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STUDENT EXPERIENCES WITH DIGITAL LEARNING OBJECTS IN HIGHER EDUCATION: A QUALITATIVE STUDY

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ABSTRACT

Objective: This study aims to explore university students' experiences and perceptions of using Digital Learning Objects (DLOs) in a distance-learning environment, particularly in supporting independent, interactive, and flexible learning.

Research Design & Methods: This study employs a qualitative research design using in-depth interviews and focus group discussions with students at the Open University. Data were analyzed using thematic analysis to identify patterns related to usage, perceived benefits, challenges, and adaptive strategies in interacting with DLOs.

Findings: The findings indicate that DLOs enhance learning flexibility, accessibility, independent learning, and digital literacy. However, students also face challenges such as technical issues, suboptimal pedagogical design, low motivation, and varying content quality. These challenges are addressed through adaptive strategies. The study also finds that learning experiences are influenced by individual characteristics and contextual factors. A conceptual model is developed, highlighting the interconnection between access, engagement, competence, motivation, and learning outcomes.

Contributions: This study provides practical insights for educators, instructional designers, and policymakers in integrating DLOs into higher education. It emphasizes the importance of student-centered and contextually relevant approaches to improve engagement, autonomy, and learning outcomes.

Novelty: This study offers a comprehensive conceptual model that captures the multidimensional interaction between technological, individual, and contextual factors in DLO-based distance learning, which has been limited in previous research.

Keywords: Digital Learning Objects, Virtual Learning, Blended Learning

JEL codes: I21, I23, O33

Article type: research paper

INTRODUCTION

The development of educational technology over the past decade has transformed traditional learning spaces into broader digital learning environments, in which digital learning objects (DLOs) have become integral to the learning ecosystem. The COVID-19 pandemic has accelerated this process and confirmed the need for shared digital learning spaces that combine the digitization of education and the digitization of materials/disciplines a phenomenon known as the digital learning space. The implications of this transformation require further study on how students experience and interpret their interactions with digital learning resources in the context of higher education (Bygstad et al., 2022).

Digital learning objects are defined in the literature as reusable digital units/fragments that support learning objectives, ranging from short e-tutorials to complex interactive modules. Frequently cited advantages include the ability to reuse, on-demand access, and flexibility of use for self-directed learning or face-to-face learning assistance. However, conceptual aspects of granularity, context of use, and the relationship between pedagogical design and technical affordances remain important research issues (Wills & Pegler, 2016).

Several empirical studies show that students appreciate DLOs that are well integrated into the curriculum because they facilitate material review, just-in-time learning, and digital skills development; however, technical issues (e.g., browser compatibility, audio quality, internet connection) and unresponsive design can interfere with engagement and learning experiences. Case studies on e-tutorials and e-learning indicate that students prefer blended learning models; they consider DLOs useful as supplements rather than replacements for full-face-to-face learning. Findings by McGuinness and Fulton (2019) emphasize the importance of conducting qualitative research on student experiences to understand the nuances of motivation, barriers, and the context of use.

A systematic study of the development and use of DLO highlights the need for a collaborative approach among actors (lecturers, librarians/IT staff, instructional designers) to ensure that DLO is not only available but also contextual and readily accessible to students. Attention to instructional design, curricular integration, and technical support are key factors that influence the effectiveness and user experience of DLO in higher education institutions. Therefore, qualitative studies that explore student experiences through in-depth interviews or focus group discussions—are highly relevant for providing actionable insights for practitioners and education policymakers.

Based on the above background, this study will explore in depth how students experience, assess, and interpret the use of digital learning objects in the context of their study programs, to produce design recommendations and user-centered (student-centered) integration practices. A qualitative approach was chosen for its ability to capture the variety of experiences, perceptions, and roles of educational actors in digital literacy and learning practices.

LITERATURE REVIEW

Digital Learning Objects

Digital learning objects are collections of materials systematically designed and organized to achieve specific competencies in the educational process. All content is stored in a format. The development of educational technology has transformed traditional learning spaces into digital environments, with digital learning objects (DLOs) as essential components that support independent, interactive, and flexible learning. DLOs offer on-demand access, flexibility, and potential for integration into various learning models, including blended learning. However, conceptual issues such as granularity, context of use, and electronic connections can be presented across multiple multimedia formats, including text, images, interactive graphics, animations, audio, and video, thereby enriching the learning experience and increasing the effectiveness of material delivery. The main advantage of digital learning objects lies in their accessibility: they can be downloaded or accessed via online repositories and integrated with learning management platforms, allowing learners to study without constraints of time or space. In addition to being self-contained, these objects can be combined with other digital components to form a more comprehensive and adaptive learning sequence aligned with user needs, thereby supporting personalized learning and improving the effectiveness of instructional objectives (Ruiz et al., 2006).

