

Navigating the Complex Barriers Influencing Technology Adoption in Education: A Social Value Concern

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ABSTRACT: Modern educational environments offer new possibilities for learning because digital technologies transform pedagogical practice. However, there are numerous and complex obstacles to the implementation of such technologies. The paper will examine the complex obstacles to technology adoption in the learning context, where it is important to note that the challenges are not confined to the availability of resources alone. Using the Unified Theory of Acceptance and Use of Technology (UTAUT), the research paper establishes four main barriers, namely, teacher-related barriers, infrastructural and technological barriers, socioeconomic barriers, and institutional barriers. These barriers are closely connected with the beliefs of educators, the contextual backgrounds of learners, and the lack of policy. This paper claims that successful technological integration should not be limited to connectivity but also to a set of policies, continuous professional growth, and cultural transformation in educational institutions. The paper provides a holistic view of technology adoption as a social value issue by linking the findings to the main constructs of the UTAUT to encourage the stakeholders to consider human and structural aspects in the quest to achieve high-level digital learning.

Keywords: Digital Learning, Technology Adoption, Teacher-related challenges, Socioeconomic Barriers, UTAUT Framework.

Introduction

The digital learning era has quickly become part of our society, and it has changed how we learn and develop skills. In the world today, every sector is beginning to evolve in the way they operate digitally. This does not exclude the education sector. The classroom, which was once shaped by the use of chalkboards and textbooks, is gradually transforming into an online environment that is beneficial in the learning process of students. Research indicates that meaningful use of technology in schools can assist students in getting the best from education by being more engaged and motivated (Haleem et al., 2022). Flexibility is an apparent advantage of technological integration in learning. Learning resources are available to the learner at all times, in all places, and in any way required by the learner due to his or her pace and personal needs. In addition, computer devices (in the form of simulations, educational games, and online tests) provide a more engaging learning environment to encourage participation and the acquisition of important 21st-century skills (Guerrero-Quíñonez et al., 2023). Modern educational technologies have a flexible, accommodating, and people-oriented design, making the learning of the next generation accessible, desirable, and relevant.

It is still worth mentioning that, though educational technologies simplify the process of learning, there are substantial barriers to making them more available in the educational environment. Despite the fact that some of the components of these barriers have been emphasized in the available literature (Gamdi & Samarji, 2016; Mairal-Llebot et al., 2024; Opeyemi et al., 2019; Porter & Graham, 2016; Romero Alonso et al., 2019), this paper

aims to present a more detailed synthesis of the most important barriers to digital learning in society by employing a qualitative research approach to gain deeper insights into the challenges of incorporating digital learning into education globally today. These challenges are considered a social concern, and particular emphasis is given to the place of socioeconomic, institutional, and teacher-level factors. Understanding teacher-related dynamics is important since they are crucial in the provision of knowledge and in influencing students to achieve the best results from learning. This paper uses the Unified Theory of Acceptance and Use of Technology (UTAUT), a relevant theoretical framework to link and unfold not only the already known barriers of technological integration in education, but also to provide a deeper insight into how people and systems interact with educational technologies (Venkatesh, 2000; Venkatesh et al., 2003). The application of the UTAUT framework connects the dots in interpreting the various barriers and opens our eyes to the importance of promoting a more inclusive and equitable environment in digital learning. A comprehensive analysis of existing literature in this area of study has revealed four major barriers in technology integration in education. Teachers, infrastructural and technical factors, socioeconomic factors, and finally, institutional factors are mostly hindrances to a more equitable digital learning society.

Speaking about the issue of technology integration into the educational field, the challenges of technology use in learning are at the forefront of teachers since they are the key actors of the educational system. The definition of computer technology barriers in education is significant and, as early described by Ertmer (1999), it includes the first-order barriers, which are external determinants, including resources and infrastructure. The second-order barriers are related to internal factors as beliefs, attitudes, and confidence of educators in their ability to make effective use of technology (Bingimlas, 2009; Makki et al., 2018).

