Analysis of the opinion of prospective teachers regarding TPACK and ICT: a glimmer of light for Pakistan's education system

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Abstract

The need for revolutionary education grew in this modern era alongside the arrival of the Industrial Revolution. Because of the rise of information and communication technologies (ICT), educational goals have shifted, and only educators with expertise in technology pedagogical material are finding success in the classroom. As a result, traditional education is on the brink of extinction. Most students are unemployed after finishing traditional education, yet there is a growing need for educators with expertise in technology, media, and content knowledge (TPACK). Competence in technical pedagogical content knowledge and familiarity with information and communication technologies are prerequisites for employment in Pakistan and other industrialized nations, as well as on the global labor market. Aiming to gauge how future educators in Pakistan view ICT and TPCAK, this study collected data from a representative sample of the country's students. In order to accomplish this, we polled 200 future educators seeking degrees in Bachelor of Education (B.Ed.), Master of Education (M.Ed.), Master of Philosophy (M.Phil.), or Doctor of Philosophy (Ph.D.) from three schools in South Punjab on their thoughts and feelings regarding technology in the classroom (TPACK). We used a 5-point Likert scale to gauge their perspective and attitude towards TPACK and ICT. The results showed that future educators had a favorable impression of communication and information. In terms of content knowledge, technical knowledge, pedagogical knowledge, and technology pedagogical, they had a favorable impression and attitude. The training of future educators should incorporate ICT and TPACK, and instructors should be qualified individuals with extensive knowledge of these topics. In order for students to be a part of the new educational revolution and compete favorably on a global scale, it is essential that ICT be incorporated into the curriculum at both the high school and university levels.

Keywords: TPACK, IST, Education, Prospective teachers

Background of the Study

"The most potent weapon that can be used to transform the world" is education, says Nelson Mandela (Madimbo, 2015). There is no doubt that the educational system in Pakistan is currently in dire need of reform. For educational fairness, high-quality teaching and learning,

teacher professional development, and a well-functioning education system to be realized, it is imperative that we integrate information and communication technology (ICT) into our pedagogical practices and classrooms (Fannakhosrow et al., 2022).

The fifth industrial revolution was ushered in by a bewildering pace of scientific and technological advancements. Every part of society is being touched by digital technology, artificial intelligence, big data, and robots as we reach the fourth industrial revolution (Musarat et al., 2023). These changes show how important it is to use technology in the classroom. The term "TPACK education" is widely used by education experts when talking about effective methods of incorporating technology into the classroom (Thohir et al., 2022). Education is a crucial area for preparing the future generation to deal with the challenges of the contemporary digital world. For pupils to be able to stay up with the ever-changing information and communication landscape, teachers need to become experts in effectively utilizing technology in the classroom. This should be read by everyone considering a career in education, whether at the secondary or tertiary level (Hafeez et al., 2023; Zaman et al., 2023; Tanjung, 2022).

Global development issues are starting to prioritize the requirement for human resources (HR) with backgrounds in STEM (science, technology, engineering, and mathematics) and associated domains, say Zhang and Chen (2023). Because of how quickly the world is changing, educational methods also need to change to keep up. This trend becomes more apparent when considering the development of ICT. As with many other fields, education has felt the effects of the information technology boom (Aslan & Shiong, 2023; Asad et al., 2023; Amir et al., 2022). New forms of educational technology that attempt to improve students' ability to study emerged about 2006. (Yang et al., 2022). This paradigm is designed to describe educational technology in a way that can more systematically and controlledly handle learning issues (Akour & Alenezi, 2022). From what we can tell, educational technology has always been a systematic way of dealing with problems in the classroom. Even though most teachers now see the need to use technology in the classroom, very few have tried to do so (Umar et al., 2023; Ahmad et al., 2023; Snezhko et al., 2022). Teachers have an impact on their students' capacity to learn. We require more qualified educators to meet the demand for improved classroom instruction (Hussain et al., 2023; 24; Sulthani & Thoifah, 2022).

