Digital Learning Platforms for Students with Disabilities: A Technology-Driven Approach

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Abstract

The use of digital learning platforms has grown as a way to provide technology-based, flexible learning to students, but research is needed on the effectiveness of teaching using digital learning platforms to students with disabilities. This article uses the Open University Learning Analytics Dataset to investigate the digital engagement and academic results of students with and without disability. A quantitative secondary data design was used, and the student demographic records, virtual learning environment activity, assessment performance and final academic outcomes were analyzed. The primary grouping variable was disability status and measures of engagement included total clicks, active learning days, and interaction with online learning resources. Differences in platform engagement, assessment performance, pass rates, failure rates, withdrawal rates and successful or at-risk outcomes were identified for descriptive and comparative analyses. The findings suggest that students who are disabled had fewer days of engagement on the platform, fewer days of active learning, slightly lower assessment scores, and higher rates of withdrawal compared to students who are not disabled. The analysis revealed a correlation between greater use of the digital learning platform and improved academic results. Students who did well and Pass students performed better in terms of mean clicks and active learning days, compared to students who failed or withdrew. Based on these finding, it can be inferred that digital learning platforms can be valuable tools in academic risk detection and in inclusive education. But digital access is not sufficient, platforms must be accessible, responsive and must receive timely interventions. The study adds to the field of special education by showcasing the importance of learning analytics in enhancing support for students with disabilities in an online learning setting.

Keywords: Digital learning platforms; Students with disabilities; Learning analytics; Inclusive education; Academic outcomes

1. Introduction

Digital learning platforms have taken a place of paramount importance in today's learning context, particularly in distance learning and higher education. They offer students access to learning content, online assessments, feedback, communication and academic support. Learning isn't confined to classroom walls: students engage with learning content in virtual learning environments, via online materials, in discussion spaces and in online assessment systems. The digital learning platform can be an opportunity for students with disabilities to access flexibly, reengage with learning materials, and participate academically in a personalized way. But these opportunities are contingent on the accessibility, usability, and responsiveness of platforms to the needs of learners.

Digital technologies have transformed how students and teachers communicate, collaborate and share academic information. In the educational landscape, social media and digital communication tools can be used to facilitate engagement, knowledge sharing, and interaction beyond the boundaries of the classroom (Alamassi et al., 2023). Relevance to digital learning platforms: Student engagement is not just a function of access to content, but opportunities for communication, participation, and ongoing interaction as well. Digital tools can enhance students' affiliation with learning activities and their capacity to stay engaged in learning activities when used effectively.

Digital learning has been opened up by the advent of Artificial Intelligence. Systems can be supported by AI to help with personalization, adaptive learning paths, automated feedback, and individualized suggestions. In the context of digital learning, these can aid in the early detection of learning issues and offer individualized support for students. AI integration studies have also demonstrated the ability to enhance learning experiences, however, there are accessibility, usability, and implementation challenges that must be addressed for successful integration (El Zaatari et al., 2024). It is paramount that these issues are considered and that platforms are developed and designed in ways that are inclusive to students with disabilities.

The recent advances of learner profiling and personalization also demonstrate the potential of using technology to gain insights into student performance and to provide personalised learning experiences. The use of virtual and immersive learning environments to accommodate learners' profiles and facilitate personalized learning is being investigated (Alaoui et al., 2026). Such technologies have great potential, but their contribution to special education is dependent upon their inclusion promoting contribution and not only on technological complexity. For students with disabilities, personalisation is not limited to changing the level of difficulty of the content but is also characterized by accessible design, flexible participation and timely support.

Teachers' readiness to adopt digital platforms and include them in teaching also plays an important role in the use of the e-platform. It requires teachers to have the necessary skills to use digital tools, understand students' engagement with their work, and offer support when they have challenges with it. Teacher preparation and the utilization of technology, thus, are crucial in digital education, especially if digital platforms are utilized in order to serve various learners (Alamassi and Alsuwaidi, 2023). In special education, the prior mentioned components of teacher readiness are of even greater significance, as students with disabilities might be in need of individualized instruction, accessible materials, assistive tools and individualized support. Even high-tech online tools can be ineffective for learners with disabilities if they are not prepared for disability use.

