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RESEARCH ARTICLE

Exploring Barriers and Supports for Students with Disabilities in Higher Education through Topic Modeling

Ahmet Ayaz[1*], Muhammet Berigel[2], Prof.Dr.Fahriye Altınay[3], Prof.Dr.Zehra Altınay[4], Prof.Dr.Gökmen Dağlı[5], Assist. Prof. Dr. Betül Yıkıcı[6]

[1,2] Karadeniz Technical University

[3,4] Near East University

[5,6] University of Kyrenia

ARTICLE INFO	ABSTRACT
	This study aims to examine the obstacles and opportunities faced by students with disabilities in higher education using the topic modeling method. 1,935 publications selected through appropriate methodological methods applied to academic articles published from the Web of Science database between 2020-2024 were analyzed. As a result of the analysis, basic themes such as inclusive education, accessibility, policy development, and the role of assistive technologies were revealed and discussed in depth. The findings of the study highlight ongoing problems such as inadequate regulations, structural barriers, and social prejudices, while emphasizing developments focused on solutions to problems such as the integration of assistive technologies and inclusive pedagogical practices. The topic modeling method was used as a guiding tool in systematically determining these themes and creating policies and strategies needed for students with disabilities in higher education. The study provides important insights for educators, policy makers, and stakeholders in order to create an equitable and accessible educational environment.

INTRODUCTION

Today, in societies and especially in our country, individuals with disabilities face many social risks such as unemployment, inability to access health services or inadequate access, poor housing conditions, exposure to violence, and exposure to domestic abuse throughout their lives during their transition to adulthood (McLaughlin, 2023). It is known that the main reason for these negativities is that they can occur especially due to the inability to access or use the right to education. Serious education provided to individuals with disabilities will enable the disabled individual to overcome many problems they may encounter more easily. If individuals with disabilities can be provided with realistic education in line with their needs, the lives of individuals with disabilities can be made much easier. Individuals with disabilities who receive realistic, inclusive and serious education can be much more successful in creating their future. In this context, it is understood that the access of individuals with disabilities to educational opportunities has gained great importance. Based on these main ideas, according to Bartz (2020), education for individuals with disabilities is of great importance, especially in their socialization, acquiring a profession suitable for their talents and skills, accessing existing job opportunities, creating their future in line with their goals, in addition to these, acquiring various social roles and realizing their hopes and expectations for their lives.

According to the YÖK (2020) Disabled Student Numbers Report for the year 2019-2020, 7,940,133 students are enrolled in higher education, and 51,647 of them, or 0.65%, are individuals with disabilities. Again, according to the YÖK (2024) Disabled Student Numbers Report for the period 2023-2024, a total of 7,081,289 students are enrolled in higher education, and 57,921 of them, or

0.73%, are individuals with disabilities. As seen in the change in the last five years, there is a numerical increase in the transition of individuals with disabilities to higher education. In light of this information, family support is very important for disabled individuals to continue higher education and to increase their self-confidence. The role of academic staff is as important as the support of families in solving the problems of disabled individuals (Morina and Biagiotti, 2022). However, according to many studies and researches in the literature, although this contribution of higher education to the lives of young people is quite great (Brewer et al., 2023), disabled individuals do not receive sufficient social support at a desired level in their participation and continuation in higher education, they encounter negative social labels, and they experience many difficulties especially in terms of accommodation.

