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THE IMPACT OF TPACK APPLICATION SUITE ON TECHNOLOGICAL PROFICIENCY OF PRE-SERVICE TEACHERS IN MEDCHAL-MALKAJGIRI DISTRICT OF TELANGANA STATE

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Abstract

Education is one of the most important tools in providing human skills needed as a result of economic, social and technological transformations of the 21st century. Qualifications describing teacher of Education 4.0 were categorized as technological skills, guidance skills, lifelong learning skills and personal characteristics. Teachers of education 4.0 were determined as being curious, patient, open to change, adaptable and investigative. In this connection the present study was envisaged with the aim to assess the impact of TPACK application suite on technological proficiency of pre-service teachers. The pre-experimental one-group pre-test and post-test design was employed on 62 pre-service teachers who were selected by employing purposive sampling technique. A checklist consist of 15 item was used. Data collected was analyzed by using frequency count and simple percentages. The study results indicated that the pre-service teachers' usage of computer device for everyday studying purpose is almost doubled after the implementation of the intervention module and none were reported as they were not using computer device for everyday studying purpose. Therefore, the intervention module helped the students to use computers on almost all their academic and personal purposes.

Keywords: Education 4.0, Technological Proficiency, Technological transformation and pre-service teachers

INTRODUCTION

“I dream of a digital India where quality education reaches the most inaccessible corners driven by digital learning”. – Shri Narendra Modi

The industrial revolution has led to rapid and radical changes in many aspects of social life such as work, education, management and daily life. Developments brought by Industrial Revolution have gone through four phases from the mid-18th century until the beginning of 21st Century. The first Industrial Revolution is called “Machine Age”, the second one is “Electricity Age”, the third one is “Electronics Age” and the fourth one is “Internet Age”. The 2010s are the years of fourth phase of Industrial Revolution which witness the fastest changes and transformations ever. Qualifications describing teacher of Education 4.0 were categorized as technological skills, guidance skills, lifelong learning skills and personal characteristics. Teacher of education 4.0 were determined as being curious, patient, open to change, adaptable and investigative.

At the heart of good teaching with technology are three core components: content, pedagogy, and technology, plus the relationships among and between them. The interactions between and among the three components, playing out differently across diverse contexts, account for the wide variations in the extent and quality of educational technology integration. These three knowledge bases (content, pedagogy, and technology) form the core of the technology, pedagogy, and content knowledge (TPACK) framework (Koehler & Mishra, 2008; Mishra & Koehler, 2006). This perspective is consistent with that of other researchers and approaches that have attempted to extend Shulman’s pedagogical content knowledge (PCK) construct to include educational technology.

The National Educational Policy 2020 recommendations in its Chapter-III emphasized about ‘Technology Use and Integration’. It is said that the digital India campaign is helping to transform the entire nation into a digitally empowered society and knowledge economy. While education will play a critical role in this transformation, technology itself will play an important role in the improvement of educational process and outcomes.



NEED AND SIGNIFICANCE OF THE STUDY

The quality of how technology is addressed in teacher education programmes is one of the conditions for how student teachers apply technology in schools after their graduation. In teacher education programmes, technology receives little attention, neither how it can be used in secondary education nor as a support of pedagogy in teacher education itself. It seems that only a small number of beginning teachers are able to use technology in diverse and flexible ways to create student-centred learning. This lack of attention to technology in teacher education means that most learning how to teach with technology in secondary education is done during school practice, after student teachers have graduated and entered the profession. More attention to technology in teacher preparation programmes (B.Ed Program) might make this learning process of teachers in school practice more efficient and effective.