The effectiveness of a student's learning is influenced by the teacher. In addition to having extensive subject-matter expertise, educators should be able to effectively connect their students to a wide range of in- and outside-classroom resources that can enhance their learning (Huang et al., 2022). Teachers should also have the ability to create learning settings that enable pupils to absorb the most comprehensive knowledge feasible, according to Alwi and Mumtahana (2023). As a result, teachers, especially those engaged in the field during the Industrial Revolution, were anticipated to have a deep understanding of technological and scientific concepts. This hurdle arises while attempting to prepare the next generation of teachers to effectively utilize technology in the classroom (Mutiara, 2022). Knowledge of data and its proper handling, as well as proficiency in electronic communication, are additional components of effective technology use beyond just being able to use a computer (Zhang et al., 2022). One of the many consequences of incorporating ICT into the classroom is the increased demand for teachers who are highly competent in technology as well as experts in

their subjects and methods of instruction (Demissie et al., 2022).

The need for teachers to accelerate the development of new information and communication technologies will persist well into the future. It is crucial to update classroom management techniques and pedagogical approaches for the 21st century to keep up with the demands of the latest innovations in ICT. Modern educators confront seven major challenges: a) educating a culturally and linguistically diverse student body; b) fostering an environment conducive to active learning; c) figuring out how to use technology effectively in the classroom; e) coming up with new ways of looking at students' abilities; f) addressing students' agency and agency in the classroom; and g) holding students to high standards of performance (Gumus, 2022).

The ability to use technology while paying attention to both its pedagogical and content-related features is called Technological Pedagogical Content Knowledge (TPACK) (Li et al., 2022). If they want their students to learn and apply what they've learned, teachers must have excellent communication abilities. This is because learning is an ever-changing process that takes place whenever a person interacts with their surroundings to gain knowledge, abilities, and habits. Therefore, students must learn early on how to convey what they know, particularly the accurate subject content, through successful pedagogical activities if they aspire to become professional future teachers. What is referred to as "content" consists of data, facts, concepts, laws, theories, and an in-depth familiarity with the topic (Abdurrahman et al., 2029). It is the field of pedagogics that deals with methods of instruction that cater to the individual needs of students (Varas et al., 2023).

Additionally, a pedagogue must be well-versed in the ideas and principles of good learning and possess an understanding of the qualities and abilities of their students (Cai et al., 2023). Pakistan needs to improve its educational system if it wants to keep up with the rest of the industrialized world (Tahir & Farooq, 2023). An improvement in teacher quality and student accomplishment is crucial for Pakistani education to reach its full potential. As a result, students who want to enter the teaching profession should have no trouble using this technology. In particular, future teachers might struggle to figure out how to use technology in the classroom (Nayazi et al., 2023). An in-depth understanding of the material is essential for a prospective instructor to select the most appropriate technology. To successfully apply learning, prospective teachers need to have both subject matter expertise and Technological Pedagogical and Content Knowledge (TPACK), according to Erfan et al. (2023).

Many teachers have only now started to realize the possibilities of using technology in the classroom, even though it has many clear advantages. Having competent educators in the classroom is the first step in improving educational standards. According to Prabawati et al. (2023), teachers are accountable for creating and implementing lessons, giving tests, doing research and studies, and communicating with community members.

Problems with teaching standards, subject mastery, and inadequate media and technology literacy are still present in Pakistani classrooms and schools, according to field research (Siddiqui et al., 2023). One major challenge facing Pakistani education in the global complex is the ability of teachers to build professional development plans that include TPACK (Technological Pedagogical Content Knowledge) (Ali et al., 2023). The term "TPACK" describes a person's extensive combination of subject-specific, instructional, and technologically sophisticated knowledge and skills. The acronym "TPACK" was first used by Shulman in 1987 and then refined in 2008 by Koehler and Mishra. When faced with

challenges related to incorporating ICT into classroom instruction, Angeli and Valanides (2014) argue that TPACK could serve as a valuable framework for educators to follow.

As a whole, TPACK encompasses a wide range of competencies, such as technical (TK), pedagogical (PK), content (CK), technological pedagogical (TPK), pedagogical (PCK), and technological (TCK) knowledge.

The term "content knowledge" refers to an individual's level of expertise in a certain subject area. Having an in-depth understanding of the subject matter is also critical since it determines the distinct viewpoint that each researcher takes (Schiering et al., 2023). Teaching expertise is defined as the ability to lead a classroom effectively, develop engaging lessons, plan for students' learning, identify and meet their unique needs, and assess their growth. Knowledge of effective teaching methods defines the ultimate purpose of classroom instruction. To guide their pupils in learning activities and achieve predetermined goals, teachers should work on their teaching talents. The second component is pedagogical knowledge (PK), which includes subjects such as educational objectives, classroom management, curriculum development, and lesson planning (Zeng et al., 2023).

