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IMPACT OF TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK) ON THE TEACHING SKILLS OF SECONDARY SCHOOL TEACHERS IN KHAIRPUR MIR'S, SINDH, PAKISTAN

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Abstract

The rapid expansion of digitalized technology has meaningfully transformed the instructive the learning countryside and formed innovative stresses for educators to progress operative skill of technology incorporated education practices. Now the 21st century, instructors are anticipated not only to own subject knowledge and pedagogical skills but likewise to comprehend in what way expertise can be expressively assimilated into classroom teaching. The TPACK structure delivers a complete approach for thoughtful the incorporation of technology, pedagogy, and content knowledge essential for effective education. The current study aimed to examine the effect of TPACK on the teaching skills of secondary school teachers in Khairpur Mir's, Sindh, Pakistan. The objectives of the research were to inspect the level of TPACK among secondary teachers, measure their teaching skills, and decide the relationship between TPACK and teaching skills founded on demographic variables such as gender, school type, teaching experience, and subject specialization. A quantitative study method was adopted for the research. A correlational study design was employed to define the relationship between instructors' TPACK capabilities and their teaching skills. The population of the research contained of secondary teachers working in public and private schools of Khairpur Mir's. A sample of secondary teachers was selected through a suitable sample technique. Statistics were together through a structured survey constructed on TPACK mechanisms and teaching skill indicators. The together facts were studied by descriptive and inferential statistical techniques, including mean, standard deviation, correlation, regression analysis, t-test, and ANOVA. The results discovered a positive and statistically significant relationship between TPACK and teaching skills. Teachers with advanced TPACK competencies established improved lesson planning, classroom management, instructional delivery, assessment

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practices, and learner engagement. The research accomplishes that TPACK plays an important role in enhancing educators' specialized abilities and enlightening teaching efficiency. The research recommends the inclusion of TPACK grounded proficient development platforms in teacher education to endorse effective technological amalgamation in secondary.

Introduction

TPACK extends Shulman's (1986) concepts of (PCK) by adding the technological aspect. This framework focuses the teaching era of latest technological dynamic and context based. It highlights that subject knowledge (CK), learning methods (PK), other and technological skills (TK) could not be treated as distinct elements; despite, they should work together in an integrated and interactive manner (Koehler et al., 2014; Niess, 2005). Because of this, TPACK framework is highly pertinent concerned education development programs; anywhere many research shown his positive role in improving instructional quality and increasing learner connected (Chai, Koh & Tsai, 2013; Harris et al., 2010).

In areas of Khairpur Mir's, the use of technology in education remains limited and inconsistent. Although national education policies stress technological advancement and digital literacy (National Education Policy, 2017), several obstacles just like as poor structure, shortage of resources, and insufficient educator learning programs have restricted proper implementation (Ahmed & Ullah, 2021). Secondary school teachers often do not receive adequate professional development opportunities to build TPACK skills and apply them effectively in classroom teaching. Considering these challenges, the present research aims to examine in what way TPACK affects the education skills of secondary teachers within its particularly educational or cultural context.

Quickly development of exchange of communication technologies meaningfully shifted learning practices universal. Now 21st century, effective teaching is no longer inadequate to mastery of subject content and outdated pedagogical skills; rather, it needs teachers to capably assimilate technology into their instructional processes. The knowledge society stresses that teachers possess the skill to use digital tools meaningfully increased learner's learning experiences, critical ideas also decisions taking abilities. Therefore, technological integration has become a core capable of quality teaching and professional competence in modern education systems.

Globally, abundant researches noted right impression of TPACK teachers' instructional practices, classroom management, lesson planning, assessment strategies, and learner engagement. Teachers were appropriate and perfect instrument of TPACK select suitable digital gadgets, employ innovative teaching plans, and adapt instruction to diverse learners' needs. As a consequence, TPACK has become a broadly accepted framework to educators training or instructional improvement.