Digital Learning Objects (DLOs) are technology-based learning materials developed in small, independent, and modular units, designed to be used flexibly, repeatedly, and independently by teachers and students across various learning contexts. As the most granular unit of content directly linked to a specific learning objective, DLOs can contain multiple types of media ranging from instructional videos, interactive simulations, infographics, digital quizzes, podcasts, text-based modules, to augmented reality elements as long as the content supports the achievement of the specified instructional objectives. The modular nature and reusability of DLOs enable their dynamic integration into larger learning designs, like assembling puzzle pieces to form a complete, efficient, and adaptive set of materials tailored to curriculum needs. With clear information structures and metadata, DLOs are also easy to manage, archive, locate, and distribute across various digital platforms. This understanding is in line with Mikropoulos and Papachristos (2021) description of DLOs as independent learning experience units that can be rearranged in multiple instructional contexts.

Digital learning objects are an essential foundation for blended learning, in which face-to-face interaction is combined with digital technologies to create a more effective and flexible learning experience, with the potential to reduce operational costs. The integration of various multimedia elements such as text, visuals, audio, and animation—enables students to tailor the learning process to their individual learning styles, thereby increasing motivation, engagement, and academic achievement. Additionally, its structured and digitized characteristics enable educators to measure various aspects of learning, ranging from student responses and knowledge development to skills, attitude changes, and behavior, in a more systematic and accessible manner during the learning evaluation process (Ruiz et al., 2006).

The development and integration of digital learning objects are now key elements of the digital transformation in education, given their role in creating learning that is more interactive, engaging, and aligned with the demands of the technological era. Through the use of multimedia and digital innovations, the learning experience not only becomes richer but also encourages the development of students' digital literacy and skills, which are essential for navigating the dynamics of the 21st century. These changes also require adjustments to the curriculum, updates to pedagogical methods, and improvements in teacher competence so that the implementation of digital-based learning can operate optimally and consistently across all levels of education. These efforts provide an essential foundation for ensuring that the digital transformation of education is sustainable and meets today's learning needs (Klave & Cane, 2024; Siringoringo & Alfaridzi, 2024).

Virtual Learning

Virtual learning is an educational approach that uses digital and immersive technologies to create learning experiences that are not constrained by space or time, enabling students to access content remotely and interactively. This technology integrates virtual reality (VR), augmented reality (AR), and mixed reality (MR),

significantly expanding learning beyond traditional physical classrooms. In higher education, the integration of AR and VR has demonstrated the potential to increase student engagement, deepen understanding of complex concepts, and enhance experiential learning through simulations and immersive 3D environments, thereby significantly improving learning motivation and knowledge retention compared with conventional approaches (Llanos-Ruiz et al., 2025).

Recent systematic research shows that the use of AR and VR in higher education not only supports the visualization of abstract concepts but also facilitates active engagement, collaborative learning, and 21st-century skills such as critical thinking and problem-solving. For example, a systematic review of VR in higher education links this technology to increased student engagement, conceptual understanding, and accessibility of learning across various disciplines, while also demonstrating its contribution to the Sustainable Development Goals (SDGs) related to access to quality education (SDG 4) (Llanos-Ruiz et al., 2025). Furthermore, a meta-analysis of AR in higher education indicates that this technology offers unique affordances by combining real-world and digital elements, thereby enriching instructional design and fostering more contextual and interactive learning experiences (Li et al., 2025).

In the scientific literature, virtual learning is considered a transformative approach that uses VR, AR, and MR technologies to create immersive, experiential learning environments, with positive effects on collaboration, communication, learning attitudes, and academic performance, particularly in formal education. Although it offers considerable potential to expand and enrich the teaching process, virtual learning still faces significant challenges, including high implementation costs, infrastructure limitations, and the complexity of content development, all of which require strategic investment and increased human resource capacity (Familoni & Onyebuchi, 2024; Maas & Hughes, 2020). On the other hand, virtual learning environments also encourage the development of scientific communication and collaboration practices through ICT-based virtual research environments, which expand the reach and efficiency of educational and research activities beyond traditional physical boundaries (Voss & Procter, 2009).

Learning Theory and Digital Technology

Several theoretical frameworks can be used to explain how students experience the learning process through digital learning objects. In this context, learning theories provide an essential foundation for understanding how learning occurs and how teaching can be optimized through technology. Rapid technological advances require educators not only to understand traditional learning theories but also to adapt them to a digital environment that offers a much more varied range of interactions, media, and learning resources. Approaches such as behaviorism, cognitivism, constructivism, humanism, and social learning theory remain key references. Still, their relevance is strengthened when integrated with digital features such as interactivity, personalization, and flexible access. This integration enables the creation of learning experiences that are more adaptive, collaborative, and tailored to students' needs in the digital age (Leonard, 2002).

The transformation of education in the digital age has brought about significant changes in teaching and learning practices, with technology serving as the primary driver of more interactive, flexible, and personalized learning processes. A variety of digital tools—ranging from online learning applications and educational software to augmented reality and virtual reality technologies—provide opportunities for students to experience more engaging, contextual, and effective learning. Research findings also confirm that the use of digital technology can enhance the depth of understanding and the quality of learning outcomes, provided that its implementation is supported by adequate instructional guidance and a well-designed integration strategy. Additionally, collaborative learning approaches that use digital technology have been shown to have a greater impact than individual learning, as they strengthen interaction, knowledge sharing, and joint meaning-making (Djibran et al., 2024; Wu, 2023).