REVIEW OF RELATED LITERTURE

It was observed that some research was done on TPACK & Technological Proficiency among pre-service teachers across many countries. The recent covid-19 pandemic awaken us to integrate more technologies into teaching and learning. In some researches it is found that the application of technology-based guided inquiry has a significant impact to improve the students' understanding of TPACK including Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK) and the application of self guided inquiry learning on TPACK can restructure teachers' experience for their professional development by designing their own learning materials with the use of technology (Irdalsina., Paidi & Djukri. 2020). Prospective teachers can also vary various methods such as demonstrations, discussions, games in the delivery of material and evaluating through online games but still the ability of TPACK can be improved by training (Maria Paristiowati et.al., 2020). In some other studies it found that TPACK educational program based on programming is effective for teachers' TPACK development (Seong, W. Kim., Youngjun, Lee. 2020). An Indian study has proved that all the teachers embraced the TPACK pedagogy and were able to enhance their teaching-learning experience (Rupal, A.Thakkar. 2020). A study results shown that Pedagogical and Content Knowledge is crux for TPACK (Betchie E. Aguinaldo (2019). Teacher trainees' strong intensions and teacher training institutions' untired efforts can enhance mathematics teachers' knowledge in integrating technology with the pedagogy and content which will be the important information for improving mathematics teachers' TPACK (Lilla, Adulyasas. 2017).

OBJECTIVES OF THE STUDY

1. To examine the impact of the Intervention Module on Technological Proficiency of Pre-service Teachers.

HYPOTHESES

1. There will be a significant improvement in technological proficiency of pre-service teachers in post-test over pre-test.

VARIABLES

TPACK application suite is independent variable and technological proficiency of pre-service teachers is dependent variable.

METHODOLOGY

The pre-experimental one-group pre-test and post-test design was employed on 62 pre-service teachers.

SAMPLE & SAMPLING

The sample of present study comprises of 62 student-teachers those who are pursuing B.Ed course. Purposive Sampling technique was adopted in order to draw representative sample from the population. A Computer Screening Test was



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administered on total population and the population is trifurcated as Poor, Moderate and Good levels based on the scores obtained on screening test. The Moderate group is chosen as sample of the study to maintain a common knowledge level in Information and Communication Technology (ICT).

TOOLS

The present study tool comprises of fifteen statements having different checklist options against each statement depending on the nature of question. This instrument was intended to assess the technological proficiency of the pre-service teachers before and after intervention module. Their purpose of using computer device, digital tools for classroom management, instruction and assessments are the broad areas used in this instrument to assess technological proficiency. Respondents were given with freedom to choose the options from the checklist against each statement and they are asked to choose more than one option from the list if the options suit/applies to them.

Content and Face Validity were ensured

EXPERIMENTATION PROCEDURE

Intervention Module (TPACK Application Suite) is the crux of the whole experimental program. The intervention program was planned for 8 weeks; 2 sessions per each week were scheduled whereas each session consists of 2 hours. On the whole 16 sessions were planned in accordance with host institution viability. These were planned online due to Covid-19 Pandemic situation by following Covid-19 SOP guidelines. Zoom Cloud Application, Personal Blog, E-mails and WhatsApp were the platforms used for the delivery of content during intervention period.

DATA ANALYSIS AND MAJOR FINDINGS

ANALYSIS OF TPACK CHECKLIST DATA ON PRE-TEST AND POST-TEST BY PRE-SERVICE TEACHERS.

Hypothesis-1: There is a significant improvement in technological proficiency of pre-service teachers in post-test over pre-test.

To test this hypothesis, the following procedure is adopted. There are total fifteen statements used to gather data relevant to the above hypothesis and each item was provided with a unique checklist to get accurate data from the pre-service teachers. Analysis of these statements was done with respect to each item individually with the help of simple percentages and finally the hypothesis was verified by compiling the total results obtained on these fifteen statements during pre-test and post-test. Thus, the improvement in technological proficiency between pre-test and post-test among pre-service teachers was verified.

1. USAGE OF COMPUTER DEVICE FOR EVERYDAY STUDYING PURPOSE

Table.1

Showing percentages on pre-test and post-test with regard to usage of computer device for everyday studying purpose

Test	During lessons	Between lessons	For independent study	For peer discussions	On Projects	I don't use my computer for studying purpose
Pre-test	36.7%	40%	46.7%	26.7%	38.7%	3.3%
Post-test	69.8%	62%	81.4%	46.3%	92.6%	Nil

INTERPRETATION:

From the above table.1 it is understood that the pre-service teachers using computer device mostly for independent study (46.7%) and least usage for peer discussions (26.7%) during pre-test. After they received an intervention program through TPACK application suite the usage of computer is registered as high on course projects (92.6%) and least usage for peer



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discussions (46.3%). Percentages obtained on post-test witnessing that pre-service teachers usage of computer device for everyday studying purpose is almost doubled comparatively pre-test results.

