

How Technological Tools Enhance Prospective Teaching in Higher Education: A Mixed Methods Study

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Abstract

The study sheds light on the effectiveness of the integrated instructional tools on prospective teachers. The incorporation of instructional proficiency in teaching has revolutionised teacher education, and the use of innovative approaches in teaching methodology has changed the teaching-learning process. The mixed-methods research study examines the use and perception of instructional tools among prospective teachers at universities. To determine the impact of technology on the teacher education system, purposive sampling was employed. The mixed design was incorporated. Qualitative sampling was conducted through interviews and focused group discussions, while quantitative sampling was conducted using questionnaires. Qualitative data were analysed using thematic analysis to identify patterns, themes, and insights that emerged from the data. Descriptive statistics and inferential statistics were used to analyse the survey data and identify significant trends and correlations. The sample consisted of prospective teachers and teacher educators. Participants' opinions of instructional tools, especially Kahoot, Nearpod, and Google Sites, were largely positive, as indicated by descriptive statistics, and the survey demonstrated good reliability (Cronbach's Alpha = .935). Individual characteristics may influence how aspiring teachers assess technology in the classroom, according to a one-way ANOVA that found significant differences in perceptions of how effective technology is at enhancing academic accomplishment, teaching proficiency, and student learning outcomes ($p < .05$). The research provides valuable insights into how teacher education programs can effectively integrate instructional technology and prepare prospective teachers for the changing paradigm of education.

Keywords: Prospective Teachers, Instructional Technology, Effectiveness, Teacher Educator.

Introduction

Technology refers to the use of digital platforms in educational settings, such as teaching and learning contexts. Ghayyur and Mirza (2021) classified techniques as various tools, including Google Sites, Padlet, Nearpod, videos, and gamification. Instructional technology influences the professional skills of prospective teachers (the future teachers), providing them with the tools and resources.

Since it measures how well the educational process is progressing, student engagement is a crucial issue. It is impossible to overlook the impact that technological advancement plays on learning in a time when technology permeates all facets of daily life. A stimulating educational setting that

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adapts to the demands of learners is produced by utilising interactive technologies, instructional applications, and online platforms for learning. Student engagement can be improved by implementing technological advances, such as flipped classes. Technology is a vital tool for encouraging pupil engagement, and educators must be equipped with the knowledge and tools they require to integrate it into their lesson plans effectively. The efficient use of technological resources to raise student engagement depends heavily on instructor preparation and ongoing professional growth. The TPACK framework, technology pedagogy and content knowledge are the indicators (Adiyono et al., 2024).

Instructional Tools and Pedagogy

Educational institutions may receive the newest resources and instruction, frequently at a discounted price, through partnerships with technology companies (Khamdamov, 2024). A particular kind of active learning is the "flipped classroom", often referred to as the "inverted classroom". The classroom that is flipped has been offered as a novel pedagogic technique and has been proven to have a greater beneficial influence across a variety of educational disciplines (Somaa, 2024). By utilising technological advances, the flipped classroom fosters an engaging and participatory learning environment, distinguishing it from conventional teaching methods. Pupils get individualized teaching using devices connected to the internet before the during class sessions, usually in the way of video courses. Collaborative cooperative learning opportunities then take center stage during in-class sessions. There are several educational benefits to this inversion of conventional tasks. It makes the pupil the focal point of the educational process and encourages an awareness of Accountability for studying the subject matter before class.

Furthermore, pupils are offered the freedom to study at their preferred speed thanks to video instructional features like a rapid forward, restarting, and stopping that let individuals take charge of their education. This method also promotes a change to educational behaviors since the ability of learners for self-regulating the way they learn can be enhanced by independent study before classes. Apparently most significantly, flipped classroom improves time spent in class by offering greater chances for interaction between students and teachers, which promotes group learning and the growth of more advanced abilities (Ribeirinha & Correia, 2024).