FIRST-ORDER BARRIERS (External Factors)	SECOND-ORDER BARRIERS (Internal Factors)
Limited access to technology	Beliefs on teaching and learning
Insufficient planning time	Beliefs about technology use
Lack of training opportunities	Classroom practices and routines beliefs
Weak technical/administrative support	Resistance to change

Table 1: *First and Second-order barriers of using technology in education (Ertmer, 1999)*

First-order barriers are external forces that impede digital learning among teachers. Such obstacles are the unavailability of the required technologies, absence of internet access, and the unavailability of devices. In addition, the absence of time to plan and introduce digital tools, the absence of professional development opportunities, and the absence of technical and administrative assistance contribute to these obstacles. These institutional failures destroy the ability of teachers to embrace digital learning irrespective of their motivation and interest.

Second-order barriers can be referred to the internal attitudes of teachers to the learning process and their willingness to adopt new pedagogical practices. These barriers are often based on deep-seated notions and attitudes toward the place of technology in the learning environment and classroom activities. The perceived agency of the technology use or the perceived effectiveness of the technology itself may be the factors that make a teacher want to switch to a digital form of instruction. Moreover, the current educational culture has a prominent

impact on these beliefs because perspectives of educators are usually influenced by the values and norms that they follow in their institutional setting (Sato & Oyanedel, 2019). Empirical evidence shows that teachers with instructional philosophies that are more in line with constructivism tend to embrace technology in their teaching practises; however, other factors can also affect this embrace (Ertmer et al., 2012; Romero Alonso et al., 2019). Recent research proposes a third-order dimension of barrier that dwells on the teacher's ability to develop and systematize learning environments that are effective in interacting with both the needs and situations of the learners. Digital education scholars claim that the lower-order barriers (resource access and positive attitudes) are not the only conditions that ensure successful technology integration. Rather, they emphasize the need to have pedagogical flexibility, claiming that the fast-changing classroom setting needs teachers to do more than just incorporate technology into their pre-existing teaching strategies. It is a flexibility that entails the mastery of context-sensitive and meaningful instruction that is developed in line with various realities of learners (Opeyemi et al., 2019).

Existing literature reveals that there are more categories of teacher-related barriers to technology integration. For instance, Becta (2004) distinguishes that barriers at the teacher-specific level include individual factors such as limited time, low confidence, and unwillingness to adopt a new learning process. Institutional barriers, also known as the school-specific barriers, include a lack of awareness of how to solve technical problems and access to digital tools and resources. Balanskat et al. (2006) outline a three-level framework: micro-level obstructions, which refer to the attitudes of instructors to and pedagogical use of ICT; meso-level obstructions, which refer to infrastructural provisions and administrative support in schools; and macro-level obstructions, which are created by the educational policies on a wider level or by systemic constraints. All these categories point to the intersection of personal, institutional, and systemic factors in determining the outcome of digital learning (Bingimlas, 2009). Technology is regarded as a strong teaching and learning instrument and can be a good aid in making learning more inclusive, and enhancing the outcomes for all students. It contributes to the support of various learning demands and improves the teaching process and involvement of learners (Fernandez-Batanero & Colmenero-Ruiz, 2016; Mairal-Llebot et al., 2024). To make digital education effective, a credible and stable technological framework is necessary. This comprises the availability of devices, good internet connectivity, and good learning facilities. Online education helps students to explore a wide range of subjects irrespective of their differences. This kind of strategy allows teachers to reach every student and provide students with all-inclusive informational materials that will make them more interested in learning more. Digital tools provide essential features such as delivery of learning resources, constant tracking of student progress, and remote learning in case of the need to do so due to the circumstances (Gupta & Hayath, 2022).

