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Accessible anatomy education: the Utibilus Project as a model for inclusive learning

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Abstract. *Background.* Anatomy education, with its dense visual landscapes and intricate terminology, represents a formidable obstacle for all the students but particularly for those with disabilities and specific learning disorders (SLD). Despite legal mandates for equal educational opportunities, the field lacks widespread implementation of effective learning enhancers, jeopardizing inclusivity, and academic success. *Methods.* This study investigated into the pressing need for accessible learning materials in anatomy education. A pilot survey assessed faculty awareness of students with disabilities and SLD within their courses, along with their knowledge and utilization of learning enhancers. To address this gap, the “Utibilus Project” of the University of Pisa developed and implemented a suite of accessible resources, including: 1) Edited PowerPoint presentations with improved layout, enhanced accessibility features, and clear explanations; 2) Implementation of dedicated fonts optimized for readability, reducing visual strain and cognitive load; 3) Comprehensive guidance on accessibility tools like screen readers and mind or conceptual maps, empowering students with diverse learning needs. *Results.* The survey (30.7% response rate) unveiled a concerning lack of faculty awareness regarding the presence and specific needs of students with disabilities and SLD. While most express interest in acquiring further knowledge, their understanding of learning enhancers and their potential to enhance student learning remained limited. The Utibilus Project effectively demonstrated the feasibility and transformative potential of accessible resources. Early data suggested significant improvements in the learning experience for students with diverse needs, particularly in the challenging domain of anatomy education. *Conclusions.* This study underscored the critical and urgent need for accessible learning materials in anatomy education. The Utibilus Project serves as a valuable model, paving the way for a more inclusive and effective learning environment where all students, regardless of individual differences, have equal access to the complex and crucial information within the field. While acknowledging the limitations of the pilot survey, such as its sample size, the findings call for further research to evaluate the long-term impact of these interventions and identify additional strategies to address the specific needs of students with disabilities and SLD in anatomy education. Additionally, exploring the broader benefits of accessible learning materials, such as their potential to improve student engagement and motivation, holds significant promise for enhancing the educational experience for all.

Keywords: accessibility, learning disabilities, specific learning disorders, medical education, anatomy, inclusive teaching, learning enhancers, Utibilus Project.

INTRODUCTION

In Italian universities, participation of students with disabilities, such as low vision, hearing impairment, or deafness, as well as those with specific learning disorders (SLD), is steadily increasing (Istituto Superiore di Sanità, 2021, 2022; ANVUR, 2022). The SLD are classified in the International Classification of Diseases (ICD-11) diagnostic system as a group of neurologically based developmental disorders characterized by significant and persistent difficulties in learning academic skills, including reading, writing, or arithmetic (World Health Organization, 2018). The SLD fall under the broader concept of neurodiversity, which includes various neurological differences such as dyslexia, Attention Deficit Hyperactivity Disorder (ADHD), and autism spectrum disorders (for a review, Clouder et al., 2020). Neurodiversity views these differences as natural variations in human brain function, not as conditions to be treated. Thus, individuals with SLD are seen as neurodivergent, meaning they have different but equally valid cognitive patterns compared to the neurotypical population (for a review, Clouder et al., 2020).

Similarly, over recent years, the percentage of students with SLD enrolled in upper secondary schools has progressively increased (Ministry of Education and Merit, 2020; Ministry of Education and Merit, 2022). Interestingly, the proportion of students with disabilities or SLD is higher in secondary schools compared to universities (ANVUR, 2022; ISTAT, 2024). This discrepancy may be attributed to various barriers that discourage neurodivergent students or with disabilities from pursuing higher education. Factors such as the perception of university studies as excessively challenging, previous negative educational experiences, and a university environment perceived as less inclusive contribute to this issue (Alivernini and Lucidi, 2011; European Agency for Special Needs and Inclusive Education, 2016; Donato et al., 2019).

Furthermore, the transition from high school to university presents a significant change, especially challenging for students with SLD or disabilities (Lithari, 2019; Koutsouris et al., 2021; Parson et al., 2023). These students, accustomed to receiving support from specialized teachers and tutoring programs in their educational backgrounds, may worry about not having access to similar assistance in university. As they move away from a familiar support system, feelings of anxiety and uncertainty may arise, affecting their confidence in achieving success at the university level.