Today, it is stated that individuals with disabilities cannot adequately fulfill the roles of paid employees attributed to them by society. It is said that there is a general perception that disabled individuals cannot do something, cannot manage something and are especially useless. (Singal and Jain, 2012). According to Corby et al. (2022), despite these misperceptions, they state that higher education, in particular, provides learning opportunities for individuals with disabilities as well as enabling them to be included in social life. In this context, it is understood that individuals with disabilities cannot access higher education opportunities at a desired level due to their inclusion in higher education (Groce, 2004; Groce and Kett, 2024). In addition to these, the basic function of education is a very important tool that can adapt the individual to their social life and meet their needs. Another purpose of education is to eliminate the misperceptions such as disabled individuals being inadequate, useless and incompetent (Burcu, 2004). However, according to many studies, it is shown that the negative attitudes and behaviors of university disabled individuals towards disabled individuals within the scope of interaction between non-disabled individuals change positively at university (Méndez et al., 2023). In addition to these, the way non-disabled students perceive disabled students changes thanks to university education, which provides a very good environment for their social interaction to increase and for them to get along with each other (Eker, 2023). Another barrier to disabled young people continuing their university education is the existing structural barriers. As stated in many studies (Sevinç and Çay, 2017), we can talk about the fact that these structural barriers still exist, albeit partially, such as having problems in reaching the campus and faculty building, the lack of suitable accommodation opportunities for disabled individuals or their inadequacy, and the inadequacy of the infrastructure on campus, especially the library and information access, are not at the desired level. In addition to these, according to Bunbury (2020), in addition to structural deficiencies, there are still some problems with the treatment of university staff towards students with disabilities, the availability of appropriate educational materials for them, and young people's access to these materials. In addition to these, Kendall's (2018) study also stated that traditional education is at the forefront in the university life of young people with disabilities and differences are not sufficiently taken into account.

METHODOLOGY

This study employs a systematic approach to examine challenges and opportunities for students with disabilities in higher education. The process involves multiple steps, from data collection to detailed topic analysis. Each step is carefully designed to ensure the reliability and validity of the results. Below is a detailed description of the methodology, aligned with the steps outlined in the Table 1:

Step	Description
Step 1: Data Collection	- **Search Query**: Focused on terms related to disability, higher education, and challenges/opportunities (e.g., barriers, inclusion, policy, assistive technology). -**Database**: Web of Science. - **Initial Data**: Retrieved 5,973 publications targeting titles, abstracts, keywords, and subject categories.
Step 2: Data Processing	- Filtered out irrelevant publications based on language, document type, and publication date (2020–2024). - Removed duplicates, reducing the dataset to 1,935 unique publications.

Step 3: Preprocessing	- Standardized text by converting to lowercase and removing irrelevant metadata (e.g., web links, publisher info). - Tokenized text into individual words and removed stopwords, symbols, and generic terms. - Applied lemmatization and created a document-term matrix (DTM) for analysis.
Step 4: Topic Selection	- Used Latent Dirichlet Allocation (LDA) to identify topics. - Conducted iterative testing to determine the optimal number of topics (K), selecting 13 based on coherence scores.
Step 5: Topic Analysis	- Determined key terms for each topic and calculated topic probabilities across documents. - Labeled topics based on term relevance and expert input. - Visualized topics and identified the top 10 terms representing each topic.

Data collection

The primary data for this research consist of academic publications addressing barriers and opportunities for students with disabilities in higher education. These publications were retrieved using a comprehensive search query: ("disability" OR "disabilities" OR "students with disabilities" OR "inclusive education" OR "special education" OR "accessibility in education") AND ("higher education" OR "university" OR "college" OR "postsecondary education" OR "tertiary education") AND ("barriers" OR "challenges" OR "inclusion" OR "equity" OR "accommodation" OR "policy" OR "assistive technology"). The search was conducted in the Web of Science database (https://www.webofscience.com), targeting titles, abstracts, keywords, and subject categories to ensure comprehensive coverage of relevant literature. Abstracts were specifically included, as they provide concise summaries of research objectives, contexts, results, and implications, which are essential for understanding the scope of the studies.

Initially, the search yielded 5,973 records. The dataset was then refined by applying inclusion criteria to ensure relevance and quality. The criteria included selecting only peer-reviewed journal articles published in English between 2020 and 2024. After applying these criteria and removing irrelevant records, the dataset was narrowed down to 1,935 unique publications. This filtering process involved removing duplicates and excluding publications that did not align with the focus of the research, such as conference papers, editorials, and non-English publications. This systematic approach ensured a high-quality dataset that captures the most recent and relevant research in the field of higher education and disabilities.