Learning analytics provides an approach for studying digital learning platforms. It analyzes student data to gain insight into student engagement, academic growth, and potential risk patterns. Ifenthaler and Yau (2020) conducted a systematic review of the use of learning analytics in the context of study success in higher education, highlighting the need to use LAs as a

means to interpreting student data and enhancing learning processes. This paves the way for the significance of learning analytics in studying how students with disabilities interact differently with the digital platforms and how their interaction pattern relates to the outcomes of learning.

Digital engagement can be assessed through non-intrusive metrics like number of clicks, number of days spent learning online, and interactions with online resources. This information can be used to gain insights into the role students play in online learning beyond what is gained from surveys or self-reports. Caspari-Sadeghi (2022) described how learning analytics can be used to monitor student engagement in online learning by tracking digital traces of student learning activities. This is appropriate for this study, as it would allow a comparison of what the platform actually does when exposed to the students' groups.

As digital learning platforms gain in use, a greater number of students with disabilities are using them, but there is a need for more evidence regarding how students with disabilities interact with digital learning platforms and the relationship between student interactions and academic outcomes. While numerous studies have addressed the overall impact of edtech, fewer have studied disability status, digital engagement, assessment performance, and ultimate academic outcomes as a single construct for analysis. The present study aims to fill this void by investigating digital learning platform engagement with students with and without disabilities in the context of the Open University Learning Analytics Dataset. This study focuses on disability status, engagement with VLE activities, assessment performance and final academic outcomes. The goal of the article is to help in the provision of inclusive digital education based on evidence and technology by identifying these patterns.

2. Literature Review

The digital learning platforms are integral to 21st century learning, especially in online, blended and distance learning contexts. Students can view learning materials, take assessments, interact with teachers, engage in learning activities and get feedback via these platforms and virtual systems. In addition to these capabilities, digital platforms also collect vast amounts of student interaction and learning information. This information can be utilized to gain insight into student use of learning resources and relationship between use and achievement. Digital learning platforms can provide flexibility of access and personalized support to students with disabilities, but these platforms need to be accessible, usable, and responsive to a range of disability needs.

The idea of learning analytics is one of the significant ways to analyze students' behavior in online learning. It is about leveraging learning data to know student engagement, participation, performance and student academic risk. Kew and Tasir (2022) found that the learning analytics in OL are generally of student-related data like engagement, achievement, interaction, participation, learning behavior etc. This is obviously relevant to this current study given that the analysis relies on platform-based indicators, such as the number of clicks, number of days of active learning, assessment scores and final results. These indicators will assist in understanding student involvement in a digital learning environment and if there is a disparity between student engagement with and without disabilities.

Increasing engagement is essential to digital learning success. The level of engagement in an online learning platform can be measured by the number of clicks, utilization of learning materials, active learning days, submission of assessments, and participation in virtual learning activities. In a virtual learning environment, Jawad et al. (2022) investigated students' academic performance and predicting their engagement based on the random forest and data balancing approaches. Their research demonstrates that digital platform engagement can be leveraged to gain insight into students' engagement and to predict academic outcomes. This supports the use of clickstream and assessment data in this article to explore

digital participation and academic outcomes of students with disabilities.

Learning analytics can also be used for enhancing academic support in higher education. Systematically analysing platform data will enable institutions to identify pupils at risk of failure or withdrawal, of low attainment, and so on. Ouyang et al. (2023) presented that combining the artificial intelligence (AI) performance prediction with learning analytics (LA) can enhance students' learning in online learning. This indicates that digital engagement information can be used to inform academic interventions in a timely fashion and inform instructional decision making. For students with disabilities, this is particularly relevant because if a student is not meeting the expected standards or is not engaged in class activities, this could signal that the student is in need of more responsive or accessible support, and could be identified early.