Moreover, some students might opt out of seeking support to avoid potential embarrassment or stigmatization, particularly if they have gone through similar experiences in the past (Pino and Mortari, 2014; Lithari,

2019; Mesa and Hamilton, 2022). This potential scenario could significantly discourage neurodivergent students or with disabilities from enrolling in university courses or even lead them to discontinue their studies if already commenced. Furthermore, if neurodivergent or disabled students do not have, or are not enabled to have, adequate knowledge of the services and support offered by universities in terms of insufficient inclusivity, they may develop a detrimental sense of inadequacy (ANVUR, 2022). Consequently, this situation could dramatically dissuade these students from continuing their university courses or push them to prematurely interrupt their studies if they have already started.

A crucial aspect of the educational process that can profoundly influence students' academic paths is the hidden curriculum. This concept refers to the set of expectations, values, and norms that govern behavior and interaction in universities, implicitly conveyed through the institution's environment and culture, beyond formal lessons (Alsubaie, 2015; Koutsouris et al., 2021). Thus, the hidden curriculum contributes differently from the formal curriculum to the overall development of students, affecting their self-perception and abilities (Alsubaie, 2015; Koutsouris et al., 2021; Hamilton and Petty, 2023). Given its implicit nature, the hidden curriculum can present a significant challenge for students with neurodivergent conditions or disabilities, generating or exacerbating feelings of inadequacy, isolation, and frustration (Sulaimani and Gut-Zippert, 2019; Koutsouris et al., 2021; Hamilton and Petty, 2023).

Therefore, it is essential for educational institutions to recognize the impact of the hidden curriculum on these individuals and take concrete steps to mitigate its potential negative effects.

Personal and family expectations also play a crucial role, as a supportive and understanding family environment significantly influences students' self-esteem and academic success (Syeda and Batool, 2020). Additionally, many students with disabilities or SLD face mental health challenges, such as anxiety and depression, which further complicate their educational path (Ghisi et al., 2016; Chieffo et al., 2023). Overall, students with neurodivergent conditions or disabilities may perceive the university environment unwelcoming due to various factors, feelings, or prejudices. These include a lack of knowledge about available support/services, a stressful transition, academic and logistical challenges, low self-esteem, social or familial pressures, and experiences or fear of discrimination and stigma. Individually or collectively, these factors can lead to a sense of inadequacy, ultimately discouraging these students from embarking on or continuing higher education.

The challenges encountered by students with neurodivergent conditions or disabilities in accessing higher education underscore the significance of fostering an inclusive educational setting, a principle strongly advocated by the United Nations Convention on the Rights of Persons with Disabilities, adopted on December 13, 2006, under resolution 61/106 (United Nations, 2006). This convention was ratified by Italy in 2009, reaffirming the nation's commitment to ensuring equal educational opportunities for all individuals (Italia, 2009). Italian laws No. 104/1992, No. 17/1999, and No. 170/2010 are specifically addressing disabilities and SLD to ensure the right to education, promote equality across all educational institutions, and establish standards for personalized support services, ensuring that all the students receive the necessary assistance to excel academically (Italia, 1992, 1999, 2010). More recently, the protection of the right to education for students with SLD has been reinforced, outlining methodologies for educational support and training for teachers, including those in universities (Ministero dell'Istruzione, 2011). Finally, guidelines to further enhance inclusive practices for students with SLD have been updated by the National University Conference of Delegates to Disability (CNUDD, 2014; available at <http://www.cruil.it/documenti-pubblici.html>).

Challenges faced by students with SLD in the study of human anatomy in Medicine and Surgery programs

Within the context of Medicine and Surgery degree program, students with SLD may encounter significant challenges in studying human anatomy. These challenges are characterized by the need to grasp the knowledge of complex anatomical structures and their three-dimensional interrelationships within the human body. In this regard, students with SLD may struggle with visualizing and mentally manipulating these structures, potentially impacting their comprehensive understanding of morphological and functional anatomical concepts.

Additionally, the need to memorize and accurately utilize the extensive, detailed, and specific range typical of anatomical nomenclature can pose a significant obstacle for students with SLD, especially those who have difficulty understanding spatial and visual information. This latter aspect may stem from the educational materials provided to them, even during frontal lectures.

