

Research on the Influencing Factors and Paths of Teachers' Digital Literacy in the Context of Digital Transformation of Education

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ABSTRACT

The integration of digital technology into education has not only driven significant changes in teaching methods, educational philosophy, and learning environments but has also raised the requirements for teachers' digital literacy. As key promoters of educational digital transformation, the enhancement of teachers' digital literacy has become a focus of attention worldwide. Therefore, based on the Technology Acceptance Model and the Theory of Planned Behavior, this study constructs a theoretical model to explain and predict teachers' digital literacy by considering multidimensional factors. These factors include external environmental factors, perceived usefulness, perceived ease of use, technology use attitude, subjective norm, perceived behavioral control, and technology application behavior. This research endeavors to reveal the influence of these elements on teachers' digital literacy and to understand the underlying mechanisms. It offers valuable insights and theoretical guidance for educational practice.

Keywords: Teachers' digital literacy, Technology Acceptance Model, Theory of Planned Behavior.

1. INTRODUCTION

The digital transformation of education is a critical topic in ongoing educational reform, exerting a profound influence on the realization of high-quality educational development. The enhancement of teachers' digital literacy is not only a key soft power in the digitization of education but also a vital support for establishing an exemplary education system and cultivating high-quality talents. In November 2022, the Ministry of Education issued the "Digital Literacy of Teachers" standard, which covers five pivotal facets: digital awareness, digital application, digital technology knowledge and skills, professional development, and digital social responsibility [1]. This standard provides a clear framework and policy guidance for the development, evaluation, and training of teachers' digital literacy. Given the significant role of teachers in talent cultivation, improving their digital literacy is important for promoting pedagogical innovation and ensuring the implementation of educational digital transformation.

Despite the continuous launch of training and development programs by universities to improve teachers' digital literacy, issues in the teaching philosophy and curriculum design limit their practical effectiveness to some extent. Therefore, to facilitate the development of educators' digital proficiency effectively, it is imperative to deeply understand the internal mechanism of its formation and transformation. Previous studies have largely focused on elucidating the connotation and improvement strategies pertaining to teachers' digital competencies, and have conducted descriptive surveys of teachers in different regions, educational stages, and genders to reveal the development status of these competencies [2]. However, the extant literature has not yet provided sufficient answers regarding how external factors influence teachers' digital literacy, nor has it fully explored the role of teachers' personal cognitive attitudes in this influence process.

The Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) both originate from the Theory of Reasoned Action, exhibiting significant complementarity in elucidating

individuals' adoption and use of digital technologies. These theoretical frameworks have been extensively applied to analyze individuals' attitudes and behaviors towards technology adoption. This study aims to develop a conceptual model that synthesizes the theoretical insights of the TAM and the TPB, thereby exploring the factors and pathways influencing teachers' digital literacy and offering practical guidance for educational practices.

2. LITERATURE REVIEW

2.1 Digital Literacy of Teachers

In 1997, Gilster introduced "digital literacy" as the capacity to understand and apply complex information presented by computers [3]. In 2011, UNESCO expanded the concept of digital literacy to include creating and using digital media, finding and processing information, sharing knowledge in social networks, and practicing various professional computational skills [4]. With the digital era progressing, the definition and scope of digital literacy continue to expand and evolve. In 2022, China's "Digital Literacy of Teachers" standard defined teachers' digital literacy as the ability and responsibility to utilize digital information and resources. This encompasses skills such as identifying, analyzing, and addressing pedagogical challenges, as well as enhancing and innovating educational practices [1].

2.2 Technology Acceptance Model

Davis conceptualized the Technology Acceptance Model in 1989 to predict the degree of user acceptance and usage behavior towards new technologies [5]. Davis's research found that the improvements in digital skills are influenced by both external factors and intrinsic motivation. When using new technology, perceived ease of use and perceived usefulness are key factors that shape user's attitudes and further affect their actual use. Perceived ease of use pertains to the extent to which users believe that utilizing a particular technology requires minimal effort, while perceived usefulness is the belief that using a specific technology will boost their work productivity. These factors are central to the TAM and reflect acceptance of new technology. Users' attitude refers to the emotions and attitudes that users exhibit when using new technology, jointly determined by perceived ease of use and perceived usefulness. Since the introduction of TAM, it has been widely validated and has shown strong

applicability in the acceptance research of educational technology courses [6].