Models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) are widely used to examine the factors influencing the acceptance and use of technology in educational contexts (Scherer et al., 2019; Venkatesh et al., 2003). Both models emphasize that technology adoption is influenced by several key variables, including perceptions of the technology's usefulness and ease of use, social pressure or support from the surrounding environment, and the availability of conditions that facilitate its use. In further development, this model is also understood to provide a comprehensive picture of how psychological, social, and institutional factors work together to shape intentions and behaviors in the use of educational technology, thus becoming an essential theoretical framework in designing, evaluating, and improving the implementation of digital-based innovations in modern learning environments.

To encourage a more comprehensive digital transformation in education, a sustainable digital pedagogy framework is needed that not only emphasizes mastery of digital competencies but also the application of evidence-based practices, the creation of a supportive learning environment, and effective collaboration between educators and artificial intelligence technologies. This integrated approach is designed to renew the way learning occurs by expanding access to in-depth learning experiences, maximizing the use of digital resources, and ensuring that the educational process can adapt quickly, responsively, and continuously amid the ever-evolving dynamics of the digital era (Huang et al., 2024).

METHOD

This study employs a qualitative, phenomenological design to explore students' experiences with Digital Learning Objects (DLOs) in higher education. The phenomenological approach allows researchers to explore the meanings that emerge from students' real experiences when interacting with digital learning resources. This approach is appropriate for understanding complex phenomena related to technology-based learning behavior because it focuses on interpreting lived experiences. Braun and Clarke (2006) explain that qualitative research is particularly effective when the research objective is to gain an in-depth understanding of subjective experiences.

The research subjects were students of the Open University (UT), selected for the characteristics of its learning system, which is based on distance learning and uses digital technology as the primary medium of instruction. UT relies on various forms of Digital Learning Objects (DLO), such as digital modules, instructional videos, e-tutorials, and interactive simulations, making it a relevant context for examining students' independent interactions with digital learning resources. The research participants consisted of 12 students from three study programs at the Open University, selected via purposive sampling, defined as active students in semesters 3–7 with at least one semester of experience using DLO. Purposive sampling was chosen because the researcher needed informants who fully understood the context of DLO use in distance learning systems and could provide rich, relevant data. In addition, the heterogeneous characteristics of UT students in terms of age, work background, and learning experience offered diverse perspectives in understanding the dynamics of DLO use in technology-based independent learning, as emphasized by Palinkas et al., (2015) that purposive sampling is adequate in qualitative research because it allows the selection of participants who can provide rich and relevant data related to the phenomenon being studied.

Research data were collected through semi-structured interviews lasting 30–45 minutes, conducted online or offline according to students' preferences, thereby providing researchers with the flexibility to adjust questions based on participant responses and enabling a more in-depth yet systematically focused exploration of learning experiences. In addition to interviews, supporting documents, such as examples of Digital Learning Objects (DLOs) used by Open University students, were collected to strengthen data source triangulation. The data were then analyzed using thematic analysis following the six stages proposed by Braun and Clarke (2006): data familiarization, initial coding, theme search, theme review, theme definition, and report preparation. Thematic analysis was chosen for its flexibility and its ability to systematically reveal patterns of meaning in students' learning experiences within the context of digital-based distance learning.

RESULT

Research Participant Profile

The analysis of interview data from 12 Open University (UT) students identified several main themes that capture the lived experiences of students using Digital Learning Objects (DLO) in the context of distance learning. This study involved 12 UT students selected through purposive sampling, with the criterion of having used DLO for at least one semester, ensuring participants had sufficient and reflective experience interacting with these digital learning resources. This approach enabled researchers to gain a deep, contextual understanding of the meaning, perceptions, and dynamics of DLO use within students' independent learning processes. The participants' complete profiles, including demographic and academic characteristics, are presented in Table 1 to provide a comprehensive overview.

Table 1. Research Participant Profile

Code	Age	Gender	Study Program	Semester	Occupation	DLO Experience
P01	24	Woman	Islamic Religious Education	5	Teacher	2,5 years
P02	32	Men	Communication Studies	6	Freelancer	3 years
P03	28	Woman	Management	4	Entrepreneur	2 years
P04	35	Men	Law	7	Private employee	3,5 years
P05	26	Men	Primary School Teacher Education	5	Teacher	2,5 years
P06	41	Woman	Primary School Teacher Education	6	Teacher	3 years
P07	29	Woman	Accounting	4	Full-time student	2 years
P08	23	Woman	Teacher Professional Education Program	3	Teacher	1,5 years
P09	38	Men	Management	7	Civil servant	3,5 years
P10	27	Woman	Entrepreneurship	5	Entrepreneur	2,5 years
P11	31	Men	Teacher Professional Education Program	6	Teacher	3 years
P12	25	Woman	Educational Technology	4	Full-time student	2 years

The table shows that the research participants comprised 12 Open University students with diverse characteristics in terms of age, gender, study program, semester, occupation, and experience with Digital Learning Objects (DLO). The participants' ages ranged from 23 to 41 years old, reflecting the characteristics of UT students as adult learners. In terms of gender, the participants were predominantly female (7 participants) compared with male (5 participants). Their academic backgrounds also varied, encompassing education (Islamic Education, Primary School Teacher Education, Teacher Education, and Educational Technology) and non-education (Management, Accounting, Communication Studies, Law, and Entrepreneurship), thereby providing a cross-disciplinary perspective on the use of DLO. By the end of the semester, the majority of participants were in the middle to final semesters (semesters 3–7), indicating a relatively stable level of academic maturity and experience with distance learning. In addition, most participants were working students, primarily teachers, entrepreneurs, private employees, and civil servants, whereas the remainder were full-time students. Their experience with DLO ranged from 1.5 to 3.5 years, confirming that all participants had sufficient exposure to and interaction with DLO and that the data obtained are sufficiently relevant and credible to describe students' experiences in distance learning.