Furthermore, it is well-known that the practical application of anatomical knowledge, understood as the translation of theoretical knowledge into practical skills in a clinical context, is a cornerstone of competence that a student in the Medicine and Surgery degree program must acquire. SLD students may encounter difficulties

in translating their theoretical knowledge into practical skills, especially if they struggle to integrate information from various sources that may not be fully accessible. This risk becomes particularly realistic if the educational materials provided by professors to students, whether they are individuals with SLD or not, have not been created with criteria aimed at improving their usability. It is evident, therefore, that the teacher plays a crucial role in engaging students in an inclusive educational journey that involves removing obstacles hindering learning to ensure all students have access to and full mastery of the educational material.

In light of these considerations, our group has developed the Utibilus Project, a collection of tools aimed at disseminating effective methodologies (best practices) to enhance the learning process for all students, particularly those with neurodivergent conditions or disabilities. As part of the project, a survey has been conducted as a pilot analysis to assess the faculty of the School of Medicine at the University of Pisa regarding (1) their level of awareness of the presence of individuals with neurodivergent conditions or disabilities in their teaching courses, and (2) their level of knowledge about tools, methodologies, and strategies suitable for creating educational materials of excellent usability, and the potential these may express, if correctly utilized, as integral components of educational tools to enhance the learning process for all students, particularly those with neurodivergent conditions or disabilities.

METHODS

The Utibilus Project (from Latin: *utibilus*, meaning "more useful and advantageous" as superlative of *utibilis*), was conceived within the School of Medicine with the aim of providing methodologies and tools to enhance the accessibility and effectiveness of educational materials offered in the medical degree program. Improving the accessibility and effectiveness of educational materials is crucial for ensuring that all students have equal opportunities to learn and succeed. This goal is particularly significant in teaching disciplines that are highly complex and challenging, such as human anatomy, which poses difficulties for many students. Therefore, enhancing the accessibility and effectiveness of educational materials can significantly alleviate these challenges, which may sometimes impede the learning process. Indeed, by improving the accessibility of materials -such as providing visual teaching tools, or material edited in a more user-friendly manner- lectures can assist all students, regardless of learning disabili-

ties, in better understanding complex concepts, leading to positive outcomes in terms of knowledge quality and, consequently, medical practice. Therefore, investing in improving the accessibility and effectiveness of educational materials, especially in disciplines like human anatomy, is crucial for promoting inclusive learning environments and fostering the success of all students in their academic and professional endeavors.

Within the scope of the Utibilus Project, a range of tools has been developed, such as PowerPoint presentations, materials in PDF format, and video clips, to disseminate effective methodologies and procedures -i.e. best practices- aimed at enhancing the learning experience for all students, specifically those neurodivergent conditions or disabilities. In particular, the project has identified five key areas of development:

1. Promoting the use of inclusive fonts to enhance the readability of educational materials (Schneps et al., 2013; Rello and Baeza-Yates, 2016; Bachmann and Mengheri, 2018)
2. Encouraging the adoption of proper formatting techniques to improve the readability of educational materials (Martelli et al., 2009; British Dyslexia Association, 2023)
3. Implementing the integration of the accessibility checker available in Microsoft 365 Office to ensure that educational materials are accessible to all students, including those with disabilities or SLD (Microsoft, 2024)
4. Advocating for the use of mind maps and concept maps as suitable instructional tools to promote deeper conceptual understanding (Johnston, 2019)
5. Introducing assistive technologies, such as screen readers, to ensure equal learning opportunities for all students (Dawson et al., 2018)

As an additional objective of the Utibilus Project, a pilot survey was conducted to evaluate (1) the level of awareness among the faculty of the School of Medicine regarding the potential presence of individuals with neurodivergent conditions or disabilities who actively attend their courses, and (2) the level of knowledge and potential utilization of methodologies, procedures, or technological tools aimed at enhancing the accessibility and usability of educational materials commonly available to students in the university academic setting. For this purpose, a questionnaire was prepared using Google Form, consisting of 25 questions (see Table 1). All faculty of the School of Medicine was invited via email (with 2 invitations sent one week apart) to participate voluntarily and completely anonymously.

