TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE: A FRAMEWORK FOR 21ST CENTURY TEACHER COGNITION

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Received: May 09, 2018 Accepted: June 21, 2018

ABSTRACT *The development of information technologies had brought many transformation processes in the field of education. Drastic changes with the interference of information technologies are reflected well in the teaching-learning process. The successful integration of technology needs teacher cognition on how to do that effectively. In a technologically advanced teaching-learning environment, a teacher needs more sophisticated pedagogical practices. Technological Pedagogical Content Knowledge (TPCK) is such an innovative framework which assists teachers to achieve this. Punya Mishra and Matthew J. Koehler have stepped far-reaching milestones in constructing the TPACK framework. TPCK is deep rooted on the idea of Lee Shulman's (Shulman 1986) Pedagogical Content Knowledge (PCK) through the inclusion of technology. Shulman's notion of PCK (Pedagogical Content Knowledge) refers to a body of knowledge that teachers needed to develop for teaching content. But Shulman (1986) didn't explain the use of technology's potential to transform content and pedagogy in teaching-learning process. As, technological knowledge became another essential knowledge base, PCK (Pedagogical Content Knowledge) expanded to TPCK (Technological Pedagogical Content Knowledge). TPCK was introduced in 2005 as a framework (Koehler & Mishra, 2005) of knowledge and skills that teachers needed for the integration of technology to the instructional processes, thus TPCK is a powerful mechanism of teacher cognition. So this study provides an updated understanding of Technological Pedagogical Content Knowledge (TPCK) or TPACK, its benefits and challenges, exploring TPCK conceptually through the lens of a twenty first century educator.*

Keywords: *Technological Pedagogical Content Knowledge*

Introduction

Educational technology is like bread and butter for those who are in thirst of education and knowledge. The need of educational technology in teaching-learning process is indispensable. The introduction of Technological Pedagogical Content Knowledge (TPCK) framework by Koehler and Mishra (2009) has flowered this thirst to its extremity. It involves the interplay between content, pedagogy, and technology. The linkage between technology, pedagogy, and content is the underlying ideas of TPCK which is an important aspect of educational technology. But there was no established theory and conceptual framework on the integration of technology. This compelled the enrichment of TPCK on the existing construct of PCK (Pedagogical Content Knowledge) that was first introduced by Shulman (1986). Pedagogy is the art or science of teaching. It refers to strategies of instruction.

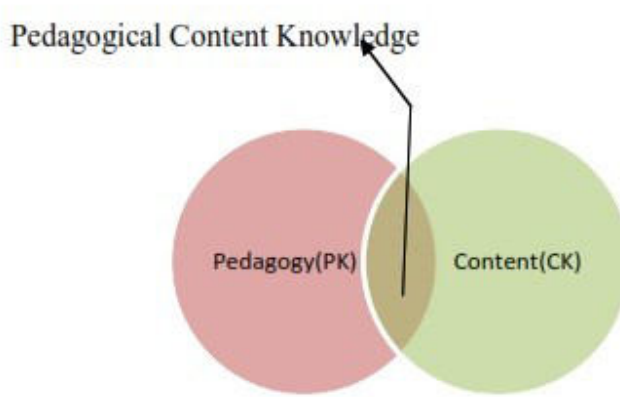

Figure1: Shulman's Pedagogical Content Knowledge

The existing pedagogy may not suffice 21st century learner. The new generation learner and teacher can be made satisfied by the proper integration of technology to content and pedagogy. The teacher in the twenty first century confronts many challenges while incorporating differentiated educational technologies to facilitate effective student learning. To promote teaching with technology, teachers needed to develop knowledge for dealing with teaching-learning process while integrating technology into teaching practices. So there is a need for teachers to develop technological pedagogical content knowledge. In the 21st century, where information and communication technologies have become increasingly accessible and valued for educational purposes, TPCK Framework is essential for quality teaching and learning process.

The TPACK Framework

The TPCK or TPACK framework gives stress on the proper incorporation of effective technology for teaching specific content which requires thorough conceptualization of the relationships between Technology, Pedagogy, and Content. Teachers who obtain this capability to meaningfully relate these knowledge components would constitute a form of excellence of knowledge in specific content, teaching and technology. The TPACK framework emphasises the blended relationships which exists between the knowledge of content, pedagogy and technology. In the present educational scenario, the TPACK framework can act as an effective organizing frame for the professional development of teachers in educational technology.