In special education, the use of learning analytics is an important area of research that needs to be explored in an inclusive context. Students with disabilities may have different experiences with online learning due to accessibility issues, usability issues, limited support, and/or lack of platform usability to meet diverse learning needs. Khalil et al. (2024) discussed learning analytics and disabled students, and highlighted the potential for learning analytics to help promote equitable participation if applied appropriately and sensitively with regards to inclusiveness. Their research is significant for the current study, as it brings direct linkage between learning analytics and disability and inclusion into the context. Learning analytics can be used to recognize the difference in engagement or outcomes that might be a result of disability and may need institutional support, as well as disability as a demographic variable.

AI is also becoming a more and more intertwined aspect of inclusive digital education. Adaptive learning, personalized recommendations, feedback and early identification of student needs can be facilitated with the support of AI-based systems. In an article published by Melo-López et al. (2025), the effect of AI on inclusive education was examined and its potential for enhancing accessibility, personalisation and inclusion in education was mentioned. This lends credibility to the concept that there is more to the use of technology for education than just prediction.This adds weight to the idea that technology-based learning must not only be about prediction, but also about minimizing barriers and enhancing participation among a wide range of learners. AI-powered analytics can be used in digital learning platforms to uncover trends that might not be apparent.

AI, in particular, has applications for students with disabilities in the field of education. Paglialunga and Melogno (2025) conducted a study on artificial intelligence interventions for students with learning disability and concluded that AI tools can be used as a support to targeted learning support. In the context of this article, it relates to the need for systems that are able to recognise risk patterns, and offer appropriate academic assistance to students with disabilities. But these systems need to be well designed to meet the needs of learners while avoiding the problem of labelling or restricting learners according to disability status.

The literature suggests that digital platforms for learning, learning analytics, and tools that are based on artificial intelligence can enhance student engagement, academic monitoring and inclusive education. The literature also reveals that technology is not a key factor in ensuring inclusion. Students with disabilities might need accessible platforms, appropriate support in time, as well as interventions based on the data that meet their learning needs. While existing studies support the use of digital engagement and assessment data to inform understanding of online learning, further studies are needed that directly compare student engagement and performance of students with and without disabilities with digital engagement and outcomes in relation to learning. The present study fills this gap by analyzing disability status, digital learning engagement, test performance and outcomes in a virtual learning environment.

3.Methodology

3.1 Research Design and Approach

The study design was quantitative secondary data research, which was used to examine the use of digital learning platforms among students with disabilities. The study involves analyzing existing educational data from students' background, online learning activity, assessment performance, registration information, and academic outcomes, hence the learning analytics approach was used. This method can be used to uncover trends in digital learning participation and success without gathering fresh primary data. The primary aim was to compare students with reported disabilities with students without reported disabilities and to explore the association of involvement in the virtual context with achievement.

3.2 Data Source and Dataset Description

The data used in this study was obtained from the Open University Learning Analytics Dataset (OULAD) that offers data for online learning platforms, including student demographics, course information, interactions in the virtual learning environment, records of assessments, registration details and final academic outcomes (Anil, 2020). Demographic and academic variables like gender, region, highest education level, age band, socioeconomic deprivation band, studied credits, disability status and final result are included.

3.3 Study Variables and Feature Construction

In this data, the primary grouping variable was disability status with "Y" and "N" being coded. Students were coded "Y" if they were students with disabilities and "N" if they were students without disabilities. The final academic outcome was the main outcome variable, represented by distinction, pass, fail, and withdrawn. The total number of clicks, number of active learning days, average number of clicks per day of active learning, and number of online resources accessed variables for digital learning were generated from the studentVle file. Academic performance variables were generated from the assessments files such as the number of assessments submitted, average scores, weighted scores, and when assessments were submitted. Other factors included were gender, age band, education level, deprivation band, region, studied credits, course module and presentation period.