In general terms, digital citizenship signifies ethical and accountable Utilization of technological devices, technological advances, and assets; this includes being aware of and considerate of other people's rights and obligations in a digital setting, including, for instance, security, confidentiality, and online harassment concerns (Von Gillern, Korona, Wright, Gould, & Haskey-Valerius, 2024). To enable the next generation to engage actively and responsibly in the world of technology and develop their ability to utilise technological innovations critically and effectively, Digital Citizenship Education (DCE) has become a global priority (Simões et al., 2024). By integrating digital citizenship instruction, pupils are better able to comprehend the moral ramifications of what they do online and are encouraged to behave responsibly and with respect (Khamdamov, 2024).

Instructional Tools and Content Knowledge

TPACK illustrates how instructional tools such as Nearpod, videos, and gamification are hypothesized to affect the effectiveness of prospective teachers.

In the current technological landscape, the primary goal of Ramya and Rajeswari's (2024) research was to examine prospective educators' propensity to use cloud-based technology. Regarded utility, believed simplicity of Utilization, believed security, regularity of Utilization, and intention for behaviour are the five usability criteria that were included in the study design that was created

based on the examined studies. A quantitative research approach was employed to gather information from 252 prospective educators in the Karaikudi area. The data evaluation techniques employed included analysis of multiple linear regression, factor analysis, percentage analysis, and analysis of Pearson correlations. Focusing primarily on the perceived simplicity of utilisation, prospective educators had a moderately positive predisposition to use cloud-based technology, according to the statistical study of the information. The research made it clear that methodologies for teaching must adapt in order to successfully integrate technologies into classes in the years to come and to create sustainability in educational procedures.

The study by Okulu and Muslu (2024) centered on examining the usage of ChatGPT in creating a science educator preparation course. The research used a method of qualitative study using ChatGPT as a helper to develop a scientific education course strategy for evaluation in the classroom. Researchers used their discussion to develop the strategy as the source of information for their work of evaluation. An interpretation evaluation was conducted on the qualitative information. The results highlighted how ChatGPT may facilitate the creation of a workable design for the course, provide flexible data, and save time. There were restrictions to take into account, however. These obstacles included things like the potential for misunderstandings and talking outside of ChatGPT. The study's results unequivocally demonstrate that ChatGPT is relatively successful at creating course plans, despite these drawbacks.

The study by Xu, Bautista, and Yang (2024) examined the elements that affect prospective teachers' reported performance in learning and contentment, as well as the interaction links between these aspects, using an integrated framework that combined the Expectation Confirmation Model (ECM) and the Technology Acceptance Model (TAM). In the province of Shandong, China, a total of seven regular colleges and universities provided a random sample of survey respondents. The research work employed the partially least-squares modeling of structural equations technique to evaluate the hypotheses it raised. Expected assurance and educational effectiveness were strongly impacted by the real-world application of Online Teaching Video Cases (OTVCs), as the study's findings showed. This had a substantial impact on prospective teachers' learning satisfaction and, consequently, learning performance. The investigation demonstrated how OTVCs may be used as a powerful educational tool for prospective teachers. Their satisfaction with OTVCs in terms of learning can be substantially explained by the suggested structure that combines ECM and TAM. To enhance their students' learning experiences, educators are urged to use relevant video-based educational resources.

The study by Colomo-Magaña et al. (2024) attempted to comprehend how prospective elementary school educators view gamification as a proactive strategy while accounting for the factors associated with gender and evaluation time. A longitudinal quantitative panel approach (post-test and pre-test) using a both inferential and descriptive methodology was used to achieve this. Two hundred eighty-four prospective elementary school educators from the University of Malaga made up the sample. The data was gathered using an approved instrument that gauges opinions on teaching strategies and digital didactic materials. The findings showed that gamification was seen favourably as an approach, and scores significantly improved from the prior test to the subsequent tests. In terms of the gender factor analysis, there were nevertheless notable variations, having the participants who were male scoring gamification better than participants who were female.