Preprocessing, data analysis and topic modeling

To standardize and improve the quality of the dataset, comprehensive preprocessing steps were applied. These steps aimed to eliminate irrelevant and noisy information while ensuring consistency in the corpus. Python's Natural Language Toolkit (NLTK), a widely recognized library for natural language processing tasks, was utilized for this purpose (Bird et al., 2010).

The preprocessing began by converting all text to lowercase to maintain uniformity. Irrelevant metadata, including web links and publisher information, was removed. Tokenization was performed to divide the text into individual words, followed by the elimination of English stopwords (e.g., "and," "the," "is") as well as numerical expressions, symbols, and punctuation. Additionally, generic academic terms such as "article," "research," and "study" were excluded to focus on semantically meaningful content (Gurcan et al., 2021).

Lemmatization was conducted to transform words into their base forms, reducing variations and preserving semantic integrity (Plisson et al., 2004). To identify frequently occurring terms, a unigram-level N-gram model was employed. This step provided insights into co-occurrence patterns within the corpus. The text was then converted into a numerical representation using the "bag of words" method, resulting in a document-term matrix (DTM). This matrix served as the input for Latent Dirichlet Allocation (LDA) topic modeling (Blei, 2012; Karl et al., 2015).

The topic modeling analysis employed the LDA algorithm via Python's Gensim library (Řehůřek & Sojka, 2011). The parameters for the model, including α (document-topic distribution) and β (topic-word distribution), were set to "Symmetric" to ensure an equal likelihood of topics across documents.

An iterative process was conducted to optimize the number of topics (K). Models were tested for K values ranging from 5 to 15, with coherence scores used as the evaluation metric. The optimal K value, determined as the score closest to 0.7, was identified as 13 (0,432) (Blei et al., 2003).

The LDA model calculated topic probabilities for each document and determined the representative terms for each topic. Terms were ranked based on their probabilities within each topic and were used to define topic labels (Ozyurt et al., 2024). The pyLDAvis library (Mabey, 2024) was employed to visualize and interpret the topic distributions, enabling better understanding of term associations and thematic patterns. Topic names were finalized with input from two domain experts, ensuring relevance and clarity.

Finally, the top 10 terms with the highest frequency for each topic were identified. The percentage contribution of each topic to individual documents, the distribution of words within topics, and the overall topic prevalence across the dataset were analyzed to provide a comprehensive understanding of the thematic structure.

FINDINGS

The findings from the Latent Dirichlet Allocation (LDA) analysis are summarized in the Table 2 below. The table highlights the identified topics, their associated terms, and the percentage of the dataset each topic represents. These topics reflect a range of themes related to disability and higher education, including inclusive education, health-related interventions, and specific support programs for students with disabilities.

topic no	topic name	topic terms	perc
2	Inclusive Education and Student Support	student | disability | education | university | inclusive | higher | inclusion | learning | support | need	40,49%
1	Diversity and Equity in Higher Education	education | health | policy | inclusion | higher | diversity | equity | disability | university | inclusive	22,57%
3	Clinical Aspects of Disability	patient | disorder | injury | child | disability | factor | clinical | risk | age | medical	8,10%
8	Teacher Training for Inclusive Education	education | teacher | student | program | inclusive | service | special | university | training | need	6,53%
7	Health and Social Interventions for Adults with Disabilities	disability | intervention | health | social | university | participant | adult | patient | support | data	4,13%
12	Healthcare and Physical Activity for Disabled Individuals	patient | care | health | physical | disability | participant | activity | disease | group | hospital	2,98%
6	Academic Support for Disabled Students in STEM	student | disability | library | service | stem | college | education | employment | veteran | academic	2,87%
13	Experiences of Students with Intellectual Disabilities	disability | student | experience | university | intellectual | education | social | learning | college | self	2,87%
5	Health, Gender, and Violence Among Disabled Women	health | sexual | participant | exercise | woman | disability | violence | group | assessment | university	2,51%
4	Autism Support Programs in Education	autistic | autism | adult | education | dot | center | student | child | social | program	2,30%
10	Pain Management and Rehabilitation in Disabilities	patient | pain | group | score | disability | treatment | shoulder | surgery | mean | criterion	2,14%
9	Accessibility Policies in Higher Education	disability | education | disease | policy | social | health | higher | access | accessibility | visual	1,88%