RESULTS

The findings from the questionnaire distributed among the 270 faculty members of the School of Medicine, with 83 responses collected (30.7%), offer valuable insights into the knowledge and utilization of tools aimed at improving the accessibility of educational materials, particularly for students with neurodivergent conditions or disabilities.

Understanding of accessibility tools and methods

Upon analyzing responses, a diverse picture emerges. Only a negligible 2% of faculty members regard themselves as “highly” proficient, while a significant 48% claim to possess “moderate” knowledge. Nonetheless, concerning is the fact that 33% perceive their knowledge as limited, with an additional 7% admitting to a complete lack of understanding.

Awareness of students with SLD or disabilities

When examining the involvement of students with SLD in educational activities, 39% of faculty members acknowledge being aware of their presence in their courses. However, a significant gap in awareness exists: 44% of faculty members are unaware of the presence of students with SLD in their classes, and only 17% report negatively. A similar pattern emerges for students with disabilities. About 32% of faculty members recognize their presence, while 47% are uncertain, and 21% report negatively.

Evaluation of educational material adequacy

An intriguing observation arises concerning the perception of the adequacy of educational material for students with SLD or disabilities: 42% of faculty members believe their material to be adequately accessible, while 45% express uncertainty regarding its accessibility. Surprisingly, only 13% consider the material to be insufficiently accessible.

Accessibility checks

Remarkably, the majority of faculty members, constituting 74%, have never conducted accessibility checks on their educational material, with only 26% having done so.

Familiarity with Microsoft Office accessibility tools and inclusive fonts

It is surprising to note that a substantial majority of faculty members, accounting for 83%, are unaware of Microsoft Office’s capability to conduct accessibility checks on created documents. Similarly, awareness of fonts that can enhance text readability is limited, with only 30% of faculty members familiar with such fonts and a mere 22% incorporating them into their documents.

Understanding of guidelines or best practices

A concerning revelation surfaces concerning awareness of guidelines or best practices for creating accessible educational material, with a notable 80% of faculty members lacking awareness. In contrast, only 20% are informed about these practices, revealing a clear knowledge gap necessitating targeted training interventions.

Understanding and use of conceptual and mind maps

A significant deficit is observed in the understanding and utilization of conceptual and mind maps among faculty members. 65% are unaware of the distinction between a conceptual map and a mind map. Additionally, only a mere 17% have ever created or used such maps in their professional activities. Moreover, the use of dedicated software for their creation is exceedingly limited, with only 2% of faculty members utilizing it.

Understanding and use of voice synthesis tools

A notable deficit emerges in the understanding and use of voice synthesis tools among faculty members. A significant 87% are unaware of programs enabling text identification and interpretation through voice synthesis. Moreover, only a modest 25% are aware of the Text-To-Speech functionalities integrated into the Microsoft Office programs currently in use.

Interest in further information

It is encouraging to note that 96% (n=80) of faculty members have expressed a strong interest in receiving additional guidance on how to make their educational materials more accessible. When asked to indicate by which method they prefer to be informed, Powerpoint presentations and video tutorials received the most preferences (see Figure 1).

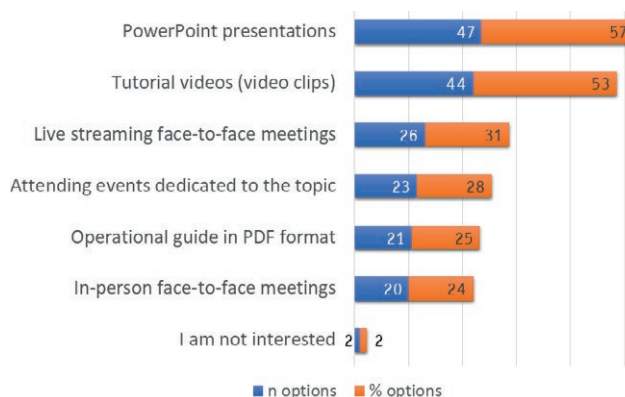


Figure 1. How survey participants prefer to receive information (graph from PowerPoint)

