

CHAPTER 2

Review of related literature

The review of related literature (literature review) in the present research work is based on the teaching models focusing on effective incorporation of (ICT) in classroom teaching by teachers i.e. “Technological, pedagogical and content knowledge (TPACK) model developed by **Kohler and Mishra (2006)**” and Substitution, Augmentation, Modification and Redefinition (SAMR) model developed by **Ruben Puentedura (2013)** followed by the research studies which were conducted nationally, regionally as well as internationally on the use and integration of technology by teachers in their teaching.

Technological pedagogical and contentment knowledge (TPACK) model

Mishra and Koehler (2006) – the prominent researchers developed a latest techno-integrated teaching model popularly known as “Technological Pedagogical and Content Knowledge’ (TPACK) model”. It is a well known teaching model primarily focuses on technology integration in the content and pedagogical knowledge of teachers. The TPACK model is originally the extended version of Pedagogical Content Knowledge (PCK) propounded by **Shulman (1986)**. It recommends on the integration of technological knowledge (TK) and pedagogical knowledge (PCK), the two important knowledge components of teachers. This integration i.e. PCK is very much helpful for the teachers in designing and implementation of successful and effective teaching-learning experiences to improve the learners learning outcomes. Based on Shulman’s concept of pedagogical content knowledge (PCK), Kohler and Mishra developed the TPACK model. The TPACK

model is based on the three (3) important aspects of knowledge i.e. technological, pedagogical and content knowledge. This teaching strategy recommended that effective & extensive incorporation of technological resources in modern day teaching is of pivotal requirement. This innovative strategy postulated that successful and effective techno-integrated teaching is possible only if teachers hold good expertise in these three aspects of knowledge i.e. technological , pedagogical (science of teaching) and content/teaching subject/s knowledge (**Graham, Borup & Smith, 2012**). Knowledge of teachers in all the three components is essential requirement for techno-integrated teaching and for the overcome of challenges in this regard. For effective and successful teaching with technology, TPACK knowledge and competency from teachers is an essential condition (**Spires, Zheng, & Pruden, 2012**). As discussed, TPACK is based on three knowledge domains i.e. technological (TK), pedagogical (PK) and content (CK). Integration of three aspects form the other four components, so this strategy is based on the seven aspects of integration **Punya, Kereluik , Shin & Graham, 2014**). The seven dimensions of TPACK model according to Kohler and Mishra are presented in the following headline.

1. Content knowledge (CK) in simple words means to the teachers' understanding about the content/topic/lesson/teaching subject/s, that they taught to their students. The content/topics taught by teachers in different courses or in different subject/s are not one and same. The knowledge of content or teaching subject/s is of vital importance for all teachers. As Shulman (1986) mentioned that content knowledge of teachers basically include the in-depth knowledge and understanding of thoughts, basic concepts, theories and models, principles, laws. Content knowledge varies greatly between teaching subjects/fields, and teachers must hold in-depth, deeper knowledge and understanding of

fundamentals of the teaching subject/s, disciplines in which they teach (**Koehler & Mishra, 2008**). Content knowledge basically focuses on- what to teach?

Pedagogical knowledge (PK) aspect focuses on the way of teaching, which helps the teachers in how to teach their learners inside or outside the institutions. Pedagogical strategies are based on the authentic and well established literature especially from the field of philosophy, psychology and education. This aspect is basically teachers' in-depth information and understanding about the various strategies and procedures about successful content delivery. Pedagogical knowledge (PK) develops an understanding of 'how to teach' in teachers mind, and accordingly the teacher selects the appropriate teaching strategies depending on the characteristics of learners. Thus, teachers' understanding of teaching strategies especially the recent ones is a significant technology incorporation aspect.

Technological knowledge (TK) primarily focuses on the understanding of various technological resource materials i.e. not knowing the names of technologies but knowing how to operate them. For successful blending of latest digital and analog ICT material resources, instructors must hold enough understanding and information about audio, video, online resources, MMTP, HTTP, also about the various other technological gadgets and how to synergize them in actual environments, especially the knowledge about the latest digital technological tools. This aspect of TPACK does not mean mere awareness of technological tools but knowledge about how to use the technologies productively in our lives. TK is therefore the teachers in-depth understanding of the latest digital technologies i.e. how and when to integrate them in our classroom teaching purpose.