3.4 Data Preparation and Integration

Data preparation entailed checking for any missing values, duplicity of data, inconsistencies in identifiers, and formatting problems in all data files. Common fields used were id_student, code_module, code_presentation, id_site and id_assessment. Clickstream data from the virtual learning environment was aggregated at the student-course level to generate easy-to-interpret engagement indicators. Summary of assessment records was also carried out to generate student-level performance indicators. Demographic data, disability status, online platform engagement, assessment performance, registration data, and academic outcome were included in the final analytical data set following the processes of merging and aggregation.

3.5 Data Analysis

The data analysis conducted in three simple stages. Descriptive data of the data was summarized using descriptive statistics. Categorical variables (disability status, gender, education level and final result) were expressed as frequencies and percentages. For numerical variables (e.g., Clicks, Active Learning days, assessment scores, studied credits), means and medians were used. Secondly, a comparative analysis was performed to explore differences between students with disabilities and students without disabilities. The focus of this comparison was on engagement with online platforms, assessment performance, pass rates, fail rates, withdrawal rates, and distinction rates. Finally, the association between digital engagement with academic outcomes was explored to determine if there was a relationship between these two variables. The findings were analysed to determine possible areas of improved academic support for students with disability through the use of digital learning platforms.

4. Results

4.1 Descriptive Statistics

Descriptive statistics indicated that the number of students with disabilities were 9.71% and the number of students without disabilities were 90.29% of the total. As can be seen from the final result distribution, pass was the highest category followed by withdrawn, fail and distinction. Table 1 shows that there has been variation in the digital platform engagement of students, with the mean total clicks and active learning days displayed.

Table 1: Descriptive Statistics of Study Variables

Variable	Frequency / Mean	Percentage / Median
Students without disability	29,429	90.29%
Students with disability	3,164	9.71%
Distinction	3,024	9.28%
Pass	12,361	37.93%
Fail	7,052	21.64%
Withdrawn	10,156	31.16%
Total clicks	1,215.15	596.00
Active learning days	55.48	40.00
Assessment score	75.78	79.50
Studied credits	79.76	60.00

4.2 Comparative Analysis by Disability Status

For students with disabilities, the mean total number of clicks, the number of days of active learning, and the mean scores on assessments were significantly lower than for students without disabilities. They also failed to achieve as well as students who did not have disabilities. Their withdrawal rate was, however, higher (Table 2) which reflects high level of academic risk.

Table 2: Comparative Analysis of Students with and Without Disabilities

Disability Status	Mean Total Clicks	Mean Active Days	Mean Assessment Score	Distinction	Pass	Fail	Withdrawn
Without disability	1,235.25	56.14	76.01	2,801 (9.52%)	11,377 (38.66%)	6,340 (21.54%)	8,911 (30.28%)
With disability	1,028.13	49.34	73.60	223 (7.05%)	984 (31.10%)	712 (22.50%)	1,245 (39.35%)

4.3 Digital Engagement and Academic Outcome

Active learning days and mean total clicks were highest for students who distinguished, followed by those who passed. There was significant lower engagement level among students who failed or withdrew. As seen in Table 3, this suggests that increased use of digital platforms was correlated

with improved academic results. As seen in Figure 1, students who earned the distinction and pass had higher mean total clicks and active learning days, whereas those who failed or withdrew had less engagement.

Table 3: Digital Engagement and Assessment Performance by Final Academic Result

Final Result	Mean Total Clicks	Mean Active Days	Mean Assessment Score
Distinction	2,666.76	110.04	88.49
Pass	1,921.81	87.04	76.16
Fail	651.85	33.18	52.51
Withdrawn	313.95	16.29	29.50