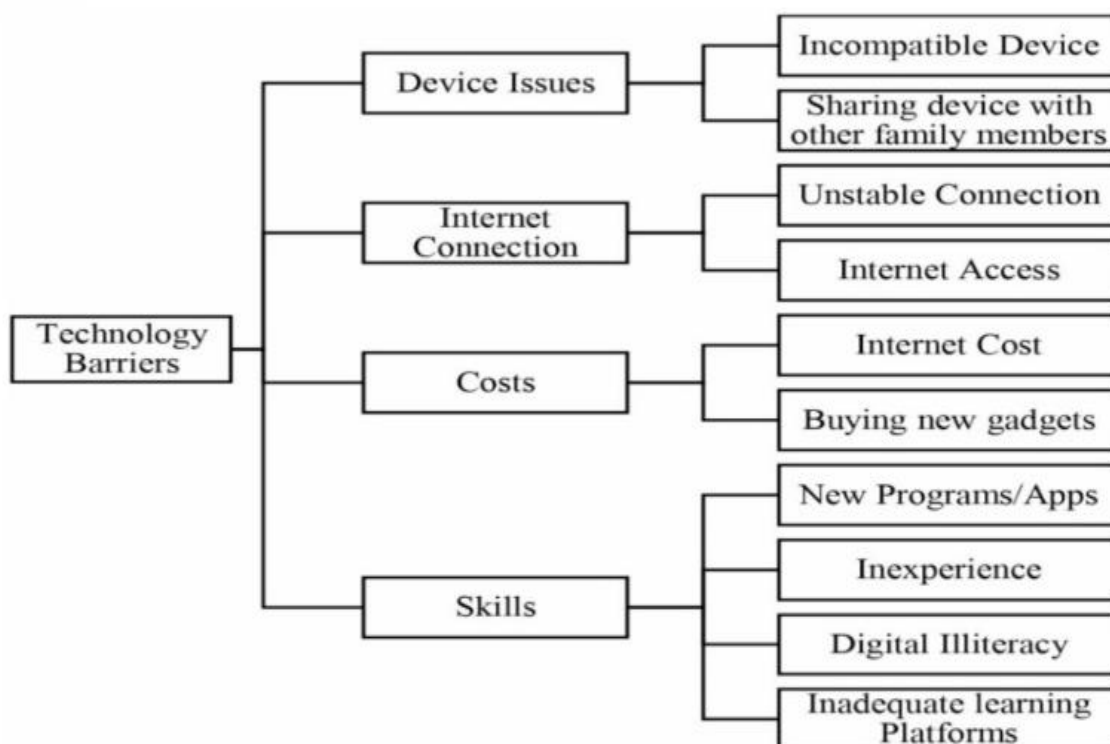


Figure 1: Digital learning barriers (Rahiem, 2020)

Despite many benefits linked to applying technological tools in learning, there are still challenges in situations where technological infrastructure is poorly developed, and access to technology is still not adequate. The adoption of digital tools in classrooms is a significant investment, which requires financial support and human resources (Haruna et al., 2019; Okoye et al., 2023). However, most nations still face challenges in obtaining the required technological infrastructure and complete adoption of digital technologies in various learning environments. Although the developed world has recorded significant successes in integrating technology in the pedagogical practises, cost implications continue to limit the developing countries, thus hindering the long-term adoption and use of the digital learning solutions (IEEE, 2020; Okoye et al., 2023; Saneh-Cruz et al., 2021; Tsegay, 2016).

Socioeconomic status (SES) is a strong aspect affecting the effective implementation of technology in education. The children with higher SES families are more exposed to modern digital tools, good internet, and favourable home environments that can contribute to successful online learning. Conversely, low-income or otherwise underserved communities, especially rural or underserved communities, often encounter difficulties because of the inability to access these essential tools, which perpetuates existing disparities in digital learning (Avanesian et al., 2021; Bi and Ishak, 2025). All these socioeconomic factors are closely related to the general financial limitations that obstruct the implementation of digital tools in the education system (Jacob et al., 2018).

SES does not only determine technology access, but also has an impact on the delivery of academic support at home. Research indicates that students with higher family resources normally enjoy a calm study atmosphere, parental engagement, and less distraction (Xiao and Liu, 2014). On the contrary, children with low-income parents will probably face overcrowded living conditions, inadequate educational resources because of the workload of their parents, and, in general, a deficit of learning opportunities (Bi & Ishak, 2025; Shafiq & Parveen, 2023).