11	Therapeutic Interventions for Developmental Disabilities	nick | therapy | social | hour | significant | intervention | hallucination | developmental | regarding | parent	0,63%

The topic modeling analysis reveals a comprehensive landscape of themes and trends related to disability and higher education. The most prominent topic, "Inclusive Education and Student Support," represents 40.49% of the corpus, emphasizing the critical focus on fostering inclusive environments and providing necessary support systems for students with disabilities. Similarly, "Diversity and Equity in Higher Education," accounting for 22.57%, highlights efforts to promote fairness and equitable access to education, reflecting the broader themes of diversity and inclusion policies within academic institutions.

Specialized topics, such as "Clinical Aspects of Disability" (8.10%), focus on the medical and health-related dimensions of disability, particularly concerning disorders, injuries, and risk factors in patients and children. Another significant theme, "Teacher Training for Inclusive Education" (6.53%), underscores the need to equip educators with the skills and knowledge required to support students with disabilities effectively, indicating a commitment to capacity building within academic staff.

Health-related themes are also prevalent, with topics like "Health and Social Interventions for Adults with Disabilities" (4.13%) and "Healthcare and Physical Activity for Disabled Individuals" (2.98%), reflecting the intersection of health, social support, and education. A niche but vital topic, "Health, Gender, and Violence Among Disabled Women" (2.51%), explores challenges unique to disabled women, including vulnerability to violence and barriers to accessing essential health services.

Education-specific topics further highlight the importance of tailored support systems. For example, "Academic Support for Disabled Students in STEM" (2.87%) focuses on the unique needs of students pursuing STEM fields, while "Experiences of Students with Intellectual Disabilities" (2.87%) delves into the personal and social challenges faced by this demographic. Similarly, "Autism Support Programs in Education" (2.30%) reflects efforts to provide specialized interventions for students with autism.

Accessibility and policy-oriented topics, such as "Accessibility Policies in Higher Education" (1.88%), emphasize the need for institutional strategies to ensure equitable resource allocation and access. Meanwhile, clinical topics like "Pain Management and Rehabilitation in Disabilities" (2.14%) and "Therapeutic Interventions for Developmental Disabilities" (0.63%) explore the medical and rehabilitative aspects of disability, addressing physical and developmental challenges.

Overall, the analysis underscores a strong emphasis on inclusion, equity, and support, revealing the multidimensional nature of disability research. While some topics dominate the discourse, others represent emerging or specialized areas that warrant further investigation. These findings provide valuable insights for stakeholders, including researchers, educators, and policymakers, to enhance support systems and drive progress in creating inclusive and accessible higher education environments. The PyLDAvis visualization is provided below, and upon examining the Figure 1, it becomes evident how the identified topics are distributed and interconnected, highlighting their relevance and prevalence within the dataset.
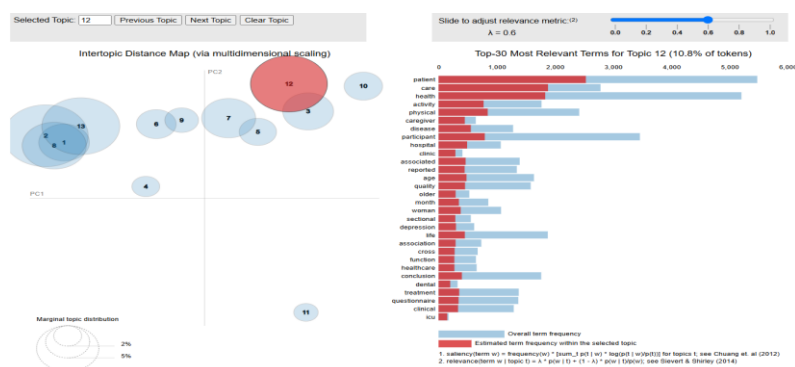
The PyLDAvis visualization provides a detailed and interactive analysis of the topics identified in the dataset. On the left panel, the intertopic distance map shows the relationships between the topics,