Investigating future social studies instructors' attitudes and views of AI was the goal of the study by Yetişensoy (2024). One of the combined methodologies used in the study was the convergent parallel model. The findings showed that the parameter of perceived AI expertise affected how potential instructors felt about AI. As a result, individuals who reported having a high level of AI

expertise showed noticeably more favourable views than those with medium or minimal levels of knowledge.

The study by Vuong and Thu (2024) aimed to investigate how prospective English as a foreign language teachers felt about the use of information and communication technologies in EFL classrooms during their practicum in education. To accomplish its goals, the research used a combination of methodologies with Forty EFL prospective instructors from a Vietnamese institution. To collect data in a quantitative form, a questionnaire centred on the model of technological acceptance was created, and semi-structured interviews were conducted to gather more detailed information. The findings from both qualitative and quantitative data showed that, throughout their instructional practicum, EFL prospective educators generally viewed the use of ICT in EFL classrooms as favourable.

The purpose of the study by Basori et al. (2024) was to investigate how prospective EFL teachers felt about readability text technologies. It addressed how well future educators embrace the Readability Analyzer and Web-FX as readability tools, as well as concerns from participants when utilizing the resources. Thirty three third-year undergraduates enrolled in a preparation for teaching program participated in the research, which was carried out at one English language education program in East Java, Indonesia. The research found that participants had a favourable perception of the resources for several reasons after using a method for qualitatively analysing data from the pupils' interviews and textual analysis studies.

The case study by Pradana et al. (2024) examined how twenty undergraduate teachers from a private institution in Indonesia enhanced their self-efficacy when using technologies in the classroom. The study participants spoke multiple native languages and came from different cultural communities. The participants, who were interviewed online in a variety of educational settings, were asked about their experiences of learning how to use technologies into instruction. In order to evaluate results, images captured throughout the process of learning were also used to gather observational data. Three emerging themes showed up from the research investigation, which showed how prospective educators' confidence in multilingual teaching environments had grown: (1) creating technology activities for learning; (2) utilising technology for learning to encourage pupils to develop independence, as well as (3) encouraging collaborative participation in various settings through instructional technology. Additionally, by modifying, creating, and working together, those who participated revealed that they could build self-efficacy in addressing the difficulties related to the use of technology in the classroom. The research study focused following hypotheses:

There is no significant difference in the mean scores of instructional tools in terms of the effectiveness of prospective teachers.

There is no significant difference in the mean scores of instructional tools, pedagogy, and content knowledge of the prospective teachers.

Methodology

The study followed mixed methods exploratory design. First the qualitative findings presented then describe the quantitative results. This study employed a mixed-methods approach, combining quantitative and qualitative data to understand the impact of instructional technology on teacher education comprehensively. The research design was divided into two phases:

Qualitative Exploration

Interviews and Focused Group Discussions: Semi-structured interviews and focused group discussions were used to collect qualitative data, providing insights into the nuances of technology integration in teacher education.

Quantitative Analysis

Survey Research: A structured questionnaire was administered to a sample of teacher educators and student teachers to gather data on their perceptions and experiences with instructional technology.

Statistical Analysis: Descriptive statistics and inferential statistics were used to analyze the survey data and identify significant trends and correlations.

Data Integration and Analysis

Qualitative and quantitative data were triangulated to validate findings and provide a comprehensive understanding of the impact of instructional technology on teacher education.

Thematic Analysis: Qualitative data were analysed using a thematic analysis approach to identify patterns, themes, and insights that emerged from the data.

Sampling Strategy

Purposive Sampling: Participants were selected based on their experience with instructional technology and their willingness to participate in the study. Study population includes prospective teachers and teacher educators.

Sample Size: The sample size was determined based on the research questions and the need for both breadth and depth of data. Research Tools

Survey Instrument: A validated survey instrument was used to collect quantitative data.

Interview Protocol: A semi-structured interview protocol was developed to guide the Collection of qualitative data.