Flexibility and Accessibility as Key Values of DLO

All participants (12/12) consistently stated that flexibility in time and place was the primary benefit of using Digital Learning Objects (DLO) in distance learning, as it allowed them to access learning materials at any time and from any location, according to their individual circumstances. This finding indicates that DLO provides a high level of learning autonomy, particularly for adult students who must divide their time among study, work, and family responsibilities. This flexibility not only helps students overcome time constraints but also encourages more adaptive and personalized independent learning, in which students can adjust their learning pace to their needs and abilities. At the Open University, adult learners predominate. DLO plays a strategic role as a facilitator of lifelong learning by supporting continuous learning without being constrained by conventional space and time, while also increasing student motivation and engagement in distance learning.

Table 2. Perceptions of Flexibility and Accessibility of DLO

Flexibility Aspects	Number of Participants	Percentage	Example Statements
24/7 access	12	100%	"I can access the material anytime without having to wait for a specific schedule, so it fits in better with my free time." (P07)
Learn anywhere	11	91,7%	"As long as I have internet access, I can still study even when I'm not at home or on campus." (P01)
Repeat material	12	100%	"If I don't understand something, I can replay the material several times until I really understand it." (P08)
Multi-device access	10	83,3%	"I usually start studying on my phone, then continue on my laptop when I need a bigger screen." (P10)

Participants' statements indicate that DLO's flexibility is crucial to sustaining adult students' learning amid time and location constraints. P05 emphasizes that as a professional worker, flexibility is a primary need in the learning process, as they state: "As a teacher who teaches from morning to noon, I only have time to study at night. DLO provides that freedom. I don't need to come to campus or follow a rigid schedule." Meanwhile, P09 highlights the dimension of geographical accessibility by stating," Living in a remote area, access to campus is complicated. DLO opens up higher education opportunities that were previously impossible for me." These two statements indicate that DLO not only provides temporal flexibility but also overcomes spatial barriers that have long been a significant obstacle to accessing higher education.

These findings are in line with the study of Martin and Bolliger (2022), which confirms that flexibility in online learning in terms of time, place, and learning pace is a key factor that influences student satisfaction, especially for adult learners who have to manage various commitments between work, family, and study. This flexibility allows students to tailor the learning process to their personal and professional circumstances, making learning feel more adaptive and relevant to their real needs. Similar support is also expressed by Turan et al., (2022), who show that learning flexibility contributes significantly to student engagement and the quality of learning experiences for non-traditional students in the context of online higher education, as it provides space for students to participate more actively and meaningfully in the learning process.

Technical Challenges and Strategies for Using DLO

The use of Digital Learning Objects (DLOs) in distance learning offers various benefits for students; however, the learning experience indicates that their use has not been fully optimized. In practice, several conditions shape how students interact with DLO and perceive its role in the learning process. Differences in background, learning contexts, and the characteristics of distance learners contribute to diverse experiences, so the effectiveness of DLO use is not always experienced equally. This general picture forms the basis for further examination of the aspects that influence the use of DLO, as presented in the table of challenges in using DLO.

Table 3. Challenges and Strategies for Using DLO

Challenge Categories	Types of Problems	Frequency of Occurrence	Adaptive Strategy
Technical	Slow internet connection	10/12	Downloading material when the connection is stable and utilizing offline mode
	Device compatibility	5/12	Using alternative devices or sharing access with other devices
	File size too large	8/12	Choosing low-resolution material formats or accessing only important sections
	Platform error/crash	6/12	Accessing DLO at different times or through backup platforms
Pedagogical	Lack of social interaction	11/12	Forming informal study groups through instant messaging applications
	Indirect feedback	9/12	Recording questions and submitting them to forums or limited synchronous sessions
	Difficulty understanding complex material	7/12	Reviewing material, searching for supporting sources, and watching additional explanatory videos
	Isolation in learning	8/12	Maintaining regular communication with classmates online
Motivation	Procrastination	9/12	Create a self-study schedule and weekly targets
	Lack of self-discipline	7/12	Use digital reminders and time management techniques
	Environmental distractions	10/12	Set aside specific time and space for studying at home
Content Quality	Outdated material	4/12	Seek additional references from more up-to-date external sources
	Unattractive design	6/12	Combine DLOs with other, more interactive learning media
	Confusing navigation	5/12	Create personal navigation notes to facilitate re-access

Based on the table, students' use of Digital Learning Objects (DLOs) faces four main categories of challenges: technical, pedagogical, motivational, and content quality. These findings indicate that even though students face various obstacles in using Digital Learning Objects (DLO), whether technical, pedagogical, motivational, or related to content quality, they do not remain passive recipients but demonstrate strong adaptive capacity in managing their learning process. Students consciously develop strategies to adapt to existing limitations, such as managing their study time independently, utilizing alternative learning resources, building social interactions through online media, and adjusting how they access and process digital materials so that they can still be understood optimally. This adaptability reflects the development of students' learning independence, self-regulation, and digital literacy, which are essential for maintaining the effectiveness of technology-based learning. Thus, DLOs not only function as a medium for delivering material but also as a context that encourages students to actively develop more flexible, context-specific learning strategies tailored to their conditions and needs.