illustrating how similar or distinct they are. One of the most prominent topics, "Healthcare and Physical Activity for Disabled Individuals," is highlighted as a distinct and significant area, occupying a large portion of the map. Its size indicates a high prevalence within the dataset, reflecting its importance. Other topics, such as "Inclusive Education and Student Support" and "Diversity and Equity in Higher Education," are positioned closer to one another, suggesting thematic overlaps related to accessibility and inclusion. In contrast, "Therapeutic Interventions for Developmental Disabilities" is placed farther from the rest, indicating a more specialized focus within the corpus.

On the right panel, the top 30 most relevant terms for "Healthcare and Physical Activity for Disabled Individuals" are displayed. Key terms such as "patient," "care," "health," "activity," and "physical" dominate the topic, highlighting its focus on healthcare and the physical well-being of disabled individuals. Additional terms like "hospital," "disease," and "clinic" reinforce its clinical and healthcare-oriented nature, while words such as "depression," "quality," and "age" suggest considerations related to mental health, aging, and overall quality of life. These terms provide a comprehensive understanding of the specific themes within this topic.

The relevance metric (λ), set at 0.6, balances exclusivity and frequency to display terms that are both highly relevant to the topic and significant within the overall corpus. This balance ensures that the terms are representative of the topic without losing contextual importance.

The marginal topic distribution in the bottom-left corner highlights the prevalence of each topic across the dataset. "Healthcare and Physical Activity for Disabled Individuals" is among the most significant topics, while smaller, specialized themes like "Therapeutic Interventions for Developmental Disabilities" contribute less but still hold importance within their niche areas.

Overall, the visualization underscores the significance of topics such as healthcare, inclusion, and equity in the research on disability and higher education. It also illustrates the diversity of themes, ranging from broad issues like inclusive education to more specific areas such as health interventions and therapeutic approaches. These insights provide a nuanced understanding of the dataset, enabling stakeholders to identify key areas for further exploration and actionable outcomes.

DISCUSSION AND COMMENTS

Individuals with disabilities face various difficulties in the higher education process and sometimes solving these difficulties can be quite complex. It is possible to systematically examine the current situation in order to address the difficulties and solution suggestions that individuals with disabilities face in the higher education process from a multidimensional perspective. As a result of the research, it has been determined that individuals with disabilities face significant problems related to inclusive education, support systems and structural barriers. In particular, the inadequacy of campus infrastructure, lack of compatible accommodation opportunities and the attitudes of the teaching staff are among the main problems that stand out. These problems become more difficult with sub-dimensions such as inappropriate and inadequate teaching materials, missing social support mechanisms and physical deficiencies (Martin,2013).

In addition, the findings obtained from the study show that disabled individuals face and struggle with prejudices and social perceptions both in higher education environments and in their social lives. These perceptions can negatively affect the academic or social success and social relations of disabled individuals. In response to this situation, it is very important to disseminate inclusive education policies and awareness campaigns, inform academics, and create institutional awareness. Many studies emphasize that inclusive education positively affects the academic and social success of disabled individuals, and increases their social relations and self-confidence. In addition, considering that disabled women in particular face double disadvantages such as violence and discrimination, creating special support mechanisms for disabled women in terms of ensuring gender equality will prevent problems from becoming more chronic.

In order to improve the quality of life of individuals with disabilities and make education processes more accessible, higher education institutions, ministries of education, relevant public institutions and civil society organizations should look at the problems holistically and take the necessary measures. In this context, making campus infrastructures more accessible for individuals with disabilities, providing access to campus environments for individuals with disabilities, providing appropriate accommodation opportunities, providing social support and creating educational

materials and environments for individuals with disabilities and creating an egalitarian ecosystem should be prioritized(Amoah et al,2023). The inclusive and supportive communication of academics, administrators, students and other personnel in the higher education environment with individuals with disabilities can be a solution to the problems that will be experienced.

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