DISCUSSION AND CONCLUSIONS

The growth of students with disabilities and SLD in Italian universities

In the academic year 2019/2020, students with disabilities or SLD constituted 2.13% of the total student population in Italian universities, including both public and private institutions (ANVUR, 2022). Notably, within public universities, the enrollment of students with disabilities experienced a substantial increase, quintupling from approximately 4,400 in the academic year 1999/2000 to around 20,000 (19,875) in 2020/2021 (ANVUR, 2022). However, over the past nine years, there has been a more pronounced increase in the enrollment of students with SLD, rising from around 1,000 (ANVUR, 2022) in the academic year 2011/2012 to approximately 20,000 (19,616) in 2020/2021 (ANVUR, 2022). Given these statistics and the current trends, the number of university students with SLD is expected to surpass those with other disabilities in the coming years (ANVUR, 2022). It is interesting to note that in the Italian educational landscape, the percentage of individuals with disabilities or SLD enrolled in universities is lower than that of those enrolled in secondary schools.

Trends in enrollment of students with disabilities and SLD in Italian upper secondary schools

Data from the Italian National Institute of Statistics (ISTAT) indicates that in Italian upper secondary schools, the percentage of students with disabilities has steadily increased over the last ten years, rising from 2.3% in 2015/2016 to 2.9% in 2019/2020, to 3.0% in the following year (ISTAT, 2021), and finally to 4.1% in 2022/2023 (ISTAT, 2024). Similarly, the percentage of

students with SLD enrolled in upper secondary schools has also progressively increased over recent years. It rose from 4.7% in the 2017/2018 school year (Ministero dell'Istruzione, 2019) to 5.3% in 2018/2019 (Ministero dell'Istruzione, 2020), to 5.9% in 2019/2020, and to 6.3% in 2020/2021 (Ministero dell'Istruzione, 2022).

Barriers to higher education for students with disabilities and SLD

The lower percentage of individuals with disabilities or SLD in university courses compared to upper secondary schools may stem from various factors influencing the decision not to pursue higher education (Dumitru, 2023). These factors could include prejudicial considerations -university studies considered too difficult and concern of failure-, past negative experiences, or perceptions of the university environment as less inclusive and motivating (Alivernini and Lucidi, 2011; European Agency for Special Needs and Inclusive Education, 2016; Donato et al., 2019).

Firstly, it can be argued that the higher prevalence and percentage of individuals with disabilities or SLD in high schools compared to universities may result, at least in part, from increased awareness and advancements in the diagnosis of these conditions in recent years. Diagnoses often occur during school age, leading to higher identification rates in secondary education. In other words, the current differences might be rooted in the fact that students in primary and secondary schools are now more likely to be diagnosed with disabilities or SLD than those who attended these schools in the past and are now at university.

Secondly, it is crucial to recognize that the transition from high school to university represents a significant period of change, particularly daunting for students with disabilities or SLD. Students who have received support from specialized teachers, tutoring programs, and curriculum adjustments in high school could fear the lack of similar assistance at the university level. Moreover, it is important to consider that many students may prefer to give up the opportunity to receive support to avoid embarrassment or stigmatization, especially when they have suffered these effects in previous school experiences (Pino and Mortari, 2014; Lithari, 2019; Mesa and Hamilton, 2022). Additionally, limited access to information on available services and supports for students with disabilities or SLD in universities could leave these students unprepared to confidently face the increased autonomy, time management, and academic workload required by university studies (ANVUR, 2022). This could lead to deleterious effects, such as students with disabilities

or SLD choosing not to enroll in university courses or interrupting their studies if they have already begun.

Thirdly, personal and family expectations could significantly influence the decisions of students with disabilities or SLD regarding university studies. A positive, supportive, and compassionate parenting style has a significant impact on the self-esteem of university students, and self-esteem significantly mediates between positive parenting, academic procrastination, and academic achievement (Syeda and Batool, 2020).

Finally, it is crucial to acknowledge that adolescents with disabilities or SLD often grapple with health issues such as anxiety and depression (Nelson and Gregg, 2012; Nelson and Liebel, 2018; Chieffo et al., 2023). Notably, a gender-based effect was observed, with females with dyslexia reporting a higher incidence of depression and anxiety symptoms compared to their male counterparts (Nelson and Gregg, 2012). A comparable scenario has been noted in the university environment, where students with dyslexia tend to report a greater number of psychological issues, such as low self-esteem, poor resilience, and symptoms of depression and anxiety, compared to students without dyslexia (Ghisi et al., 2016).