2. USAGE OF COMPUTER DEVICE DURING LESSONS

Table.2

Showing percentages on pre-test and post-test with regard to usage of computer device during lessons

Test	Taking pictures	Making videos	Group work	Peer collaboration	Doing assignments & reference	I don't use my computer for studying purpose
Pre-test	46.7%	40%	40%	36.1%	60%	6.7%
Post-test	71.5%	91.3%	79.4%	51.8%	95.8%	nil

INTERPRETATION:

From the above table.2 it is understood that the pre-service teachers using computer device during lessons mostly for doing assignments and reference purpose (60%) and least usage for peer collaborations (36.1%) during pre-test. After they received an intervention program through TPACK application suite the usage of computer during lesson is registered as high on doing assignments and reference purpose (95.8%) and least usage for peer collaborations (51.8%). Percentages obtained on post-test witnessing that pre-service teachers usage of computer device during lessons is almost doubled comparatively pre-test results.

3. USAGE OF COMPUTER TOOLS/APPLICATIONS FOR LEARNING PURPOSE

Table.3

Showing percentages on pre-test and post-test with regard to usage of computer tools for learning purpose

Test	One-drive	word	Excel	Power point	Google drive	WhatsApp	I don't use
Pre-test	3.3%	46.7%	36.7%	50.7%	33.3%	40%	16.7%
Post-test	47.1%	97.5%	89.3%	100%	63.7%	86.9%	Nil

INTERPRETATION:

From the above table.3 it is understood that the pre-service teachers usage of computer applications/tools for learning purpose is registered high with Ms-power point (50.7%) and Ms-word (46.7%) and least with one-drive (3.3%) during pre-test. After they received an intervention program through TPACK application suite the usage of computer tools for learning purpose is registered high with Ms-power point (100%) and Ms-word (97.5%) and least with one-drive (47.1%). Percentages obtained on post-test witnessing that pre-service teachers usage of computer tools/applications for learning purpose is almost doubled comparatively pre-test results.

4. AVERAGE USAGE OF COMPUTER DEVICE ON ANY GIVEN DAY

Table.4

Showing percentages on pre-test and post-test with regard to average usage of computer device in any given day

Test	0-1 hr.	1-2 hr.	2-3 hr.	3-4 hr.	5 & above hrs.	I don't use
Pre-test	56.3%	23.7%	21%	19.4%	13.3%	6.7%
Post-test	96.8%	81.7%	80.1%	59.6%	36.7%	Nil

INTERPRETATION:

From the above table.4 it is understood that the pre-service teachers' average usage of computer device in any given day is registered high as 0-1 hour (50.7%) and low as above 5 hours (13.3%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers' average usage of computer device in any given day is



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registered high as 0-1 hour (96.8%) and low as above 5 hours (36.7%). Percentages obtained on post-test witnessing that pre-service teachers usage of computer device in any given day is drastically recorded as high comparatively with pre-test results.

5. DESCRIBING COMPUTER DEVICE UASGE

Table.5

Showing percentages on pre-test and post-test with regard to describing the usage of computer device

Test	Only for learning purposes	Mostly for learning purposes	Only for non-academic purposes	Mostly for non-academic purposes	Even for learning and personal use also	I don't use
Pre-test	16.7%	36.9%	Nil	10%	66.7%	5.7%
Post-test	59.3%	87.5%	Nil	8.1%	99.3%	Nil

INTERPRETATION:

From the above table.5 it is understood that the pre-service teachers described their usage of computer device is registered high with learning and personal purpose (66.7%) and least with non-academic purpose (10%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers described their usage of computer device is registered high with learning and personal purpose (99.3%) and least with non-academic purpose (8.1%). Percentages obtained on post-test witnessing that pre-service teachers usage of computer device is almost purposeful to excel in their learning comparatively pre-test results.