Pedagogical Content Knowledge (PCK): This aspect of TPACK strategy refers to the conception of modification of content for teaching. This aspect concentrates on the

incorporation of specific teaching strategy in accordance of the type of content. Here, the teachers should select the way of teaching that will make the understanding of the topic or lesson easy for learners. Pedagogical Content Knowledge (PCK) is to Shulman's (1986) notion of "an understanding of how specific topics, lessons, problems, contents, or issues are organized, represented, and adapted to the different characteristics, interests and abilities of learners, and presented for teaching.

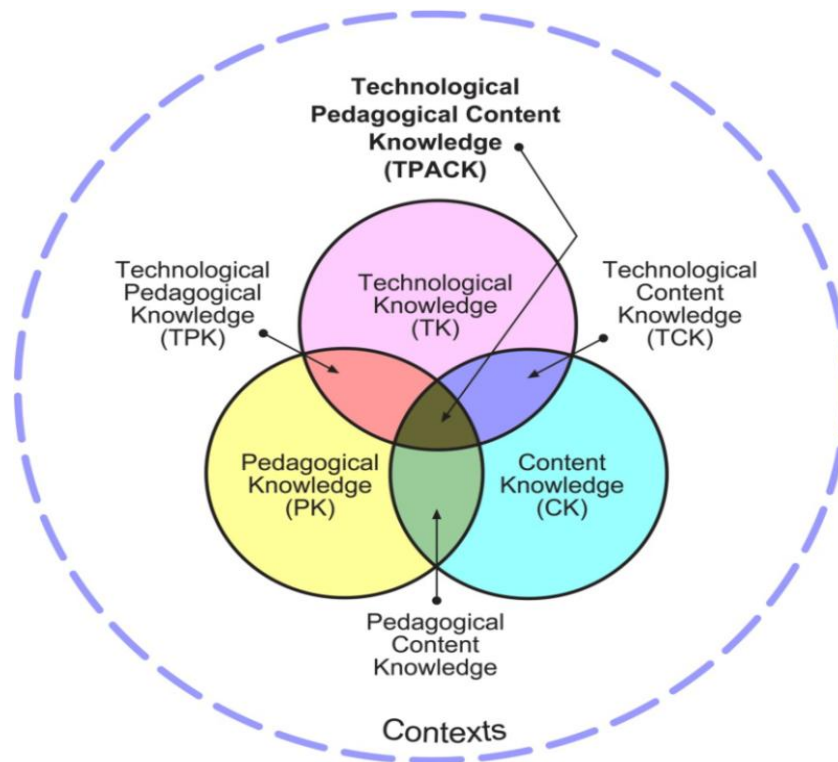
Technological Content Knowledge (TCK): This aspect of the model postulates that teachers in 21st century should hold intensive knowledge about the digital technological resources, especially the competency in how to blend them with their subject of teaching. This aspect completely focuses on the effective incorporation of technology in our teaching process, so that the connective learning environment will be created and the process of learning will be in constructive manner. Here, the teachers can develop electronic content for their teaching subject and can use internet services for collaboration purposes.

Technological Pedagogical Knowledge (TPK), this aspect of (TPACK) basically focuses on the integration of technological knowledge and pedagogical knowledge. Here, the major concern is to incorporate the knowledge about the ICT material resources along with the different ways of teaching. First, the teachers have to decide effectively the strategy of teaching for their teaching subject, after that their concentration should be on blending those electronic gadgets in it, so that these material resources will enhance our teaching strategy and make it more effective.

Technological Pedagogical and Content Knowledge (TPACK): TPACK is basically the sum up of all the above mentioned aspects defined separately. This aspect is

comprised of all kinds of characteristic that were possessed by the other 6 aspects of TPACK. This aspect is the strong and one of the core component, as it completely concentrates on the successful and effective incorporation of teachers knowledge and understanding about his/her subject/s of teaching, about the new, latest and innovative strategies developed by the educationists and psychologists and about the operation of ICT material resources that we are using in our life or especially in our educational sub-system. The basic purpose of this aspect or we can say that of this entire model is to make our classrooms in accordance to the requirements of 21st century.