In Pakistan, mostly in the province of Sindh, alignment of digital technology in secondary school education remains a significant challenge. Although government initiatives and educational reforms stress usages in schools technology, many secondary school educators face limitations such by way of inadequate training, deficiency of technological resources, insufficient infrastructure, and limited professional development opportunities. These challenges are more pronounced in semi-urban and rural districts, including Khairpur Mir's, where access to modern educational technologies is comparatively restricted.

Secondary school educators perform part production learners' learning foundations, preparing them for higher education and future careers. However, without satisfactory TPACK

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competencies, teachers may struggle to effectively utilize technology to progress learning qualities like a lecture delivery, learning place interaction, assessment, also student motivation. Sympathetic and existing level of TPACK and its influence on teaching skills is therefore essential for identifying gaps and proposing targeted professional development interferences.

Despite the growing importance of TPACK, limited empirical study conducted at the local context in Sindh, particularly stressing of secondary school teachers in Khairpur Mir's. This lack of localized research creates a gap in understanding how TPACK influences teaching skills within this definite educational and socio-cultural setting. Addressing this gap is vigorous for informing policymakers, educators, and school administrators about growth of secondary educators in institutions.

Therefore, this research aims enquiry and influence of (TPACK) in education competencies of high school educators in rural Khairpur, Sindh, Pakistan. The results of this research contributed the data and factual based taking initiatives also deliver practical recommendations for enlightening TPACK based educators learning and growth programs in the areas.

Literature Review

In the promptly developing countryside of teaching, the incorporation of digital and technological has develop an important component in enlightening teaching effectiveness and improving student's learning outcomes. The 21st century needs that teachers not only possess strong subject matter proficiency and pedagogical skills but also establish the ability to efficiently assimilate digital devices into their instructional performs. This essential has given rise to the TPACK structure that provides a comprehensive model for understanding and developing the awareness essential for effective digital gadgets amalgamation in education (Mishra & Koehler, 2006).

About this research present a comprehensive appraisal of the literature related to TPACK, integration in teaching, instructor proficient progress, then the particular challenges besides opportunities in rural Pakistan. It creates with an exploration of the hypothetical fundamentals of TPACK, followed through a discussion of global and national perspectives on ICT in Education.

At the same time, global study highlights that technology integration is most effective when it moves beyond mere replacement of traditional tools with digital ones. Instead, it should transfer the education process by promoting high level intellectual abilities, active participation, then collaboration among learners (Full & Langworthy, 2014). Framework like as a SAMR and TPACK guide educators in designing technology-rich lessons that foster deep learning.

In the Pakistani background, the adoption of technology in schooling has been progressing, though unevenly. National initiatives, such as Digital Pakistan Policy (2018) and provincial-level ICT in Education Programs, aim to provide digital infrastructure, increase teacher training, and include e-learning resources into the School curriculum. Projects like the Punjab information Technology Board's e-learning program and Sindh Education and Literacy Department's digital content development have accomplished notable contributions to expanding access to quality educational resources.

However, the urban-rural digital divide remains a main challenge. In urban centers like Karachi, Lahore, and Islamabad, many private and public schools have initiated integrating smart classrooms, interactive whiteboards, and online learning platforms, conversely, in rural areas-including much of rural Sindh-Schools face hindrances such as insufficient ICT infrastructure, undependable electricity, poor internet connectivity, and a lack of trained personal to manage and use digital resources effectively (Shafique & Mahmood, 2020). Teachers in rural context often rely on traditional, teacher-centered pedagogies, with

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technology being used sporadically, if at all, and generally for administrative or basic infrastructural purposes.

Methodology

This research was employed a quantitative research design, specifically a descriptive-correlational design. The descriptive aspect of the design aim to define the present status of secondary school teachers' (TPACK) and their education skills it emphases on identifying existing patterns and levels of TPACK among secondary teachers working in public and private secondary school of Khairpur Mir's, Sindh, Pakistan.

The correlational aspect seeks to decide the association among mentors' TPACK besides their teaching abilities. It inspects how variations in educators' (TPACK) influence their classroom practices and instructional effectiveness. This design is suitable as allows the investigator the measure the point of connotation between the research variances deprived of employing them.