6. LOG IN INTO UNIVERSITY WEBSITE

Table.6

Showing percentages on pre-test and post-test with regard to their frequent login into university website

Test	Every day	Every week	A Few times in a month	Occasionally	Never seen
Pre-test	Nil	13.3%	36.7%	54.2%	3.1%
Post-test	47.1%	69.4%	55.9%	33.6%	Nil

INTERPRETATION:

From the above table.6 it is understood that the pre-service teachers frequent log in into their university website is registered high as occasionally (54.2%) and low as never seen (3.1%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers' frequent log in into their university website is registered high as every week (69.4%) and low as occasionally (3.1%). Percentages obtained on post-test witnessing that pre-service teachers log in into their university website drastically changed from occasionally to every week comparatively with pre-test results.

7. PURPOSE OF PRE-SERVICE TEACHERS TO VISIT UNIVERSITY WEBSITE

Table.7

Showing percentages on pre-test and post-test with regard to pre-service teachers purpose of visiting university website

Test	Results	Academic calendar	Examination notification/fee	Syllabi	Events/ occasions	I don't know
Pre-test	66.7%	43.3%	33.9%	70.4%	26.7%	Nil
Post-test	78.1%	59.4%	71.9%	100%	47.3%	Nil



INTERPRETATION:

From the above table.7 it is understood that the pre-service teachers purpose of visiting university website is registered high with Syllabi (54.2%) and Results (66.7%) and low as events/occasions (26.7%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers’ purpose of visiting university website is registered high with Syllabi (100%), Results (78.1%) and Examination notification/ fee (66.7%) and low as events/occasions (47.3%). Percentages obtained on post-test witnessing that pre-service teachers purpose of visiting university website is became multipurpose searching for different information than only for results and syllabi and its clearly seen in results comparison.

8. BROWSER USED BY PRE-SERVICE TEACHERS FOR THEIR ACADEMIC INFORMATION

Table.8
Showing percentages on pre-test and post-test with regard to browser used for academics

Test	Chrome	Apple Safari	Opera	Internet Explorer	UC browser	Firefox	Don’t know
Pre-test	89.3%	Nil%	Nil%	16.7%	29.3%	37.5%	Nil%
Post-test	100%	29.4%	45.9%	77.1%	59.6%	87.7%	Nil

INTERPRETATION:

From the above table.8 it is understood that the internet browser used by pre-service teachers for their academics is registered high with only Google Chrome (89.3%) and none were using Apple Safari and Opera browsers during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers started using different browsers i.e., Google Chrome (100%), Mozilla Firefox (87.7%) and Internet Explorer (77.1%). Percentages obtained on post-test witnessing that pre-service teachers started using all most all different browsers effectively comparatively pre-test results.

9. ONLINE ASSESSMENT TOOLS USED BY PRE-SERVICE TEACHERS FOR STUDENTS’ ASSESSMENTS

Table.9

Showing percentages on pre-test and post-test with regard online assessment tools used by pre-service teachers for students’ assessments

Test	Open-ended questions	Checklists	MCQs	Blanks	Cross	Online Quiz
Pre-test	40.8%	16.7%	79%	33.6%	16.7%	36.5%
Post-test	97.3%	100%	100%	91.5%	57.2%	61.6%

INTERPRETATION:

From the above table.9 it is understood that the online assessment tools used by pre-service teachers for students’ assessments is registered high with MCQs (79%) only and they are least in using cross (16.7%) and Checklists (16.7%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers started using different assessment tools to assess their students i.e., Checklists (100%), MCQs (100%), open-ended questions (97.3%) and Blanks (91.5%). Percentages obtained on post-test witnessing that pre-service teachers started using all most all different assessment tools to assess their students comparatively pre-test results.