The participants' statements clearly describe the complexity of the challenges students face when using Digital Learning Objects (DLOs) in distance learning. From a technical perspective, P04 expressed frustration when infrastructure limitations disrupted the learning process, stating: "When I have free time to study, the internet connection is often problematic. Videos keep buffering, and files cannot be downloaded. This really disrupts my learning momentum." On the pedagogical aspect, P11 highlights the limitations of interaction in DLO-based learning, particularly the lack of two-way communication, as they reveal: "What I miss the most is direct discussion with lecturers and friends. DLO is one-way communication. When there are concepts that I don't understand, there is no one to ask directly". Meanwhile, in terms of learning motivation, P05 emphasized the psychosocial challenges that arise in independent learning at home: "Studying alone at home is a big challenge. There are many distractions, and there are no friends to encourage me. I often procrastinate in opening digital materials". These experiences are consistent with the findings of Faza et al., (2024) and Marsevani (2022) who identified that students in online learning face three main categories of challenges, namely technical, pedagogical, and psychosocial, which collectively affect the effectiveness and quality of online learning. The study emphasizes that the success of online learning depends not only on the availability of technology, but also on academic interaction support and students' psychological conditions.

Patterns of DLO Use Based on Student Characteristics

A more in-depth analysis shows that patterns of Digital Learning Object (DLO) use are heterogeneous and influenced by students' demographic and contextual characteristics, such as socioeconomic background, level of digital literacy, device availability, and prior learning experiences. Students with adequate access to technology and higher digital literacy tend to use DLO more intensively and flexibly. In contrast, students with limited access are more selective in choosing efficient, easily accessible DLO. In addition, academic contexts such as field of study, course load, and assignment demands also shape students' preferences for specific DLO formats, whether visual, interactive, or text-based. These differences in characteristics have implications for how students interact with DLO, their purposes for using it, and the adaptive strategies they develop to support learning.

Table 4. DLO Usage Patterns Based on Student Characteristics

Characteristics	Preferred Study Times	DLO Format Preferences
Aged 23-27 years old	Evening (8:00 p.m. to 11:00 p.m.)	Video, Interactive Simulation
Aged 28-35 years old	Morning (5:00 a.m. to 7:00 a.m.) & Evening	Module, Video
Aged 36-41 years old	Afternoon (12:00 p.m. to 2:00 p.m.)	Module
Working students	Weekends & Evening	Video (time efficiency)
Full-time students	Flexible throughout the day	All formats

Based on the table, differences in student characteristics directly affect dominant learning times and preferences for Digital Learning Objects (DLO) formats. Students aged 23–27 tend to study at night and prefer video-based DLOs and interactive simulations that are visually engaging, consistent with a digital-native learning style. The 28–35 age group shows a more flexible learning pattern in the morning and evening, with a preference for modules and videos that are considered efficient and structured. Meanwhile, students aged 36–41 spend more time during the day and tend to choose systematic, easily accessible written modules. In terms of academic status, working students focus their learning activities on weekends and evenings, with a preference for videos because they are considered more concise and time-efficient. In contrast, full-time students have greater flexibility in their learning time and use all DLO formats to meet their learning needs. These findings emphasize the importance of providing diverse and adaptive DLOs to accommodate students' varying characteristics and needs.

Student Competency Development through the Use of DLO

Table 5. Student Competency Development through DLO Usage

Competency Aspects	Before DLO	After DLO	Changes
Independent Learning			
Self-regulation	Low-Medium	Moderate-High	Significant increase (10/12)
Time management	Low	Moderate-High	Increase (11/12)
Goal setting	Moderate	THigh	Increase (11/12)
Self-assessment	Low	Moderate	Increase (11/12)
Digital Literacy			
Digital platform navigation	Moderate	High	Significant increase (12/12)
Online source evaluation	Low-Moderate	High	Increase (10/12)
Use of digital tools	Moderate	High	Increase (11/12)
Digital citizenship	Moderate	Moderate-High	Increase (7/12)

Findings from participants indicate that the use of Digital Learning Objects (DLOs) significantly contributes to the development of student learning independence and digital literacy. P01 describes a shift from dependence on lecturer instruction to self-directed learning, in which students independently plan their study time, determine the material to be studied, search for additional sources, and reflect on and evaluate their understanding without waiting for formal assessment. This is reflected in his statement, "At first, I was very dependent on the lecturer's instruction. Now, I can manage my own study schedule, find additional resources on my own, and evaluate my understanding without having to wait for exams" (P01). Meanwhile, P12 emphasized the improvement in digital

literacy gained through the experience of interacting with various DLO platforms, which not only improved technical skills but also confidence in overcoming technological obstacles independently and sharing knowledge with others, as stated, "The experience of using various DLO platforms has made me more tech-savvy. Now I can quickly adapt to new applications, troubleshoot technical problems on my own, and even help others" (P12).