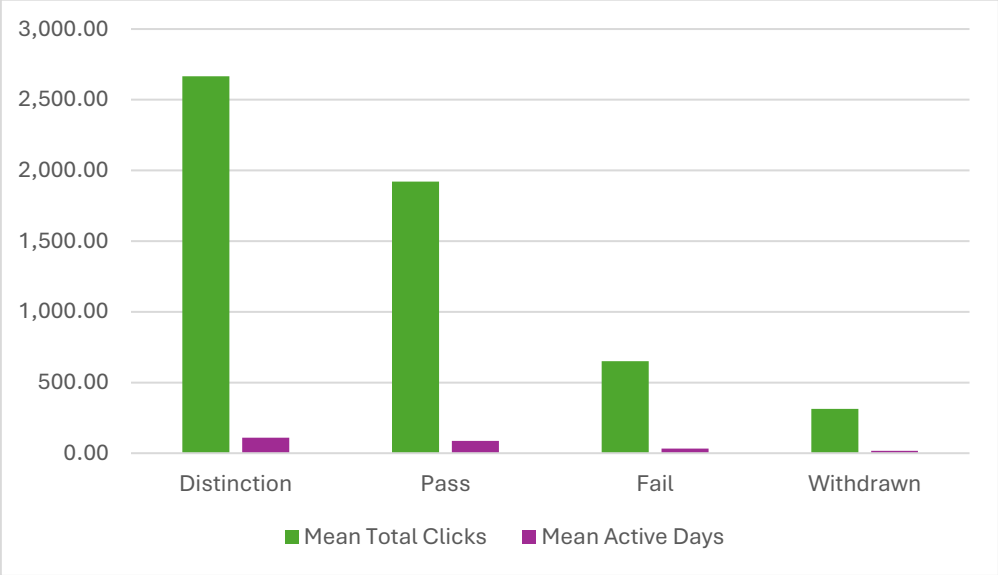

Figure 1: Digital Engagement by Final Academic Result

4.4 Successful and At-Risk Outcomes

Distinction and pass were combined into successful outcome group and fail and withdrawn into at risk outcome group. Students with disabilities were less likely to be successful than students without disabilities. They also had a higher rate of at-risk outcomes, indicating that there is a need for better academic support in digital learning platforms as indicated in Table 4. Figure 2 indicates that students with disabilities had a lower percentage successful outcome and a higher percentage at-risk outcome when compared to students without disabilitie

Table 4: Successful and At-Risk Outcomes by Disability Status

Disability Status	Successful Outcome	Successful %	At-Risk Outcome	At-Risk %
Without disability	14,178	48.18%	15,251	51.82%
With disability	1,207	38.15%	1,957	61.85%

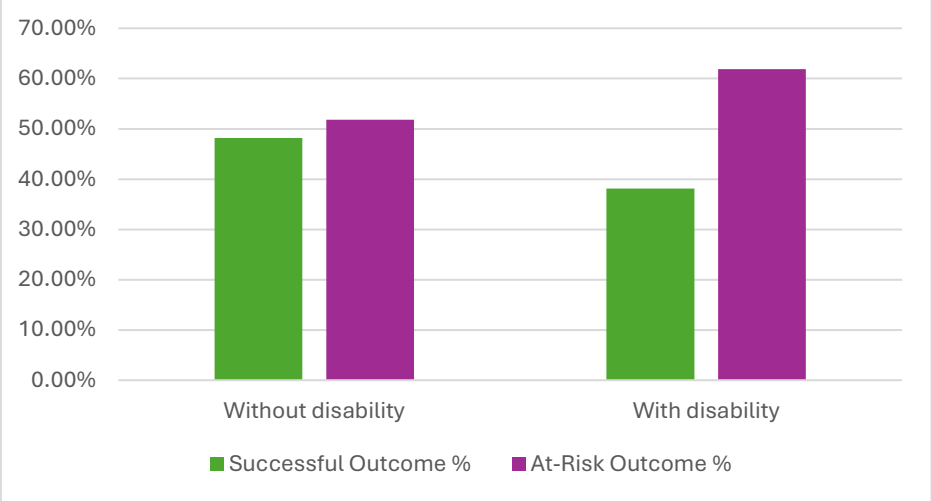

Figure 2: Successful and At-Risk Outcomes by Disability Status

5. Discussion

Digital learning environments are increasingly being called upon to enable inclusive education through support with flexibility, online resources, communication and academic support. These platforms hold great promise to lessen barriers and enhance disability participation for students with disabilities. Their effectiveness is dependent on other factors such as accessibility and usability, engagement and timely intervention. In the present study, these issues were explored by comparing the engagement in digital learning and learning outcomes for students with and without disabilities.