1.0 DIFFERENT APPLICATIONS USED BY PRE-SERVICE TEACHERS DURING ONLINE CLASSES

Table.10

Showing percentages on pre-test and post-test with regard to different applications used by pre-service teachers during online classes

Test	PPTs	Shared white boards	Videos	Animated text	Word docs	others
Pre-test	63.3%	17.2%	61.9%	23.8%	36.7%	8.5%
Post-test	100%	52.4%	100%	83.7%	87.1%	61.6%

INTERPRETATION:

From the above table.10 it is understood that the different applications used by pre-service teachers during online classes is registered high with PPTs (63.3%) and videos (61.95) only and they are least in using animated text (23.8%) and shared white boards (17.2%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers started using different applications including PPTs (100%), Videos (100%), word docs (87.1%) and animated text (83.7%). Percentages obtained on post-test witnessing that pre-service teachers started using all most all different applications during online classes comparatively pre-test results.

11. VIRTUAAL PLATFORMS USED BY PRE-SERVICE TEACHERS DURING ONLINE CLASSES

Table.11

Showing percentages on pre-test and post-test with regard to virtual platforms used by pre-service teachers during online classes

Test	Google Meet	Zoom Cloud Meetings	Facebook Live	YouTube live	Google Classroom	others
Pre-test	36.7%	86.7%	3.3%	Nil	Nil	2.9%
Post-test	100%	100%	31.9%	23.7%	57.1%	Nil

INTERPRETATION:

From the above table.11 it is understood that the virtual platforms used by pre-service teachers during online classes is registered high with Zoom Cloud Meeting (63.3%) only and they are least in using Facebook live (3.3%) during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers started using different virtual platforms for online classes including Zoom Cloud Meeting (100%), Google meet (100%), and Google classroom (57.1%). Percentages obtained on post-test witnessing that pre-service teachers started using all most all different virtual platforms for their online classes comparatively pre-test results.

12. SOCIL MEDIA PLATFORMS THAT PRE-SERVICE TEACHERS CAN ABLE TO USE FOR ACADEMIC INFORMATION

Table.12

Showing percentages on pre-test and post-test with regard to social media platforms that pre-service teachers can able to use for academic information

Test	Facebook	Google group	Twitter	WhatsApp	Instagram	None
Pre-test	16.7%	11.3%	3.3%	86.9%	10%	6.7%
Post-test	96.2%	93.8%	51.6%	100%	41.5%	Nil

INTERPRETATION:

From the above table.12 it is understood that the social media platforms that pre-service teachers can able to use for academic information is registered high with WhatsApp (63.3%) only and they are least aware of all other platforms during pre-test. After they received an intervention program through TPACK application suite the pre-service teachers started using



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different social media platforms for academic information including WhatsApp (100%), Facebook (96.2%), and Google group (51.6%). Percentages obtained on post-test witnessing that pre-service teachers started using all most all different social media platforms for their academic information comparatively pre-test results.

13. POWER POINT PRESENTATION TOOLS THAT PRE-SERVICE TEACHERS CAN ABLE TO USE FOR CLASSROOM INSTRUCTIONS

Table.13

Showing percentages on pre-test and post-test with regard to power point presentation tools that are pre-service teachers can able to use for classroom instructions

Test	MS Powerpoint	Slides carnival	Sildescanvas	Prezi	None
Pre-test	76.9%	21.3%	3.3%	3.3%	13.8%
Post-test	100%	97.3%	91.6%	90.2%	Nil

INTERPRETATION:

From the above table.13 it is understood that the power point presentation tools that pre-service teachers can able to use for classroom instruction is registered high with Ms-Power point (63.3%) only and they are least aware of other platforms during pre-test. After they received an intervention program through TPACK application suite the power point presentation tools that pre-service teachers can able to use for classroom instruction is widen to Ms-power point (100%), Slide carnival (97.3%), Prezi (90.2%) and Slide canvas (91.6%). Percentages obtained on post-test witnessing that pre-service teachers started using a variety of power point presentation tools for their classroom instruction comparatively pre-test results.