These empirical findings are consistent with broader research evidence on the strategic role of digital technology in higher education, particularly in promoting student learning independence. Rashid and Asghar (2016), in Computers in Human Behavior, show that the intensity of digital technology use is significantly positively correlated with students' self-directed learning abilities and learning engagement, including aspects such as learning planning, time management, independent search for learning resources, and reflection on self-understanding. Although the relationship between technology use and academic achievement is complex and not always linear, these findings confirm that technology plays a vital role in enabling independent learning behavior. In this context, technology including Digital Learning Objects (DLO) functions not only as a medium for content delivery but also as a learning environment that encourages students to be more active, reflective, and responsible for their own learning process.

Student Recommendations for Improving the Quality of DLO

Based on their learning experiences, participants emphasized the need to improve the quality of Digital Learning Objects (DLO) to better align with students' learning needs and realities. Findings indicate that ideal DLOs should provide a stable learning experience, be easily accessible under varying technical conditions, and be presented with a clear and systematic structure. Students also consider it necessary to have interactive, contextual materials that support independent learning through content that is not only informative but also applicable. In addition, the quality of DLO is understood not only in terms of technology but also in how the learning design accommodates diverse learning styles and encourages active engagement.

Table 6. Recommendations for Improving DLO from the Student Perspective

Aspects	Recommendations	Participant Frequency
Content	Update materials regularly	11/12
	Add contextual case studies	10/12
	Include local Indonesian case studies	8/12
Design	Increase interactivity	12/12
	Use attractive visual designs	9/12
	Simplify navigation	10/12
Technical	Optimize for mobile devices	11/12
	Provide offline/downloadable versions	12/12
	Reduce file size	10/12
Pedagogical	Add discussion/collaboration features	11/12
	Provide automatic feedback	9/12
	Integrate peer assessment	7/12
Support	Create clear usage guidelines	8/12
	Provide responsive technical support	10/12
	Hold DLO orientation for new students	6/12

P03 emphasized that "A good DLO not only presents information, but also encourages us to interact. For example, there could be a quiz in the middle of a video, or a simulation that we can try ourselves," while P07 proposes additional collaborative features such as "features for virtual group learning, such as breakout rooms or shared annotation on documents." These proposals reflect students' need for learning designs that do not merely provide passive content but also enable active engagement and intense social interaction in digital learning environments. This is in line with the findings of Gao et al., (2024) which show that social interaction and social presence—the feeling of being together with other participants in an online learning space—play an essential role in increasing learning engagement and the efficiency of online learning, where interactions between participants and between participants and instructors contribute to a more meaningful and efficient learning experience.

Synthesis of Findings: Model of Student Experience with DLO

Table 7. Conceptual Model of Student Experience with DLO

Dimension	Positive Factors	Negative Factors	Strategi Mediasi
Access	24/7 flexibility; Multi-device	Unstable internet connection; Device limitations	Offline mode; Optimasi ukuran file
Engagement	Variety of formats; Interactivity	Lack of social interaction; Monotony	Gamifikasi; Forum diskusi; Study groups
Competence	Digital literacy development; Independence	Technology learning curve; Isolation	Tutorial; Peer support; Scaffolding
Motivation	Learning autonomy; Content relevance	Procrastination; Distractions	Goal setting, reminders, and accountability partners
Outcome	Conceptual understanding; Digital skill	Superficial understanding; Digital fatigue	Blended approach; Active learning strategies

Based on the table presented, students' experiences with Digital Learning Objects (DLOs) are not linear. Still, they are shaped by the interrelationships among multiple dimensions, including access, engagement, competence, motivation, and learning outcomes. Each dimension comprises factors that can either support or hinder the learning process; therefore, the effectiveness of DLO is highly dependent on the balance between the opportunities afforded by technology and the challenges that arise in its practical use. These findings confirm that the characteristics of DLO technology cannot be separated from the pedagogical context and students' individual conditions in shaping meaningful learning experiences.

Research shows that students actively develop mediation strategies to address limitations they face, such as technical constraints, limited social interaction, and motivational challenges. These strategies serve as adaptive mechanisms that enable students to remain engaged, enhance their digital competence, and maintain continuity in the learning process despite limitations. Thus, the resulting conceptual model reinforces the view that DLO-based learning experiences are multidimensional and contextual, and contribute significantly to enriching the understanding of technology-based learning in the context of distance education in Indonesia, while offering practical implications for the development of DLO that is more inclusive, effective, and responsive to the needs of adult students from diverse backgrounds.

DISCUSSION

The Flexibility of DLO as an Enabler of Distance Learning for Adult Students

The findings of this study confirm that flexibility and accessibility are the most crucial aspects of the learning experience of students using Digital Learning Objects (DLO). All participants (12/12) appreciated DLO's ability to adapt learning to their personal schedules and circumstances, which is highly relevant given that the majority of Open University students are adult learners who juggle multiple roles as workers, parents, and students. This flexibility allows them to manage when and where learning takes place, so that materials can be accessed as needed without interfering with professional or family responsibilities. In other words, DLO not only provides academic content but also supports the integration of learning into complex daily routines, strengthens self-directed learning abilities, and enables students to maintain effective learning continuity. This situation demonstrates that the role of educational technology is not merely that of an information medium but also that of a facilitator that adapts the learning process to the real-life dynamics of adult students.