The educational background of parents is another significant factor in the digital learning experiences of students. Parents who have attained higher education are more involved in the process of supporting and appreciating the activities of their children with respect to online education. This support may be in the form of any help in school work, promoting good learning habits, and being interested in the academic success of their child. On the other hand, children with less educated parents might not be provided with enough academic support and encouragement by their parents and, therefore, might not succeed in digital education and hence become less motivated and interested in the learning process (Bi & Ishak, 2025; Jia & Ericson, 2017; Oleksiyenko & Ros, 2022).

Resource distribution policies and teachers' continuous professional learning policies play a major role in the explanations of institutional barriers to digital learning. The institution can develop effective digital learning with the help of clear strategies and supportive frameworks (Ali, 2025; Porter & Graham, 2016). The policies are supposed to ensure that teachers get the necessary infrastructure, pedagogical training, and technical assistance. Professional development is also essential because it will help teachers to gain the skills required to be comfortable users of digital tools. The lack of ongoing training can become a great barrier to the successful application of technology-mediated practices, such as blended learning (Philipsen et al., 2019). Furthermore, institutional policies can also be used to promote consistency in technology integration within the various academic departments, and thus, the integration can be more coherent and efficient (Porter & Graham, 2016).

Khan (2005) divides the institutional barriers into three general categories, namely, administrative affairs, academic affairs, and student services. The administrative functions are addressed under different functions such as budgeting, course cataloguing, financial aid, scheduling, tuition management, registration, IT services, and instructional planning. Academic affairs issues are those associated with policy making, quality of teaching, intellectual property, and support of employees. Meanwhile, student services are supposed to offer the required help to have an effective e-learning environment. Studies by Panda and Mishra (2007) and Gamdi and Samarji (2016) point out that ambiguity in institutional policies towards e-learning is a significant hindrance to the effective use of digital learning tools. Heurteloup and Moustaghfir (2020) agree with this view and state that institutional structures are crucial in the creation of digital education.

Understanding Barriers to Educational Technology Adoption: A UTAUT Perspective

The Unified Theory of Acceptance and Use of Technology (UTAUT) explains the factors that determine the adoption of technology in digital learning by integrating antecedent theories and focusing on four fundamental constructs, which are, performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs summarize the beliefs about improved performance, ease of use, influence of the people who are relevant, and presence of the necessary support and resources. Together with personal experiences and contextual variables, they give a holistic explanatory model on how educators and learners are likely to adopt or not adopt digital tools. UTAUT then provides an appropriate prism in which to examine the problems of digital learning and come up with practical solutions. In the current study, the challenge of teachers, infrastructural/technological barriers, socioeconomic barriers, and institutional barriers are proved to be closely associated with the four main constructs of UTAUT, which shows how the beliefs of usefulness, ease of use, social expectations, and support availability interrelate to define the success of using technology in educational institutions (Alblooshi & Abdul Hamid, 2021; Dwivedi et al., 2019; Graf-Vlachy et al., 2018; Venkatesh & Davis, 2000; Venkatesh et al., 2003; Xue et al., 2024).

Particular barriers, including weak or unreliable internet access, unstable electricity, and the lack of digital devices, are all examples of facilitating conditions. Facilitating conditions determine whether people feel that they

have the technical and organisational support needed to make use of technology (Venkatesh et al., 2003). Empirical data suggest that learners and educators in developing nations believe that these infrastructural deficiencies are significant obstacles to holistic interaction with digital learning in areas with poor or skewed infrastructure distribution (Tsegay, 2016; IEEE, 2020).