14. TYPE OF CONTENT THAT PRE-SERVICE TEACHERS CAN ABLE TO PROVIDE TO THE STUDENTS DURING CLASSROOM INSTRUCTIONS

Table.14

Showing percentages on pre-test and post-test with regard to type of content that pre-service teachers can able to provide to the students during classroom instructions

Test	Textual	Text with pictures	Videos	Recorded Classes	None
Pre-test	43.6%	86.7%	59.1%	30%	6.7%
Post-test	100%	100%	93.6%	56.4%	Nil

INTERPRETATION:

From the above table.14 it is understood that the type of content that pre-service teachers can able to provide to the students during classroom instructions is registered high with Text with Pictures (86.7%) and AVs (59.1%) during pre-test. After they received an intervention program through TPACK application suite the type of content that pre-service teachers can able to provide to the students during classroom instructions is widen to Text with pictures (100%), Textual (100%), Videos (93.6%) and Recorded classes also (56.4%). Percentages obtained on post-test witnessing that pre-service teachers started using a variety of the content during classroom instruction comparatively pre-test results.

15. TOOLS/APPLICATIONS USED BY PRE-SERVICE TEACHERS TO DEVELOP E-POTFOLOIS

Table.15

Showing percentages on pre-test and post-test with regard to the tools/applications used by pre-service teachers to develop e-portfolios

Test	MS-Word	MS-Power point	MS-Publisher	Personal Blogs	Animoto application	others
Pre-test	46.7%	63.9%	6.7%	13.5%	6.7%	13.3%
Post-test	86.1%	100%	81.8%	91.3%	96%	Nil



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INTERPRETATION:

From the above table.15 it is understood that the tools/applications used by pre-service teachers to develop e-portfolios is registered high with Ms-Power point (63.9%) and low with Animoto application (6.7%) and Ms-Publisher (6.7%) during pre-test. After they received an intervention program through TPACK application suite the tools/applications used by pre-service teachers to develop e-portfolios is spread to Ms-Power point (100%), Animoto application (96%), Personal Blogs (91.3%) and Ms-Word (86.1%) also. Percentages obtained on post-test witnessing that pre-service teachers started using a variety of tools/applications to develop e-portfolios to compile their work during academic sessions comparatively pre-test results.

Therefore, the improvement in technological proficiency between pre-test and post-test among pre-service teachers was proved. Hence, the formulated directional hypothesis is accepted.

DISCUSSION

The study results indicated that the pre-service teachers' usage of computer device for everyday studying purpose is almost doubled after the implementation of the intervention module and none were reported as they were not using computer device for everyday studying purpose. Pre-service teachers' curriculum got balance between theory and practicum, particularly projects on which students certainly uses computers to gather the required information and to report the same to respective mentors. Usage of computers cannot be confined to any one area or purpose in B.Ed program. Therefore, the intervention module helped the students to use computers on almost all their academic and personal purposes. Teaching modules related to TPACK helps the trainees in many ways during teaching-learning and this finding is supported by the findings of *WEI Li, GAO Xia (2016)*.

The study results indicating that pre-service teachers' usage of computer device during lessons is almost doubled comparatively pre-test results. Before implementation of the intervention program students' usage of computers is found to be high with the academic reference and doing assignments but later on students were started using computers for taking pictures, making videos, group work, peer collaborations etc. for the preparation of e-portfolios and academic study as well. The research finding inquiry based learning improves the TPACK of trainees found by *Irdalsina., Paidi & Djukri (2020)* is repeated in present study.

CONCLUSION

Unfortunately, the lack of technology related basics and skills in teacher trainees and teacher educators became an inhibition for the implementation of NEP 2020 recommendations in Teacher education institutions. In light of this problem, the present study is envisaged to find out the effect of the technology related training program on technological skills and practice of teacher trainees. TPACK is a repository which covers all the necessary skills for a teacher. Realising TPACK significance in teacher training, a TPACK application suite is devised to use as an intervention program. Results of the study indicated that pre-service teachers' knowledge on TPACK has been turned as high from moderate as they received intervention. Pre-service teachers technological proficiency in adopting recent technologies also been improvised. Pre-test and post-test mean scores were witnessing that a technology based training program can promote good technology related skills and practice among future teachers.

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