Being well-versed in a variety of methods and resources, both digital and otherwise, is one definition of technological expertise (Padmavathi, 2017). One component of technological knowledge is the ability to learn and adapt to new technologies. This competency is becoming more important as the rate of technological development continues to rise (Brianza et al., 2023). Cutting-Edge Technology Theoretical and practical comprehension of the most effective ways to incorporate technology into the classroom make up pedagogical knowledge. A key factor contributing to TPK is the reciprocal relationship between technology and schooling. Thanks to technological improvements, new forms of education can be more widely disseminated and easily implemented (Gerhard et al., 2023).

Pedagogical content knowledge refers to an educator's ability to draw on their subject-matter expertise when instructing. Aspiring teachers can gain insight into how to address students' unique needs in each subject area through Pedagogical Content Knowledge. It takes more than just knowing your material or having a vague notion of what works in the classroom to be well-versed in both topic and pedagogy; it's about understanding the finer points of how the two interact with each other (Sen, 2023). "Pedagogical knowledge" includes both theoretical and practical understanding of how to effectively integrate technology into the classroom, according to Jiménez Sierra et al. (2023) and Abubakir and Alshaboul (2023). To promote both student learning and teacher effectiveness, TPACK provides a framework for identifying and understanding the body of knowledge that educators require to successfully integrate technology into their classrooms. Researchers and educators have come up with the TPACK framework as a way to evaluate a candidate's readiness to teach effectively with technology.

Justification of the Study

In today's fast-paced world, the Industrial Revolution is likewise advancing; this revolutionary shift in production has altered the market's need for highly trained workers. Since the desire for general traditional education has abruptly vanished to suit the demands of the modern market, educational curricula would inevitably need to be adjusted to match these demands. One country that is feeling the effects of the current industrial revolution is

Pakistan. Despite this, industrial development is painfully sluggish in Pakistan. Pakistan's educated youth, however, find employment in other industrialized nations, necessitating modern, specialized education for them. In today's world, a modern education is essential. TPACK and ICT have evolved into essential competencies for educators. The curriculum in Pakistan has become more technology-integrated, and teachers will soon need to be fluent in both ICT and TPACK, rendering traditional teacher training useless. The purpose of this study was to emphasize the significance of technology, process knowledge, and attitude (TPACK) in the classroom and to find out how future educators feel about these topics.

The Goals of the Research

1. This study set out to examine how future educators rate their levels of ICT, TK, PK, CK, TPK, PCK, and Technological Content Knowledge in the context of their classrooms (TCK).
2. To better prepare future educators to meet students' evolving learning needs and to increase the efficacy of both instruction and student learning through the use of technology, this study aimed, among other things, to propose innovative changes to the educational system and to revamp teacher preparation programs to reflect current needs.

Study Research Questions

1. The following questions were the targets of this investigation;
2. Does the program provide information and communication skills training to aspiring educators?
3. Do aspiring educators have access to courses that teach them about technology?
4. Are future educators getting instruction in pedagogical knowledge?
5. Are future educators getting training in the subject matter?
6. Do aspiring educators have access to courses that educate them on how to use technology in the classroom?
7. Is training in pedagogical content knowledge provided to future educators?
8. Do aspiring educators have access to instruction in technical subject matter?

What Makes the Research Important

i. Since Pakistan is still using its old teaching-learning technique, but the global demand for a trained workforce has altered due to the industrial revolution, this study's results will be highly beneficial to the country's educational system. The global market has been radically altered by ICT, and today teacher certifications are tied to proficiency in both ICT and TPACK. So, fresh ideas are desperately needed in Pakistan.
ii. Everyone from educational policymakers to community members and stakeholders will gain from the research's findings.
iii. The findings will provide light on fresh directions for educator preparation.
iv. For the trainee to succeed in the field, what abilities does the trainer believe the trainee should have?
v. As they adapt their practices to the latest innovations in education, educators will find the research findings invaluable in meeting the problems of the present and the future.