The difficulties that are specific to teachers are linked to various UTAUT elements. It is possible to explain this relationship in terms of the first- and second-order concepts defined by Ertmer (1999). Facilitating conditions are associated with first-order barriers, which include the external barriers, such as a lack of training, planning time, and technical support (Bingimlas, 2009). The second-order obstacles include the mindsets and perceptions of the teachers towards digital learning. These aspects are connected to the expectancy of effort and expectancy of performance under UTAUT since they influence the perceived ease of technology use and its perceived usefulness in teaching and learning (Ertmer et al., 2012; Romero Alonso et al., 2019). The third-order barrier is the ability of teachers to develop lessons that promote learning in the students due to the expectancy of performance, which highlights the need for teachers to demonstrate flexibility and proficiency in the development of student-centred learning environments (Opeyemi et al., 2019).

The socioeconomic barriers are also linked to the facilitating conditions in UTAUT, especially the access to technological resources, the context of online learning, and the support of their family members. The students with lower incomes have other problems, such as sharing devices, low internet access, or an unfavourable home situation that hinders their involvement with digital learning (Bi & Ishak, 2025; Xiao & Liu, 2014). In addition, the absence of adult guidance and the uncertainty of the effectiveness of digital learning may lower the expectations of the students towards its effectiveness (performance expectancy) and increase the perception of the operational difficulty (effort expectancy), which in turn can reduce motivation and engagement (Oleksiyenko & Ross, 2022).

The social influence and facilitating conditions under the UTAUT framework are closely related to institutional barriers, including ambiguous digital learning policies, inconsistent leadership, and lack of professional development (Philipsen et al., 2019; Porter & Graham, 2016). Social influence demonstrates the way institutions create expectations in the use of technology. This effect can be harmful in cases where institutions are weak in their commitments, policies are ambiguous, or the administrative support at the top levels are poor (Gamdi & Samarji, 2016; Panda & Mishra, 2007).

The intersections of several types of barriers confirm that UTAUT is right in its assumption of the lack of a single determinant in the use of technology. Instead, it can be adopted based on a combination of perceived usefulness, personal expectancy of usefulness, perceived ease of use, perceived social support, and the presence of infrastructural resources. As can be seen in this review, external factors, like limited resources or vague policies, interplay with internal ones, such as personal beliefs and expectations, to ensure that teachers, students, and institutions accept or reject digital learning. In the end, the framework clarifies that breaking down the obstacles to learning with the help of digital technology does not only require the investment of resources, but also structural changes, capacity building on a personal level, and a change of mindset within schools, households, and the education system.

Conclusion

The technological aspect of the educational practice has a very promising future for the learning process, which is more responsive, engaging, and learner-oriented. Digital tools implementation in the educational field is a complex process, which is why it has many challenges to ensure its effective use. Infrastructural, socioeconomic, institutional, and contextual forces continue to shape and even constrain the digital learning environment.

The application of UTAUT to understand more about the barriers to the adoption of technology in education shows that the issue is not only regarding access to technology. They also involve beliefs, attitudes, and the systemic contexts in which the participants are engaged. The four UTAUT constructs combined form a web of determinants, which affect the attitude of teachers, students, and institutions towards digital learning. These aspects are connected to each other and should be tackled to realize the potential of digital education.

Stakeholders must go beyond the provision of devices and the internet connection in order to have truly equitable and transformative digital learning. This vision can be realised by the power of policy structures, long-term investment, cultural transformation in schools and institutions of higher learning, and generally the overall provision of support to the teachers who will be central to this digital revolution. Also, it is necessary to realize that learners possess diverse backgrounds and experiences and come to the digital classroom with their own needs and challenges.

Further research is required to explain the discrepancy in development and change of these issues in various teaching situations. Future studies could investigate the statistical interaction of technological education barriers in line with the UTAUT framework. Rather than examining literature alone, it would be informative to conduct empirical research on the relationship between the theoretical constructs and the teachers, who are among the primary actors of the learning process. Use of UTAUT in research in the education field is not as extensive as it could be. The contribution of cultural, regional, and policy variations to the identification of the determinants that the UTAUT model revealed, particularly in the developing environment where the digital divide remains significant, should be investigated. Lastly, such barriers must be theorized as social value, meaning that their mitigation extends beyond the technical factors, and it is a social duty that facilitates inclusivity, equity, and sustainable digital revolution of education.

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