity from lecturers unaware of dyslexia [18]
Preference	Hands-on activities Detailed plans to stay focused Computers for exams	Hand on activities [14] Weekly one to one tutorials [3] Repetition of information, use of recording devices [3], [14] Dialogue, discussion, formative oral feedback [3], [14]	Verbal examinations and presentations [3] Present information in multi-modality formats [14], [23] Provision of lecture notes/materials in advance [14], [24]
New	More spacing, visual breaks in text Flexible, varied assessment formats	Graphic syllabus [3] Variety of formats for handouts and assessment [3], [24]	Exchange short summaries of tutorial feedback [24]

Table 2 shows a good match between primary and secondary sources, although the low number of interviewees led to fewer findings. Six out of eight strengths discussed in section 2.2 were identified. Interconnected reasoning, intuition, and insight were missing, possibly due to the small sample size and limited literature on dyslexia and Product Design.

5 PROPOSALS

Based on the findings of the previous section, a structure for a 12-week module **(see Figure 2)** was designed to leverage the strengths of dyslexic students in Product Design, which are also well aligned with the skills described in the UK Art and Design benchmark [1]. It follows the Double Diamond methodology, which organises the design process into Discover, Define, Develop, and Deliver stages. The module is structured in 6 two-week stages and includes hands-on activities and flexible assessment formats. Adjustments have also been made to overcome common challenges, such as heavy reading tasks, extensive writing, and time management, without affecting neurotypical students by allowing them to take the traditional approach to learning.

5.1 Inclusive aspects of the proposed module

Syllabus Structure and Timeline: A graphical syllabus (Figure 2) complements the standard written syllabus, providing a visual week-by-week overview of activities, stages, and deadlines. This approach aligns with the visual thinking of dyslexic students, as recommended in [3].
Project-Based Module: This module follows an active, constructive learning approach, emphasising practical session activities. It utilises the hands-on skills of dyslexic and Product Design students, aligning activities with briefs and assessments to reinforce key concepts and support working memory.

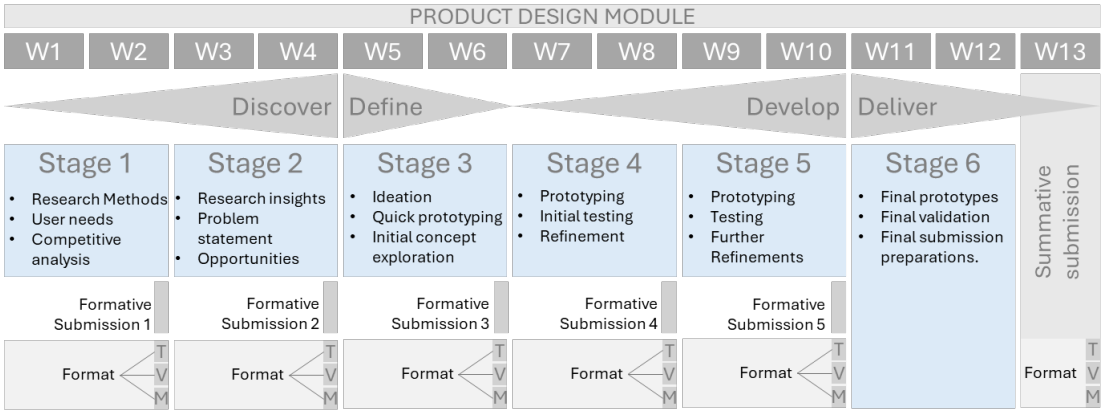

Figure 2. Week-by-week structure of a Product Design module

Time Management: Deliverables are structured into bi-weekly tasks with regular formative feedback, reducing the cognitive load of large submissions. Each two-week stage ends with tutorials providing formative assessments, ensuring consistent feedback as recommended in [3], [14]. Sessions can be recorded for later reference, supporting organisation and time management. The final submission compiles intermediate submissions that have already received feedback.

Accessible Study Materials & Briefs: Course materials are available in text, visual, and multimedia formats to support dyslexic students. Multimedia content supports traditional reading, with text-to-audio tools for additional aid. Project briefs are concise (one page or less) and provided in written, visual, and multimedia formats.

Flexible Assessment Formats: Each submission offers three format options, allowing students to demonstrate their learning through Traditional (T), Visual (V), or Multimedia (M) formats:

- **Traditional Format (T):** A report with text, images, graphs, or tables, suited for students comfortable with written expression.
- **Visual Format (V):** A poster-like document with images, diagrams, and minimal text, supporting students who communicate better visually.
- **Multimedia Format (M):** Videos, audio recordings, or animations, ideal for students who prefer oral or audiovisual expression.

This approach allows students to focus on demonstrating understanding rather than struggling with format constraints. Marking guides accommodate all formats.

Additionally, learning outcomes emphasise key competencies in product design, such as creativity, problem-solving, and practical skill demonstration, rather than traditional essay writing. This proposal builds on the strengths of dyslexic students while offering universally accessible assessments, making product design education more engaging and inclusive for all.

6 CONCLUSIONS AND FUTURE WORK

The prevalence of dyslexia in Art and Design highlights the need to move beyond accommodating challenges to actively using its strengths. These strengths align with the UK's Subject Benchmark Statement for Art & Design. This work proposes that flexible assessment formats (visual, multimedia, and traditional) can suit dyslexic students in product design without disadvantaging neurotypical students. Allowing students to choose formats that match their cognitive abilities fosters inclusivity. A variety of formats is also considered for briefs and study materials.

Additionally, breaking assessments into specific tasks and providing regular verbal formative feedback (recorded and transcribed using AI) supports students with working memory and time management. This approach reflects industry practices, where diverse problem-solving and communication styles are valued. It also supports student engagement and confidence, helping dyslexic students recognise their strengths (“gifts”) and have a positive learning experience.

Future research should focus on fully implementing the proposed module and assessing its impact on dyslexic and neurotypical students. An initial pilot on flexible assessment formats has been tested with positive student feedback. Examining how these formats benefit other neurodivergent profiles, like ADHD, will extend the research. Additionally, exploring AI tools such as text-to-speech and visual summarisation could further inform inclusive practices.

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