A quantitative descriptive-correlational design aligns well with the pragmatic paradigm, as it emphases on collecting objective, measurable data that can lead to practical implications for improving teaching quality. Statistics was collected by a structured survey questionnaire through Google form, analyzed statistically, and interpreted to draw conclusions that inform teacher education programs and professional development decisions.

Population

The targeted population of this research comprises of secondary school teachers in Government and private schools of Khairpur Mir's, Sindh, Pakistan.

Sampling

A sample of approximately 250 to 300 secondary school teachers was selected for the research. The sample size was determined using standard statistical guidelines for social science research to ensure adequacy for correlational analysis and hypothesis testing.

The determination of the sample size was guided by Cochran's formula for approximating sample size in large populations, ensuring that the selected sample is statistically sufficient to:

- Detect significant relationships between TPACK and teaching skills
- Perform subgroup comparisons
- Conduct reliable correlation and regression analyses

The selected sample size is considered adequate to deliver expressive visions though upholding applied possibility in relations of statistics gathering and management.

Instrumentation

Main data were collected through a structured closed ended questionnaire founded on a 5-point Likert scale. The questionnaire was designed according to the TPACK framework and included closed ended items to measure teachers' perceptions and competencies. The collected data were analyzed by numerical tools like as SPSS to calculate mean scores, standard deviation, correlation, and regression analysis.

The Likert scale comprised the following responses categories:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Section A: Demographic Information

The first segment composed general contextual information about the participants. This section included variable such as gender, age, academic qualification, teaching experience, category of school (government or private), and subject specialization. Demographic information remained comprised to better understand the characteristics of the respondents and to permit for subgroup comparisons during data analysis.

Section B: TPACK and Teaching Skills

The second section consisted of structured statements planned to measure teachers' competencies related to the (TPACK) framework then their teaching skills. The items remained

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prepared to reflect the major dimensions of the TPACK framework.

Data Collection

Data collection process was carried out systematically to ensure accuracy, reliability, and ethical compliance. Before collecting the data, the investigator obtained consent from the relevant school authorities in secondary schools located in Khairpur Mir's, Sindh, Pakistan. The aim of the research remained clearly described to the school administration and contributing educators to ensure transparency and cooperation.

After obtaining endorsement, the researcher contacted secondary school teachers and invited them to participate voluntarily in the research. The structured questionnaire was then shared among the selected respondents. The questionnaires were delivered through online platform to facilitate greater participation and convenience for respondents, while questionnaires were shared electronically through Google Forms WhatsApp, based on the accessibility and favorite of the respondents.

Data Analysis

The replies collected through the study were processed into the (SPSS), type 25, for scrutiny. Descriptive statistics like as mean, standard deviation, and occurrence distribution remained used to recapitulate the levels of TPACK and teaching skills among teachers. To test the key hypothesis, the Pearson correlation coefficient was applied to decide the strength then direction of the association between TPACK and teaching skills. In addition, simple and multiple linear regression examination were obtained to examine the projecting result of separate TPACK framework on different areas of education skills. Toward further examine the association between teaching skills and TPACK levels, autonomous examples t-tests were used for comparison. Moreover, (ANOVA) was practical to identify changes founded on demographic variables like as gender, nature of institution, and education knowledge.

Key Findings

1. Data Screening and Reliability

Case processing summary revealed that all 254 responses (100%) were valid, with no excluded cases. The reliability of the research instrument consisting of 28 items was measured through Cronbach's Alpha. The value was .833, which indicates good internal consistency and reliability of the questionnaire.

2. Model Summary Regression Analysis

A linear regression analysis was conducted to examine the predictive role of TPACK on Teaching Skills. The model was found to be significant with $R = .469$, $R^2 = .220$, and Adjusted $R^2 = .217$. This indicates that 22.0% of the variance in Teaching Skills is explained by TPACK.

3. ANOVA Results

The ANOVA results show that the regression model was statistically significant, $F(1, 252) = 71.073$, $p < .001$. This confirms that TPACK significantly predicts Teaching Skills of secondary teachers.