These findings further strengthen the arguments for Knowles' Andragogy Theory, which emphasizes that adult learning must be self-directed and flexible, tailored to the needs, life contexts, and social roles of adult students in their daily lives (Knowles et al., 2020). Within the framework of andragogy, adult learners are given full autonomy in choosing the goals, strategies, media, and learning time that best suit themselves, in contrast to traditional pedagogical models that emphasize fixed schedules and specific physical locations as prerequisites for learning. Approaches such as distance learning or online learning have been proven to provide flexibility in terms of time and place, allowing students to determine when, where, and how they learn effectively, which in turn contributes to increased student engagement and retention in distance education because they feel they have control over their own learning process. Modern empirical research by Kuluşaklı (2025) also shows that flexibility in content, time, and interaction in online learning environments is positively associated with students' cognitive and emotional engagement—two factors known to strongly influence academic success and student retention in the context of distance learning.

The paradox of flexibility in the use of Digital Learning Objects (DLO) indicates that although 100% of participants value anytime, anywhere access to materials, the majority (75%; 9/12) also report procrastination and difficulty maintaining learning discipline. This emphasizes that flexibility, without sufficient supporting structures, can be a double-edged sword providing freedom while increasing the risk of harmful procrastination. The Self-Determination Theory (SDT) perspective by Deci and Ryan asserts that the premise of autonomy alone

is not enough to guarantee high learning engagement; optimal motivation arises when basic psychological needs such as autonomy (control over activities), competence (sense of ability), and relatedness (social connection) are satisfied simultaneously. In contrast, a lack of support for any of these needs can reduce motivation and engagement in the learning context (Ryan & Deci, 2000).

In the context of online and distance learning, structured scaffolding strategies such as learning milestones, peer accountability, and regular check-ins have been empirically proven to help students increase self-efficacy, reduce procrastination, and improve learning outcomes, because scaffolding provides support that combines elements of competence and relatedness in addition to the learning autonomy provided by DLOs (López-Vargas et al., 2025).

Development of Self-Regulated Learning and Digital Literacy

One of the most notable benefits of using Digital Learning Objects (DLOs) is students' development of self-regulated learning (SRL) skills and digital literacy. Data show that the majority of participants (83%; 10/12) reported a significant increase in their ability to organize, monitor, and evaluate their learning processes, while all participants (100%) reported an increase in their ability to navigate digital platforms effectively. These skills are not only relevant in academic contexts but also transferable competencies that can be applied in professional environments and everyday life, where technological mastery and self-regulated learning are essential for productivity and adaptability.

Within the framework of self-regulated learning (SRL), independent learning is understood as a reflective cycle comprising three phases: forethought, performance, and self-reflection (Panadero, 2017). The forethought phase includes activities before learning begins, in which students set learning goals (goal setting) and plan strategies (strategic planning) to achieve those goals, a crucial step in directing learning efforts effectively. Next, in the performance phase, students implement these plans while monitoring their own progress (self-monitoring) and employing various self-control strategies (self-instruction and self-control) to manage the learning process without direct instructor supervision. Finally, the self-reflection phase focuses on self-evaluating goal achievement and material comprehension, and on adapting learning strategies based on that assessment for the next learning cycle. In the experience of students who use Digital Learning Objects (DLO), these three phases are practiced naturally: the flexibility of DLO encourages students to set personal goals (what to learn and when), monitor progress without face-to-face guidance, and conduct self-assessment through quizzes and reflections available on the platform.

Participants P01 and P09 provide clear illustrations of the transformation from externally regulated learning where students are highly dependent on the structure, direction, and supervision of instructors to internally regulated learning, in which they assume full ownership of their learning processes. This transition marks a significant development in adult learning, as it reflects the ability to independently set learning goals, strategies, and evaluations without external direction. This transformation is not only crucial for short-term academic success but also lays the foundation for lifelong learning, in which individuals must continually update their knowledge and skills independently to keep pace with ever-changing professional, technological, and social demands.

Students' experience with various Digital Learning Objects (DLO) platforms not only improves basic technical skills such as operating applications and troubleshooting—but also strengthens higher-level digital competencies. These competencies include information literacy, the ability to evaluate the credibility and relevance of online information sources; digital communication, active participation in forums or online collaboration; and digital citizenship, awareness of and application of ethics and responsibility in the digital environment. The digital competence framework developed by Punie and Redecker (2017) emphasizes that these dimensions are essential skills for 21st-century learning and life, enabling students not only to become technically competent users of technology but also to think critically, interact ethically, and contribute productively in complex digital ecosystems. This experience demonstrates that the integration of DLO in higher education has dual potential: supporting academic learning and equipping students with digital literacy skills relevant to the digital professional and social worlds.