TPACK Knowledge components

The term TPCK became very popular in the year 2006 after Mishra &Koehler (2006) introduced their framework. Koehler & Mishra (2008) conceptualized TPACK framework in terms of seven knowledge components. They are

(a) Content Knowledge (CK),
(b) Pedagogical Knowledge (PK),
(c) Technological Knowledge (TK),
(d) Pedagogical Content Knowledge (PCK),
(e) Technological Content Knowledge (TCK),
(f) Technological Pedagogical Knowledge (TPK), and
(g) Technological Pedagogical Content Knowledge (TPCK)

The TPCK Framework is most commonly represented using a Venn diagram with three overlapping circles, each comprising a distinct form of teacher knowledge as shown in the figure below.

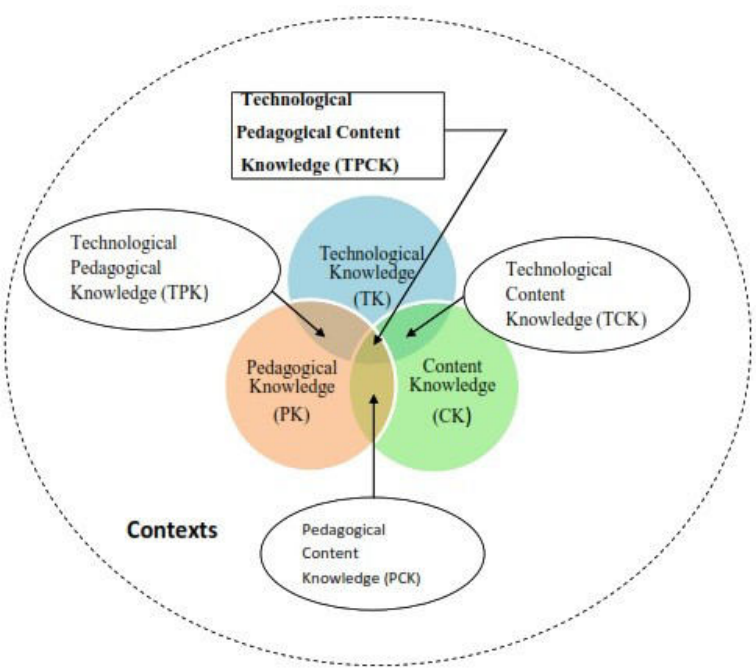

Figure2: TPCK Framework by Koehler and Mishra

The knowledge components of TPACK are the following.

(a) **Content Knowledge (CK)** -It is the knowledge about the topic that is to be taught. Content knowledge varies in different educational scenarios like the differences between the content of school level math and graduation level math. e.g. Knowledge about different content areas in 8th grade physics.

(b) **Pedagogical Knowledge (PK)** -It is the knowledge about the processes, practices or strategies about teaching. e.g. Knowledge about how to use different teaching strategies.

(c) **Technological Knowledge (TK)** -It is the knowledge about operating digital technologies such as internet, software applications, simulations, modelling tools etc. e.g. Knowing how to use digital tools like blogs, wikis etc.

(d) **Pedagogical Content Knowledge (PCK)** -It is the knowledge of representing content knowledge and adopting pedagogical reasoning to make the specific content more accessible to the learners. It is the interaction of PK and CK. Shulman(1986) opines that pedagogical content knowledge is the knowledge on how to link pedagogy and content effectively. This knowledge makes a subject more understandable to learners. e.g. Knowledge of using command style when teaching dance

(e) **Technological Content Knowledge (TCK)** -It is the technological representation of content knowledge without any account to teaching (Cox&Graham, 2009). It is the interaction of TK and CK. e.g. Knowledge about using digital animation to conceptualize the structure and functioning of Circulatory system in biology

(f) **Technological Pedagogical Knowledge (TPK)** -It is the pedagogically sound ways of using technology with no reference towards specific content matter. It is the interaction of TK and PK.e.g. Knowledge about how to use online tools that facilitate collaborative learning for geographically separated learners.

(g) **Technological Pedagogical Content Knowledge (TPCK or TPACK)** -It is the interaction of PCK and TCK and TPK. TPCK point out the knowledge and understanding of the interrelation between knowledge in pedagogy, content and technology which includes the use of technology for teaching and learning. e.g. Knowledge about how to use video analysis apps to assess students' movements in physical education.

Mishra and Koehler's TPCK changed to TPACK in 2007, which was proposed as a more easily remembered and spoken (Thompson & Mishra, 2007).In view of Thompson &Mishra(2007),TPACK is a Total PACKage, which is an integrated whole and should not taken in isolation.