Figure 1: TPACK model developed by Kohler & Mishra



Source: www.tpack.org

Substitution Augmentation Modification Redefinition (SAMR) Model

SAMR means - “Substitution, Augmentation, Modification and Redefinition”. The SAMR model of teaching and learning is basically a pedagogically and technologically complementary model to the Kohler & Mishra’s TPACK model. The SAMR teaching model authorizes teachers to look if the technology incorporation has made any functional improvement to their content/course design and delivery. This model is a good strategy to assess how technology is incorporated in our classroom to bestow a best learning environment for learners, as contradictory to only using a technology tool or simply the replacement of pen/pencil with highly cost technological gadgets. SAMR model is a teaching model which basically explains the level of technology integration in a class by teachers. Developed by Dr. Ruben Puentedura, the SAMR Model explains four levels of technology incorporation by teachers in teaching-learning process. The four levels are Substitution, Augmentation, Modification and Redefinition. This model bestows a good lens to see at the intensity of technology incorporation by teachers while teaching their students. The four levels of technology integration of SAMR model defined by Puentendra are as under.

Substitution

Substitution level is the first and lowest level of technology incorporation. Here, technology functions as a direct resource to substitute without effective improvement. This level may include Ms Word processing; learner writes the content with the help of keyboard instead of writing it by pencil-paper. As it is the lowest, but still a good use of the

technology (ICT). Moreover, the instructor worked hard in order to locate content in the form of articles, research links and online You Tube videos on his content or teaching subject/s. Again the internet acts as a substitute for the content provided to our learners before this strategy. The teacher is just moving from library resources to online resources.

Augmentation

Augmentation level of integration is one step above from Substitution one. Here, technology is incorporated direct with some effective enhancement. For example, learners use different applications such as counting of words app and mistakes checker along with ms word or calculators or excel spreadsheets to solve their content related problems. In this technology incorporation, opportunities to interrelate our opinions identify latest developments and knowledge or cooperative and collaborative learning through blogs is possible.