Data analysis

For qualitative data analysis, thematic analysis was used to analyse the transcriptions of the interviews. The coding scheme focused on identified indicators of effectiveness, pedagogy and content knowledge. Participants mentioned the use and effectiveness of Nearpod in lesson planning.

Quantitative Analysis

Reliability test and sample adequacy test were performed to validate the instruments.

Descriptive statistics were calculated for each variable. Frequency distribution test was performed. ANOVA was used to examine the differences between the means of independent groups.

Results

The present study explored how prospective teachers perceive the use of instructional technology in relation to their motivation, teaching proficiency, and student learning outcomes. To ensure the consistency of the responses, a reliability analysis was conducted, which revealed a very high reliability score (Cronbach's Alpha = .935) (Table 1). This indicates that the items included in the survey were closely related and consistently measured the intended constructs.

Table 1: Reliability Statistics

Cronbach's Alpha	N of Items
.935	27

An analysis of the descriptive statistics shows that overall, participants responded positively to the integration of instructional tools such as Nearpod, gamification, and platforms like Kahoot and Google sites. The average scores for most items fell between 1.6 and 2.2 on a 4-point Likert scale, suggesting general agreement. Among the highest-rated items was the belief that Kahoot is an effective tool for gathering classroom feedback, while slightly lower agreement was seen in statements about the long-term professional development impact of instructional technology.

To examine whether these perceptions differed across groups (possibly based on the extent of technology integration or academic performance), a one-way ANOVA was carried out on selected items. The results showed that participants' opinions varied significantly in a few key areas (Table 2).

There was a statistically significant difference in how participants perceived the role of instructional technology in enhancing academic achievement, $F(2, 63) = 12.654, p < .001$.

Similar differences were observed in their views regarding the use of technology to develop professional teaching proficiency, $F(2, 63) = 12.136, p < .001$.

A smaller but meaningful variation was also found in participants' views about how technology supports students' learning outcomes, $F(2, 63) = 4.088, p = .021$.

Table 2: ANOVA statistics

Sum of Squares	Df	Mean Square	F	Sig.
6.600	2	3.300	12.654	.000
16.430	63	.261		
23.030	65			
4.737	2	2.368	12.136	.000
12.294	63	.195		
17.030	65			
3.037	2	1.518	4.088	.021
23.402	63	.371		
26.439	65			

These findings suggest that not all prospective teachers view instructional technology in the same way. Factors such as their prior exposure, comfort level with technology, or academic standing may influence how they assess its usefulness in teaching and learning. This highlights the need for targeted training and support to help future educators integrate technology more effectively in their practice.

Discussion

This study analysed the effectiveness of instructional tools that utilise innovative strategies to enhance teacher effectiveness. Regarding the first hypothesis, the results confirm that instructional tools improve the factors of prospective teachers at the university.

The finding is in line with those of other authors' references. In the context of different perspectives. The study can be compared with the results of the studies by Pradana et al. (2024). The findings of the research contribute to the growing body of innovation in instruction technology within the context of the University. Therefore, it is important to consider the broader landscape of instructional technology in the context of prospective teachers at a higher education level. For example, the study by Colomo-Magaña et al. (2024) suggests that incorporating technology into

teaching practices can enhance engagement, motivation, and learning outcomes. Moreover, the use of technology can provide a more dynamic and interactive learning experience, enabling prospective teachers to develop professional skills and problem-solving abilities. Prospective teachers must possess the necessary skills and knowledge to use technology tools effectively and design instructional materials that align with their teaching objectives in the new normal.

Conclusion

This study highlights the growing importance of incorporating instructional tools into teacher preparation programs. According to the results, prospective teachers typically have favourable opinions of Google Sites, Nearpod, and Kahoot because they understand how these tools might improve pupil educational outcomes, academic performance, and teaching effectiveness. Considerable disparities in perception, based on personal characteristics, highlight the necessity of tailored training and support. Providing aspiring teachers with the expertise and self-assurance to effectively utilise technology is crucial to creating stimulating and productive learning environments as education continues to evolve in the digital era.

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