Research Design and Methods

Using a five-point Likert scale and five questions per category, this research collected data from a cross-sectional survey and then ran it through SPSS using a one-sample t-test. We regarded these as favorable viewpoints, while we saw components with a mean value below (3) as negative attitudes. Two hundred education scholars from three schools in South Punjab who were pursuing Bachelor of Education, Master of Education, Master of Philosophy, or Doctor of Philosophy degrees were surveyed using a convenience sampling method. The research objectives were briefly presented to prospective teachers before data collection began, and each part was described. We learned about the research goals, which include the following: the need for technical education in Pakistan and around the world; how to equip our students with the necessary technical skills, knowledge, and abilities (TPACK) through the use of information and communication technologies; and how to help them find good jobs in today's competitive job market.

Research Participants and Samples

This study used a cross-sectional survey design to interview 200 future educators from three schools in South Punjab who were enrolled in Bachelor of Education (B.Ed.), Master of Education (M.Ed.), Master of Philosophy (M.Phil.), or Doctor of Philosophy (Ph.D.) programs. In all, 200 points of view made up the study's sample.

Table 1 Sample of the study

The first stage for the selection of sample institutions		
Districts	Public Schools	PEF Schools
District Bahawalpur	The Islamia University Bahawalpur	
District Dera Ghazi Khan	Ghazi University D.G. Khan	
District Dera Ghazi Khan	University of Education Lahore D.G. Khan Campus	
Through the convenience sampling method, prospective teachers of B.Ed., M.Ed., M.Phil., and Ph.D. education were selected.		
Prospective teachers	200	
Total Sample		200

Gathering Data and Analyzing It

Two hundred future educators from three South Punjabi teacher preparation programs were polled using a 5-point Likert scale as part of this convenience sample cross-sectional survey study. In total, there were 35 questions covering interest, perception, and the relative relevance of various aspects; 5 questions were used to assess each factor, and 5 questions were used to determine how potential instructors perceived ICT. The same was true for the following areas of expertise: technological, pedagogical, content, and technology-pedagogical knowledge; each of these areas saw five questions. Technical content knowledge was the subject of five questions, whereas pedagogical content knowledge was the subject of five. Once the data was collected, it was loaded into SPSS and a one-sample t-test was run. Factors that were more than the mean value of 3.0 were deemed positive.

Data Analysis and Findings

Table 2 Data analysis of the factors (one sample t-test)

Factors	Mean	Std. Deviation	t	df	Sig. (2-tailed)
ICT	3.6240	.54967	93.240	199	.000
TK	3.6630	.51259	101.061	199	.000
PK	3.3280	.56854	82.783	199	.000
CK	3.4380	.57148	85.079	199	.000
TPK	3.4900	.53416	92.399	199	.000
PCK	3.4170	.59505	81.210	199	.000

All categories had great mean values (3.0 plus) in the data analysis, which indicates that all prospective instructors had good attitudes and views about TPACK and ICT. The average values of the following categories were found to be statistically significant: ICT (3.6240), TK (3.6630), PK (3.3280), CK (3.4380), TPK (3.4900), PCK (3.4190), and TCK (3.5840).

Discussion

As a whole, prospective teachers had a favorable impression of ICT, and this was true across the board. The majority of prospective educators had a favorable impression of TPACK. The findings were statistically significant, and the component about information and communication technology (ICT) had an improved mean value. Technological Pedagogical Knowledge (TPK) had a higher mean value and significant results; Pedagogical Content Knowledge (PCK) had a highly positive mean value and significant results; Technological Content Knowledge (TCK) had a high mean value and significant results; and teachers' perceptions and attitudes were discovered to be positive due to the positive Technological Knowledge (TK) and significant results. In general, the results showed that future educators had a favorable impression of ICT and TPACK, and they understood their significance.

Conclusions

Both ICT and TPACK were well-received by prospective educators, but the former had a higher mean rating. Teachers' attitudes were positively impacted by Technological Knowledge (TK). There was a beneficial effect on PK, CK, TPK, PCK, and TCK, that is, on pedagogical knowledge, content knowledge, and technological pedagogical knowledge. The importance of ICT and TPACK was acknowledged by prospective teachers on the whole.

Recommendations

1. The following suggestions are based on the study's results and interpretations:
2. The training of future educators should incorporate ICT and TPACK, and instructors should be qualified individuals with extensive knowledge of these topics.
3. Students can take part in the new educational revolution and compete favorably on a global scale if ICT is integrated into the curriculum at the elementary, middle, and high school levels as well.

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