Quality Matters: Quality Criteria for DLO from the Student Perspective

The students' recommendations for improving the quality of Digital Learning Objects (DLOs) in Table 6 provide essential insights into quality criteria that are highly valuable to end users. The main priorities highlighted are interactivity, which all participants consider necessary (12/12), access to offline versions or downloadable materials (12/12), and discussion and collaboration features that support social interaction and collaborative learning (11/12). These findings challenge the common assumption that high production value—such as fancy visuals or complex animations—is a key factor in the effectiveness of digital learning. Instead, students emphasized that functionality, ease of use, and accessibility were far more decisive in determining a practical learning experience. This shows that user-centered DLO design must balance aesthetic considerations with principles of usability and pedagogical functionality, so that materials are not only visually appealing but also capable of supporting independent, collaborative, and flexible learning in accordance with students' needs.

Effective online learning according to Quality Matters (QM) Standards. Contrary to the common assumption that high production values such as luxurious visuals or complex animations are the key to quality, students prioritize interactivity, offline/downloadable access, and discussion/collaboration features components that reflect instructional design effectiveness, a central QM standard. Quality Matters emphasizes that the quality of online learning is determined by strong instructional design and the integration of learning elements, not merely by the availability of media production. This is in line with findings in the literature that show QM standards focus on aspects such as course overview, learning objectives, assessment and measurement, instructional materials, learner interaction, course technology, learner support, and accessibility and usability as the main categories for assessing the quality of online courses (Sadaf et al., 2019). This QM framework underscores the importance of usability, learner engagement, and structural support in course design aspects that appear to be more valued by students in this study than simply complex visual presentations.

The findings show that most participants emphasized the importance of content that is constantly updated and contextually relevant (11/12), indicating that students play a role not only as passive consumers but also as critical evaluators of learning quality. They recognize that in fields such as management and communication, knowledge evolves rapidly; therefore, outdated content diminishes the relevance and applicability of learning, necessitating that institutions treat DLOs as continuously evolving learning resources. In addition, the need for automatic feedback (9/12) underscores the importance of formative assessment; without immediate feedback, students struggle to gauge their understanding and identify knowledge gaps. The use of technologies such as adaptive learning systems, automated grading, and AI-powered feedback can provide timely responses even in independent learning contexts.

Towards Blended and Hybrid Models: Optimalisasi DLO dalam Ekosistem Pembelajaran

The synthesis of these findings shows that Digital Learning Objects (DLOs) are most effective not as standalone solutions but as components of an integrated learning ecosystem contextualized within a comprehensive learning design. The resulting conceptual model (Table 7) identifies that each dimension of DLO has affordances (potential benefits) and constraints, and optimal effectiveness is achieved when constraints are minimized through thoughtful instructional design and adequate support systems. These findings are consistent with evidence from the literature that in blended learning practices, the combination of digital resources and face-to-face interaction provides more flexible and integrated learning opportunities, while also demonstrating affordances and constraints that must be carefully planned in course design to achieve the desired learning outcomes (e.g., affordances such as motivation, flexibility, and collaboration, and constraints such as limited access and technological readiness) (Zakariya et al., 2024).

This argument supports the blended learning approach, which combines the strengths of digital and traditional methods to maximize learning effectiveness in the context of distance education, such as the Open University. Other studies also show that Digital Learning Objects can play an important role in personalized education and learning adaptation when integrated into a holistic learning environment with appropriate pedagogical support. In the context of distance learning, such as the Open University, a blended model could mean a combination of:

1. Asynchronous DLO (modules, videos, simulations) for content delivery and individual study
2. Synchronous virtual sessions for discussion, clarification, and social interaction
3. Occasional face-to-face sessions at regional learning centers for hands-on activities and community building
4. Online collaborative activities (group projects, peer review) for developing teamwork and communication skills

Blended learning strategies enable flexibility, a core value of Digital Learning Objects (DLO), while mitigating limitations related to social interaction and practical learning. By combining independent digital modules, face-to-face or live online sessions, and tutor support, this approach creates a more holistic and adaptive learning experience. Research by Rey and Steib (2013) shows that blended learning models tend to produce superior learning outcomes compared with fully online or fully face-to-face approaches, as they combine the advantages of both while minimizing their respective weaknesses.

CONCLUSION

Advances in educational technology have transformed traditional learning spaces into digital environments, with Digital Learning Objects (DLOs) as essential components that support independent, interactive, and flexible learning. The COVID-19 pandemic has accelerated this transformation, emphasizing the need for digital learning spaces that are integrated with subject matter and disciplines. DLOs offer on-demand access, flexibility, and the potential for integration into various learning models, including blended learning. However, conceptual issues such as granularity, context of use, and the relationship between pedagogical design and technical capabilities remain concerns, underscoring the need for qualitative research that explores students' experiences to deepen understanding of motivation, barriers, and context of use.

This study shows that DLO improves students' flexibility, accessibility, independent learning, and digital literacy, although challenges related to technical, pedagogical, motivational, and content quality remain. The learning experience with DLO is influenced by student characteristics and the context of use, and the conceptual

model shows a reciprocal relationship between access, engagement, competence, motivation, and learning outcomes. DLOs (Digital Learning Organizations) are most effective when integrated into a comprehensive learning ecosystem that combines digital and traditional strengths. Therefore, DLO development and faculty support must balance technical and pedagogical aspects to create a more interactive, inclusive, and student-centered learning experience.

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