In summary, it can be argued that individuals with a disability or SLD may perceive the university environment as unwelcoming due to a combination of factors, including lack of support, a stressful transition, academic and logistical barriers, low self-esteem, social and familial pressures, inadequate information and awareness, and experiences of discrimination and stigma. These factors could contribute to a sense of inadequacy that discourages students with disabilities or SLD from pursuing higher education.

The legislation promoting inclusive education

On December 13, 2006, the United Nations General Assembly formally adopted the Convention on the Rights of Persons with Disabilities (CRPD) under resolution 61/106 (United Nations, 2006). This treaty underscores the importance of acknowledging the right to education for individuals with disabilities and advancing an inclusive educational system (Article 24.1). Additionally, it calls upon Member States to enact measures that promote the use of alternative communication methods, educational techniques, and materials to support persons with disabilities (Article 24.4). Italy ratified the Convention through Law No. 18/2009 (Italia, 2009).

Italian legislation on disabilities, including SLD, is primarily governed by Laws No. 104/1992, No. 17/1999, and No. 170/2010 (Italy, 1992, 1999, 2010). These laws protect the right to education for individuals with disa-

bilities and promote equality across all educational institutions, including universities. They also establish standards for personalized support services, ensuring that students with disabilities receive the assistance they need to succeed academically. Law No. 170/2010 focuses on SLD and enhances the educational rights of affected individuals by providing tailored support, including dispensatory tools and/or compensatory measures, to address academic challenges and promote success.

Subsequently, Ministerial Decree no. 5669/2011 further safeguards the right to education for students with SLD, outlining educational and didactic support methodologies, along with training procedures for teachers, including those operating within university settings.

More recently, the CNUDD updated its guidelines (<https://www.crui.it/documenti-pubblici.html>) adding a section dedicated to SLD students in which the general references for inclusive practices are redefined (CNUDD, 2014).

The analysis of survey responses highlights the need for improvement initiatives to promote a more inclusive and accessible educational environment within the School of Medicine. Specifically, four key areas emerge as interconnected and fundamental to achieving this goal.

Firstly, promoting targeted training programs is crucial to encourage the adoption and use of methodologies, procedures, and tools capable of creating more accessible and usable educational materials for the entire student community. This is particularly critical for students who struggle with poorly formatted or inadequately edited educational content. Such initiatives would ensure that the educational needs of neurodivergent students or those with disabilities are properly addressed.

Additionally, faculty members, especially those teaching challenging subjects such as human anatomy, should receive training to accommodate diverse learning needs. This would enable them to implement and promote the use of appropriately formatted materials, visual aids, mind maps, or alternative assessment methods in their teaching, thereby enhancing inclusivity and accessibility in the learning process.

Simultaneously, introducing initiatives that provide opportunities for assessing and evaluating the adequacy of educational materials and teaching practices, including incorporating student feedback, would make educational materials more inclusive and accessible for all students, especially those with visual impairments or dyslexia.

Lastly, the lack of accessibility checks for materials produced (e.g., slides or .doc documents) by the vast majority of faculty members underscores the need to

improve familiarity with Microsoft Office accessibility tools (Microsoft, 2024). Organizing workshops and informative sessions focused on understanding and appropriately using these tools and procedures could significantly enhance faculty awareness of document and presentation accessibility.

Thus, developing and disseminating guidelines or best practices for creating accessible educational materials is an important objective that requires attention to promote a more inclusive and accessible educational environment within the School of Medicine. Addressing these four interconnected key areas represents a crucial step in this direction.