2.3 Theory of Planned Behavior

In 1991, Ajzen proposed the Theory of Planned Behavior to predict and explain an individual's intentions and behaviors. TPB includes three fundamental elements: attitude, perceived behavioral control, and subjective norm [7]. Attitude reflects an individual's view of performing a specific behavior. Perceived behavioral control describes the individual's sense of self-efficacy in performing a particular behavior. Subjective norm relates to the social expectations and pressures perceived by the individual. TPB suggests that an individual's actual behavior is influenced by three factors: a positive attitude, a high level of perceived behavioral control, and a strong perception of subjective norm. These factors increase the likelihood that the individual will perform the behavior. TPB provides a robust theoretical foundation for understanding individual behavior, particularly within the educational domain, where it aids in uncovering the determinants affecting teachers' digital literacy and the underlying mechanisms.

3. MODEL CONSTRUCTION OF INFLUENCING FACTORS FOR TEACHERS' DIGITAL LITERACY

3.1 External Factors and Perceived Usefulness and Perceived Ease of Use

Based on the TAM, this research defines perceived usefulness as teachers' evaluation of how well digital technology solves teaching problems and enhances efficiency and effectiveness. Perceived ease of use is how easy teachers think the technology is to use. The perceptions of usefulness and ease of use in digital technology among teachers are shaped by a multitude of external factors, including technical training, school culture, policy support, and convenience conditions. Firstly, systematic digital professional training helps teachers master digital knowledge and operational skills required for teaching, deepening their grasp of the potential value and practicality of digital technology in teaching. Secondly, positive feedback from school management on teachers' use of digital technology can increase teachers' perception of the value of digital teaching work. Thirdly, policy support from education authorities, such as providing funds, formulating digital education strategies, and promoting the digitization of education, helps

augment teachers' perception of the usefulness of digital technology. Fourthly, convenience conditions, including good hardware, rich software resources, and a stable network, are essential for effective teaching. When teachers conveniently access and use these resources to improve teaching effectiveness, their ease of using digital technology increases.

3.2 Perceived Ease of Use and Technology Use Attitude and Technology Application Behavior

Technology use attitude reflects teachers' emotional responses, either positive or negative, to employing digital tools in their practice. According to the TAM, the ease of use perceived by teachers is a pivotal element in shaping their perspectives and behaviors regarding technology application. Teachers who perceive new technologies as easy to learn and operate are more likely to develop a positive attitude, which in turn increases their technology application behaviors. Research has shown that a positive attitude can significantly enhance the continued use of technology [8]. Conversely, if teachers encounter difficulties in learning and using new technologies, they may harbor a negative attitude. This perception can be exacerbated if they believe that becoming proficient in these technologies demands considerable time and effort. Such beliefs might result in undervaluing the potential benefits of technology, potentially leading to a reluctance to adopt or a decrease in its use.

3.3 Perceived Usefulness and Technology Use Attitude and Technology Application Behavior

Based on the TAM, perceived usefulness positively influences attitude, which is a key factor in predicting individual behavior. A survey of Nigerian teachers shows that teachers' perception of the usefulness of digital technology in teaching positively affects their attitude, which in turn positively influences their digital teaching behavior [9]. Teachers' positive perception of digital tools, especially when they believe them to enhance teaching and learning, will stimulate a positive attitude toward technology use and increase their motivation to adopt these tools. In teaching practice, teachers' adoption of digital technology is often based on their assessment of the potential contribution to achieving instructional goals and improving the student learning experience. Teachers are more likely to continue using a technology if it effectively improves teaching efficiency. Conversely, if teachers

do not see the benefits of digital technology for teaching in practice, or if they believe the cost of using the technology is higher than its teaching value, they may reduce or stop using it.