Earlier work of Mishra and Koehler (2006) did not reflect the role of context in teachers' decisions regarding technology integration. Later the expanded notion of TPCK reflected into the situated form of knowledge, acknowledging that successful technology integration requires teachers' understanding of the complex relationships between content, pedagogy technology and knowledge of the surrounding educational context.

Context –It includes students, social networks, parental concerns, the available infrastructure etc. Many teachers are limited to integrate technology to pedagogy effectively because of the lack of proper knowledge about that and also the improper technological accessibility.

For example, teachers with limited technological access are unable to utilize various Goole educational apps available to students in schools. Nature of training, time and assessment in schools also affects technological usage in classrooms.

Impacts of TPACK Framework on 21st century education

Technological innovations have influenced every walks of human life and hence in the field of education. TPACK Framework is a new paradigm for 21st century education. Teachers in the 21st century should rely on the TPACK Framework which is needed for quality instruction. Teachers should become multi-facilitator in their approach to students. The major impacts of TPACK Framework on 21st century education are the following:

- TPACK framework enables teachers to create a powerful, productive learning environment.
- TPACK framework provides a mental framework for teachers by focusing the different domains of teacher knowledge and their relationships.
- TPACK framework created a need of measuring teacher TPACK.
- TPACK framework facilitates the strategies for planning and implementing educational technology.
- TPACK framework relates innovative ideas in using various technologies already accessible to educators instead of mere introduction of new technologies.

- Teachers can develop TPACK by applying instructional design to the integration of technology in the teaching and learning process.
- All the three knowledge components - Technology, Pedagogy, and Content are given due weightage.
- TPACK framework necessitates teacher's professional development opportunities and creates technology assisted lesson plans.
- Teacher with TPACK can teach students at distant places effectively.

Benefits of TPACK Framework

There are different advantages of TPACK Framework. They are:

- **Higher quality of instruction:** As the instruction is combination of the three knowledge domains in teaching practices, it's of higher quality.
- **Usability for every subject and at all levels:** TPACK framework can be used to teach any subject and at all levels of education.
- **Higher Level in Retention:** A concept or an idea is explained in a more concrete way so that it can be understood easily and retained properly**.**
- **Easy Learner Reception:** By virtual clarification and visualization of the process, learner can receive information easily.
- **Effective transmission of reality or simulation:** Using simulation, effective transmission of reality is possible.
- **Motivates learners-** This frame work motivates students by providing content knowledge using appropriate teaching strategies with the help of innovative technologies.
- **Ubiquitous nature:** Learning can happen at anywhere, anytime and to anyone learning. Anybody can access information whenever they need. It provides flexibility.
- **Better access:** TPACK framework provides access to learning in an effective manner.
- **Learner focused:** Utilization of various technologies can satisfy individual learner's learning style and skills. It can also anticipate pupil's future needs.
- **Promotes student collaboration:** TPACK Framework Streamlines collaboration and commutation.
- **Teacher as a facilitator:** The role of teacher is that of a facilitator of learning who assists the students in attaining the learning goals with their active participation.
- **Cost Effectiveness:** Teachers can post materials online on a virtual classroom. Students can submit their assignment through e-mail to teachers without printing it anymore. Thus by using TPACK instructor and beneficiary could save money.
- **Disseminates Information:** If teachers know how to effectively disseminate information and transfer materials to students with technological skill, then they find it easy.

Challenges of TPACK Framework

A number of challenges may be faced while dealing with TPACK Framework and that can be vanquished by taking its remedial measures in advance. They are:

- **Technical difficulties:** Technical or Operator error may hamper students and instructors.
- **Not All Teachers have the Same Pedagogical, Content, And Technology Knowledge:** All teachers may not have the same knowledge in the here basic domains of content, pedagogy and technology .So it may affect the teaching-learning process badly.
- **Lack of proper training regarding technology integration:** Teachers may not have proper knowledge regarding the technology in an advance form. Lack of proper training regarding integration of technology may give negative feedback.
- **Limited time period:** The time allotted for various lessons in integrating technology may be limited.

Conclusion

TPACK is a full-fledged knowledge framework for thinking about the type of knowledge that teachers should have to integrate technology into teaching-learning process and ways of developing this knowledge. TPACK framework has a wide range of benefits that curtains the challenges for its implementation. TPACK Framework renders instruction of higher quality and transmits reality using simulation. It is learner-oriented and the teacher act as a facilitator. Using TPACK as a framework for teacher knowledge would potentially have a positive impact on 21st century education as it comprises meshed knowledge of content, pedagogy, and technology. In the 21st century, there is an urgent need to

reframe our teacher preparation practices and propose TPACK framework that better prepare new era teachers to mould their teacher cognition to provide quality education.

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