The Utibilus Project

The project has aimed to develop a repertoire of tools, including presentation software, PDF documents, and video clips, to create opportunities for access to best practices and guidelines to facilitate the production of materials that ensure equal access to educational resources for all students (British Dyslexia Association, 2023). Within the project, we highlighted best practices in correct editing and formatting for dyslexia-friendly features. This includes proper line spacing, inter-letter spacing, inter-word spacing, optimal line length, maximum number of lines, and maximum number of words per line on a single slide (Martelli et al., 2009; Zorzi et al., 2012; Gori and Facoetti, 2015; Damiano et al., 2019; Galliussi et al., 2020; British Dyslexia Association, 2023). Attention was also given to text justification, appropriate font sizes, and the selection of inclusive fonts (Schneps et al., 2013; Rello and Baeza-Yates, 2016; Hakvoort et al., 2017; Bachmann and Mengheri, 2018; Damiano et al., 2019). All these strategies allow to enhance readability and reduce visual stress for students with dyslexia or other reading difficulties. With the Utibilus Project we aimed to contribute to the creation of a more inclusive and accessible learning environment for all students, regardless of their individual learning needs or abilities. To achieve this goal, and considered the preferences expressed by the faculty on the methods that they would have preferred to be informed by, we have developed PowerPoint presentations and short video tutorials that comprehensively outline the steps for installing inclusive fonts, properly editing and formatting slides and textual documents, creating mind maps and concept maps, and conducting accessibility checks for educational materials.

The analysis of responses to the open-ended question regarding the measures taken by faculty to enhance the accessibility of educational materials has uncovered a broad spectrum of strategies employed, some of which

prove suitable for the purpose, while others are wholly or partially inadequate. Moreover, there is considerable variability in individuals' awareness of the importance of accessibility.

Many professors reported providing educational materials to their students in various formats, such as video recordings and PDF slides, yet they failed to provide details on the editing and formatting criteria applied for their creation. Some professors mentioned using fonts and colors that, in their view, enhance readability. Many indicated their aim to simplify content using "clear and concise" language, avoiding "complex terms," and incorporating visual aids like images and diagrams. However, some instructors admitted to not employing specific strategies to improve accessibility, citing a lack of knowledge about the types of disabilities among their students. Others, finally, reported not having specific strategies in place but being open and willing to learn more about accessibility.

Overall, therefore, there is a widespread willingness on the part of professors to implement strategies to improve accessibility, although the need for greater awareness and training on this topic to effectively meet the diverse needs of our students remains marked, thus ensuring equal opportunities for success across the board.

Therefore, the analysis of the questionnaire responses highlights several critical areas that need addressing to improve and ensure a more inclusive and accessible educational environment within academia. These gaps can be addressed through the dissemination and implementation of appropriate tools to enhance the accessibility and usability of educational materials. Achieving this goal is pivotal in academic education to ensure equal learning opportunities for all students, particularly those who are neurodivergent or have disabilities.

Promoting inclusivity through a shift in perspective

The responses provided by the faculty of the Medical School to the questionnaire highlight a lack of awareness regarding the tools, methodologies, and procedures necessary to improve the accessibility of educational materials for all students, whether they are neurotypical, neurodivergent, or have disabilities. This gap could only be bridged through the implementation of specific and effective support and training initiatives, enabling faculty members to create more inclusive and accessible educational materials, thereby enhancing the learning process.

In this context, it is crucial to emphasize that at present, the professors lack the ability to determine if there are neurodivergent students or those with disabilities in their classrooms. The existing legislation does

not mandate the disclosure of such information, which serves to protect privacy rights and mitigate the risk of stigma. Nonetheless, this circumstance may result in the presentation of educational materials that are potentially inaccessible.

Therefore, it would be advisable to consider the opportunity to completely overturn the approach followed up to now. It would be significantly more beneficial, not just for neurodivergent or disabled students but for the entire student community, if faculty were willing to see their classrooms as potentially including students with diverse needs, without needing direct confirmation of this. As widely recognized, paying careful attention during the editing and formatting of educational materials can greatly improve usability and accessibility for all users, including those who are neurodivergent or disabled (Schneps et al., 2013; Rello and Baeza-Yates, 2016; Hakvoort et al., 2017; Bachmann and Mengheri, 2018; Damiano et al., 2019; Galliussi et al., 2020). If we adopted this perspective, we would feel ethically obligated to implement procedures to improve the accessibility and usability of educational materials for all students. This approach would not only be desirable but indeed necessary, as qualitative improvements in the material would benefit all students, whether they are neurodivergent, disabled, or not.