3.4 Subjective Norm and Technology Application Behavior

Subjective norm refers to the social expectations and pressures from school management, colleagues, and students that influence a teachers' technology application behaviour [10]. When teachers view the use of digital technology as a shared expectation or standard practice in education, they feel a stronger social motivation to embrace it. In teaching practice, this perception of digital tools is shaped by support from school leaders, examples from colleagues, and expectations from students. When school leaders clearly support the use of digital tools in teaching, colleagues actively integrate these tools in their classrooms, and students show acceptance and expectations for digital instruction, teachers are more likely to recognize the value and necessity of using digital tools. As a result, they tend to adopt and continue using these tools for teaching.

3.5 Perceived Behavioral Control and Technology Application Behavior

In this research, perceived behavioral control refers to teachers' beliefs about their capacity to use digital technology in teaching, which mainly includes their evaluation of digital technology accessibility, technical knowledge mastery, skill proficiency, and confidence in using technology. These beliefs can significantly influence the depth and frequency of technology use in teaching. For instance, if teachers believe they have sufficient resources, time, and capacity to use digital tools effectively, they possess a higher level of perceived behavioral control, which in turn fosters a more extensive use of technology in their lessons. Moreover, a strong sense of perceived behavioral control can empower teachers to overcome potential barriers, such as initial difficulties or resistance from traditional teaching methods. It can also encourage them to seek out and utilize digital tools that align with their teaching philosophy and goals, thereby enhancing their professional efficacy and the overall quality of education they provide.

3.6 Technology Application Behavior and Teacher' Digital Literacy

Technology application behavior denotes the active engagement with digital tools by teachers in

their teaching practice. Practice-oriented teachers' digital literacy emphasizes the importance of integrating digital technology into teaching practice. This integration is essential for the effective enhancement of teachers' digital literacy. Existing research indicates that there is a significant positive correlation between teachers' technology application behavior, which includes proficiency, duration, and frequency of technology use, and teachers' digital literacy [11]. As teachers use technology often, they get better at using specific tools. This improvement is a key aspect of digital literacy, especially regarding

technical knowledge and skills. Moreover, the longer teachers use technology, the more experience they gain. Long-term use helps them solve teaching problems more effectively. This enhances their digital capabilities, promotes teaching innovation, and can lead to more effective instructional strategies and student engagement.

In summary, combined with the TAM and the TPB, this study constructs a model of the influence mechanism of teachers' digital literacy (see "Figure 1").

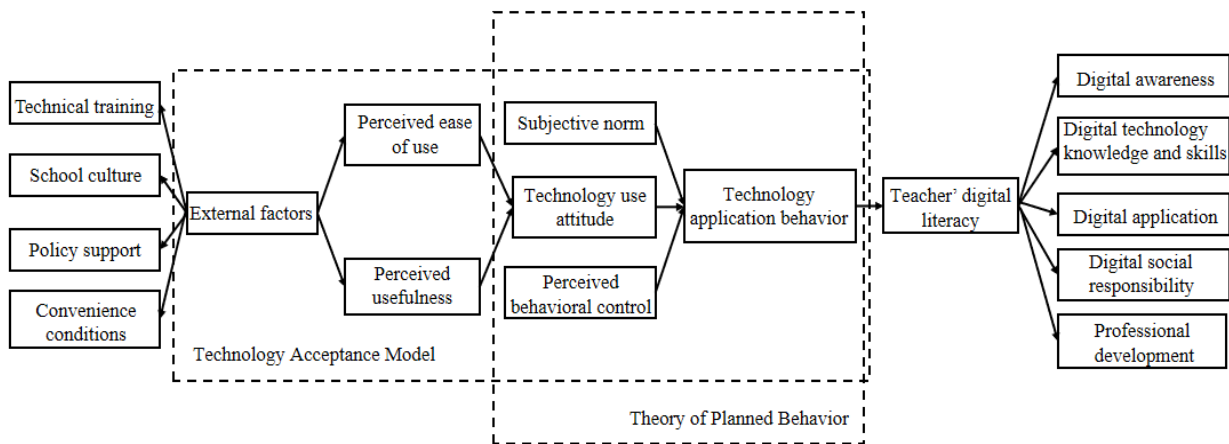


Figure 1 Influence mechanism model of teachers' digital literacy.