4. Coefficient Analysis

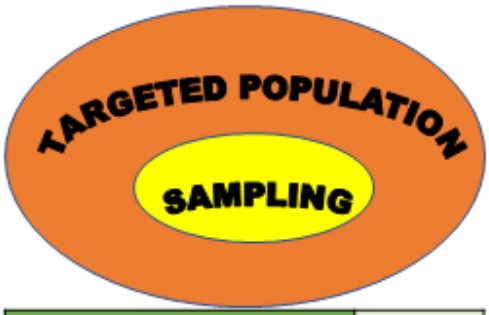
The coefficient results indicate that TPACK is a significant predictor of Teaching Skills, $B = 1.539$, $Beta = .469$, $t = 8.430$, $p < .001$. This suggests that for every 1-unit increase in TPACK, Teaching Skills increase by 1.539 units.

5. Correlation Analysis

Pearson Correlation analysis shows a moderate, positive and significant relationship between TPACK and Teaching Skills, $r = .469$, $p < .001$, $N = 254$. This indicates that higher TPACK competency is associated with better teaching skills, including improved lesson planning, classroom management, instructional delivery, and learner engagement.

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SOURCE OF DATA:	PRIMARY DATA

Total Questionnaires distributed	300
Returned and used questionnaires	254
Response Rate	84.66%

Nature of Questionnaire				
Likert scale				
1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

7/8/2026

Results

The research aimed to inspect the impact of (TPACK) on the teaching skills of secondary teachers of Khairpur Mir's, Sindh, Pakistan. This research was quantifiable in side and statistics is present together from 254 secondary instructors using an organized survey. To ensure the reliability and validity through the tool, Cronbach's Alpha (.833) confirmed strong internal consistency. Factors analysis supported the paradigm legitimacy of TPACK components besides teaching skills. Numerical methods like as descriptive statistics, correlation, and regression analysis remained applied to examine about the facts. The Person correlation coefficient ($r = .469$, $p < .01$) indicated a moderate association between the two variables. Moreover, regression analysis revealed that TPACK significantly predicts teaching skills ($R^2 = .220$, $F = 71.073$, $p < .001$), explanation approximately 22% of the variance in teaching skills.

Conclusion

The present research concludes that (TPACK) has an important and positive impact on the teaching skills of secondary school teachers of Khairpur Mir's, Sindh, Pakistan. The findings provide empirical evidence that the efficient incorporation of digital equipment with teaching and subject contented improves educators' overall teaching performance.

The consequences of correlation and regression analysis confirmed that teachers possessing higher levels of TPACK demonstrate better classroom management, enhanced lesson planning, effective instructional strategies, and the ability to address learners' diverse learning needs. The statistically significant relationship between TPACK and teaching skills indicates that technology, when meaningfully integrated with pedagogical approaches and content knowledge, strengthens teaching effectiveness rather than serving as a supplementary tool.

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Recommendations

1. Professional Development Programs

Consistent TPACK-focused training workshops should be organized for secondary school teachers to enhance their capability in the direction of assimilates technological and digitalized through teaching and subjects contented effectively.

2. On-the-job Teacher Training

Education department should include hands-on technology integration modules in in-service training programs, emphasizing real-world and practical classroom applications rather than theoretical knowledge only.

3. Curriculum and Policy Support

Educator teaching programs must be reviewed and updated on the way to explicitly incorporate the TPACK framework by way of a fundamental factor of before service besides on-the-job educator teaching.

4. Access to Technological Resources

Educational institutions should be provided with adequate digital infrastructure, including computers, projectors, internet access, and subject-specific digital resources, to facilitate effective technology-integrated teaching.

Suggestions for Upcoming Study

Future studies may:

. Contain a greater sample size from other districts of Sindh

. Use mixed-method or qualitative approaches for deeper insights

. Examine the effect of TPACK on students' educational accomplishment

. Conduct comparative studies urban and rural districts of Sindh

. Explore TPACK development at primary and higher secondary levels.

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