Students with disabilities had fewer mean total clicks and fewer active learning days than their non-disabled peers, indicating that the former were less likely to be part of the virtual learning environment. The difference should not be attributed entirely to low motivation of the learners. In a digital learning context, decreased engagement can also be related to accessibility challenges, usability of the systems, lack of help or guidance, and usability of online learning materials. Therefore, digital learning platforms should be assessed in terms of access to platforms as well as effective participation of learners with disabilities.

Additionally, the results indicate that students with disabilities had slightly lower assessment scores, lower pass rates, and higher rates of withdrawal from school. The pattern shows that the students with disabilities had a higher risk of academic risk in the online learning environment. This is especially significant since withdrawals can be the culmination of a series of problems that occur during the learning process (e.g., lack of engagement, poor access to resources, difficulty with timely assistance, difficulty with assessments etc.). Digital platforms should incorporate more comprehensive supports for early identification and support for students who are on the verge of disengaging.

The academic outcome was found to be significantly related to the engagement level with digital platforms. Students who graduated with distinction or pass showed higher mean total clicks and their active learning days were more compared to the students who failed or withdrew. This implies that digital engagement could be an effective metric to assess academic development. The importance of using data-driven approaches to assess student engagement in the virtual learning environment was highlighted by Solé-Beteta et al. (2022). The clickstream indicators (total clicks and active learning days) in the current study highlighted the relationship between student participation and academic outcomes.

AI can enhance the application of digital learning platforms by enabling teachers to detect students who may require academic support. From the

students' perspective, Shater et al. (2023) emphasized the importance of AI in the field of education, especially when it comes to helping learners learn and enhance their educational experiences. With reference to the current results, technology that uses AI could be used to identify lack of participation, missed evaluations, and performance drop off for students with disabilities. But, the use of these systems should be done carefully. AI should not be used to marginalize learners with disabilities as weak learners, but to pinpoint obstacles and act swiftly to support learners.

The results also underscore the need for communication and interaction in a digital learning environment. The online environment is not just a place to find learning resources, it is a place for discussion, collaboration, feedback and student-teacher communication. Taha et al. (2025) described the social media as an important part in higher education learning in supporting communication and engagement. Users of a disability can gain more from participation and less from isolation by using accessible communication tools. Thus, digital learning platforms should ensure the presence of an inclusive discussion feature, an easy-to-use messaging system, and flexible communication features to enable all students to participate effectively.

Support for inclusive education through digital learning platforms may be provided if the performance data of the platform helps to direct intervention. Reduced clicks, less active days and poor performance on assessments are early signs of academic risk. The indicators are designed for use by educators and institutions to identify students who might need extra academic support, learning resources, and special attention. But the ability of teachers to interpret engagement patterns and respond to them is important for the successful use of these data. This requires teacher readiness in order to make the platform information relevant to learning.

6. Conclusion

Digital learning platforms have great potential to contribute to inclusive education as they offer flexible access, learning resources, assessment, communication and support for learning for diverse learners. The analysis revealed that students with disabilities did not have as high a platform engagement, increased number of active learning days, assessment scores, or decreased level of withdrawal compared to students without disabilities. These findings show that access to digital technologies is not enough to guarantee inclusiveness in learning. Students with disabilities may need academic, technical, and instructional accommodations to have an effective learning experience online. There was also a positive link between digital engagement and academic achievement. Students who recorded distinction or pass had more number of total clicks and active learning days, whereas students who recorded fail or withdraw had fewer number of total clicks and active learning days. This implies that platform activity may be indicative of academic progress and risk, at an early stage. The results show the significance of creating digital learning platforms that are inclusive and responsive. Learners' engagement data can be used to enhance the monitoring of the learner, to increase access, and to offer targeted support to learners with disabilities. Future research into enhancing the support of diverse learners through digital platforms could incorporate learning analytics and accessibility data and student experiences.

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