4. PATHWAYS FOR ENHANCING TEACHERS' DIGITAL LITERACY

4.1 At the School Management Level

To enhance teachers' digital literacy effectively, schools must improve the digital literacy training system, as systematic support is essential for the success of teacher training programs. Firstly, schools ought to develop personalized training programs tailored to the diverse stages and requirements of teachers' professional growth. These programs should include initial basic skills training, advanced application training, and practical operation training. Secondly, during the implementation of training, a blended learning model that combines online and offline elements should be adopted. This approach provides flexibility in terms of time and environment, allowing teachers to plan their learning according to their personal schedules, thus accommodating their individual needs and availability. Lastly, an integrated feedback and tracking system should be established to monitor teachers' progress, address their challenges, and adjust training strategies as needed.

Schools should improve digital infrastructure and create an optimized tech environment to support teaching activities. Firstly, schools need to accelerate the construction and upgrading of digital teaching facilities, which not only include hardware equipment such as computers, smart projectors, and interactive whiteboards but also educational software and applications like digital management platforms and digital teaching materials. Secondly, schools can leverage existing cloud-based digital learning platforms, resource libraries, and educational technology tools to build an intelligent teaching environment. For instance, schools can establish a data-integrated teaching resource sharing platform, which not only allows for the effective gathering and use of digital teaching resources from both within and outside the school but also improves the efficiency of resource use. Furthermore, the platform fosters the sharing and promotes a virtuous cycle of utilization for high-quality digital teaching resources.

4.2 At the Individual Level of Teachers

Teachers must enhance their digital teaching awareness and commit to integrating technology into both teaching management and practice. By doing so,

they can continuously improve their digital capabilities and understanding of digital teaching. Confronting the swift evolution of information technologies such as the internet and big data, teachers should not only proactively adapt and develop a digital teaching mindset but also actively enhance their digital skill and proficiency in using digital teaching tools. Teachers must recognize that integrating digital technology into teaching is more than a mere methodological update; it represents an innovation in teaching philosophy. Furthermore, embracing their role as “digital teachers”, teachers should transform the integration of digital instruction from a mere requirement to a personal drive. By consciously incorporating digital technology into their teaching, they can enrich the content and foster a habit of regularly employing digital teaching methods.

Teachers must strengthen their knowledge of digital technology and enhance their ability to apply it. They can independently learn digital teaching knowledge and skills through internet resources and digital education platforms. Gaining an understanding of the practical application of digital technology in teaching enables them to continuously improve both their technical proficiency and teaching effectiveness. Additionally, teachers can use digital tools to design course content and activities that fit their teaching style and students' needs. For example, teachers can use smart devices like tablets to organize and manage teaching activities, thereby enhancing student engagement and interaction. They can also employ cutting-edge technologies such as VR, MR, and AR to transcend traditional teaching limitations and create immersive learning environments. Additionally, online assessments can be utilized to gauge students' understanding, allowing for the adjustment of teaching strategies accordingly.

5. CONCLUSION

With the advent of the digital era, the educational landscape is experiencing a transformation without precedent. Continuously improving teachers' digital literacy is vitally important for building a high-quality, professional teaching team and accelerating the process of educational digitization. In light of this, based on the TAM and the TPB, this study constructs a theoretical model to explain and predict teachers' digital literacy. The model not only deepens our insight into the formation mechanisms behind teachers' digital literacy but also provides a theoretical foundation for the development of educational policies and teacher training programs.

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