Interestingly, to enhance inclusivity in universities and bridge the gap between students with and without dyslexia, a recent machine learning model has been developed to estimate the most suitable support methods for dyslexic students (Zingoni et al., 2024). This approach facilitates the customization of educational activities to meet each student's specific needs, offering tools and strategies tailored to the challenges encountered throughout their university journey.

Breaking down barriers to empathy and inclusivity in human anatomy

Viewing classrooms as potentially accommodating students with diverse needs, including those who may be neurodivergent or have disabilities, would not only be desirable but also essential, as qualitative improvements in materials would benefit all students, regardless of their neurodiversity or disability status. The adoption and application of this paradigm appears particularly desirable, especially for the teaching of those disciplines that are considered particularly challenging, such as human anatomy traditionally is within the context of the medical degree course.

In conclusion, within the context of the Medicine and Surgery degree program, teaching human anatomy

necessitates every effort to ensure maximum accessibility and inclusivity of educational materials. This entails adopting pedagogical approaches that consider the diverse learning needs of students and ensuring that the educational content is accessible to everyone, regardless of any disabilities or language barriers. This fosters the creation of an inclusive learning environment where every student feels respected and supported in their academic path (Fitzpatrick and Barrett, 2023). Such an approach not only enhances students' educational experience but also helps to cultivate more empathetic and aware healthcare professionals who understand the challenges associated with accessibility in the healthcare setting.

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Table 1. Survey on School of Medicine Faculty awareness and use of educational material accessibility enhancement tools.

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1. How much do you consider yourself knowledgeable about methods and tools aimed at improving the accessibility of educational materials? (*)
 2. Do students with SLD participate to the lessons of your teaching course? (**)
 3. Do students with some form of disability participate to your course lessons? (**)
 4. If you answered affirmatively, do you know what disabilities they have (e.g., auditory, motor, visual)? (‡)
 5. Do you think your educational material is adequately accessible to students with SLD or disabilities? (**)
 6. Have you ever conducted an accessibility check on your educational material? (**)
 7. Do you know that Microsoft Office you currently use (Word, PowerPoint, Excel) allows you to check whether the document created has accessibility problems? (\$)
 8. What measures do you take in preparing lessons for your teaching course to improve the accessibility of educational material? (‡)
 9. Do you know if there are fonts that can improve text readability for individuals with dyslexia? (\$)
 10. If you answered affirmatively, can you indicate which ones you are aware of? (‡)
 11. Do you use fonts in your Word, PowerPoint, or Excel documents that can improve text readability for individuals with dyslexia? (\$)
 12. If you answered yes, can you indicate which one you use? (‡)
 13. Are you aware of any guidelines or best practices for creating educational material (e.g., slides) that make text reading easier? (\$)
 14. If you answered affirmatively, can you indicate which ones you use most frequently for preparing your educational material? (‡)
 15. Do you know the difference between a concept map and a mind map? (\$)
 16. Have you ever created and/or used mind maps or concept maps in your professional activity? (\$)
 17. Do you use software programs and/or websites for creating concept maps? (\$)
 18. Do you use software programs and/or websites for creating mind maps? (\$)
 19. If you answered affirmatively, can you indicate which ones? (‡)
 20. Are you familiar with programs that allow for the identification and interpretation of text displayed on a computer monitor and present it via speech synthesis? (\$)
 21. If you answered yes, can you indicate which one you know? (‡)
 22. Do you know if the Microsoft Office programs you currently use (e.g., Word, PowerPoint, Excel) include default Text-To-Speech functionality tools to reproduce written text as spoken words? (\$)
 23. Would you like to receive more guidance on methodologies to improve accessibility to your educational material? (\$)
 24. Indicate through which method(s) you would prefer to be informed
 - a. PowerPoint presentations
 - b. Operational guide in PDF format
 - c. Tutorial videos (video clips)
 - d. Live streaming face-to-face meetings
 - e. In-person face-to-face meetings
 - f. Attending events dedicated to the topic
 - g. I am not interested
 25. Indicate any other preferred methods (‡)
-

Note:

(*) answer using a 5-point Likert scale, where 1 represents “Not at all” and 5 represents “Very Much”

(**) Answer using “Yes,” “No,” or “Don’t know”

(\$) Answer using “Yes,” or “No”

(‡) Open-ended response