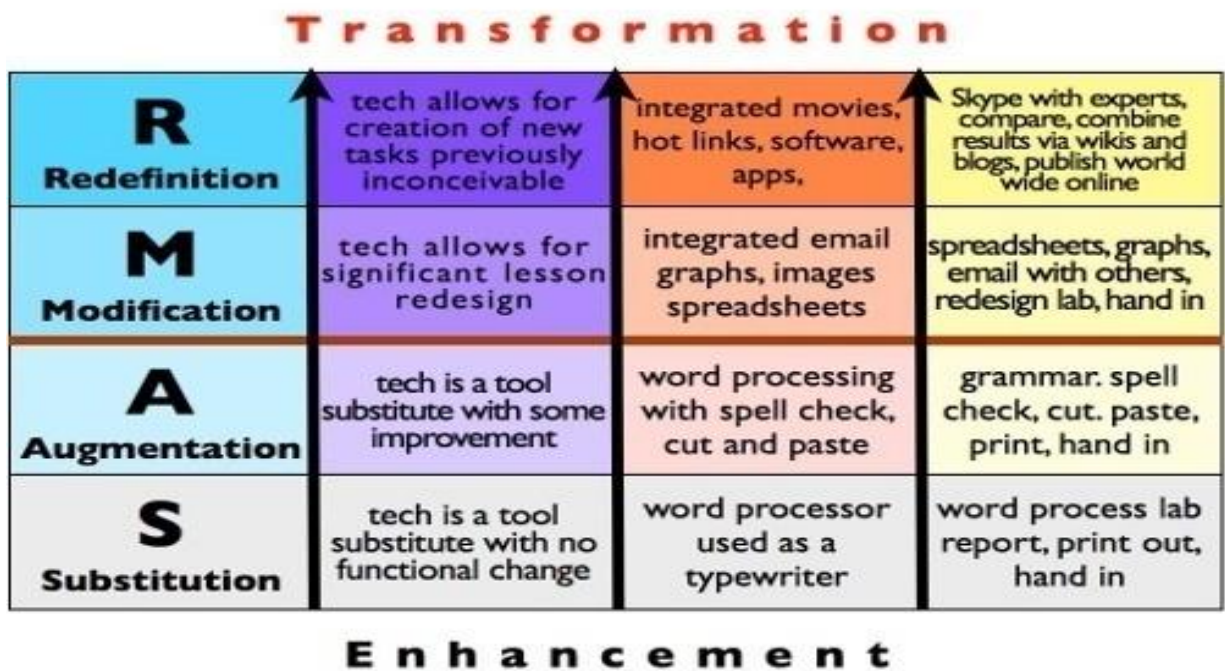
Modification

Modification allows the technology to change the view of what learners do. This step demands more reflection and work from the facilitating teacher. This level incorporates Google Doc along with some pictures so that group collaboration may become possible anytime and anyplace. Learners, on their own search for content materials and organize it using online technological applications like 'Diigo' (social bookmarking website). Online Google Forms can be used to collect, analyze & interpret data. The data collection may come from large number of diverse samples. In this level, instructors/teacher must mirror on learning redesign integration of technology.

Redefinition

Redefinition permits learners to bounce outside the classroom and for development of innovative ways that were not possible previously. A topic/content takes the form of a picture/graphical book, a PPT slide show, or even a video/movie. The learners could cross the four walls and indulge in the world. Learners are developing their own lessons/content and used by others say for example through Google Custom Search. Blended approach – beyond our classrooms - made this learning redesign/change possible. Here, learners become their own knowledge producers, information creators, and strategy innovators.

Figure 2: SAMR model by Putuendra



Source: beaver.instructure.com

Reviews

Sharma & Sharma (2018) conducted an experiment which studied the impact of (ICT) material resources on the teacher trainees techno-integrated teaching knowledge (TPACK). Study was experimental research design based. Researcher's objective was assessment (ICT) intervention program on the techno-integrated teaching knowledge on sample teachers. The investigator used quasi-experimental procedure. Researcher included ninety (n=90) teacher trainees from the Haryana college of Education (TEC), Bahadurgarh through a simple random selection technique. An ICT intervention was provided to the selected participants. The TPACK scale developed by (Schdint et.al, 2009) was employed by the researchers in order to fetch the data from the selected respondents. The analysis was done through SPSS 21.0 software using statistical techniques of mean, SD and t-test. Results revealed that before intervention, the TPACK level of both the (C) and (E) group was similar .But after experiment program, the TPACK score of both groups significantly varied. Moreover, the findings of this quasi-experiment also revealed that mean scores gained by the control and experimental group after ICT intervention program also showed a significant statistical difference. In the last, the researcher concluded that the ICT intervention program improved the overall techno-integrated (TPACK) knowledge among pre-service teachers.

Arora (2018) conducted a qualitative study on “Redesigning the Mathematics classroom through technological pedagogical content knowledge (TPACK) enriched pedagogical strategies”. The research work focused to explore different pedagogical

strategies along with technologies which are effective in improving the learning outcome of students of the subject mathematics. Researcher recommended that teachers must be competent enough while incorporating the three aspects of knowledge i.e.TK, PK & CK. Moreover, the study also mentioned that along with the conventional pedagogies like teaching through lecture method, inductive-deductive reasoning, discussions, and play-way method, modern technological facilities should be integrated for improving the teaching-learning efficiency. As the teaching of the subject mathematics is considered, the study recommended that along with the use of concrete manipulative, virtual manipulatives are most effective like National Library of Virtual Manipulative (NLVM) for addition and National Council of Teachers of Mathematics (NCTM) for adding fractions. Moreover, graphic interchanging format (GIF) for teaching Pythagoras theorem, cubes, cones, cylinders and surface areas. Dynamic and Interactive Mathematics Learning Environments (DIMLE) and interactive software like Geogebra for vectors, polynomials, quadratic equations recommended by the study for effective teaching of the subject Mathematics.

Naaz & Khan (2018) made an assessment of the techno-integrated teaching knowledge (TPACK) of teacher trainees. Moreover, the researcher was interested to compare them with respect to two demographic variables 1) gender 2) stream. The research was carried out on the pattern of cross sectional survey design. In order to go for this survey study, researcher selected a sample of one hundred thirty one (n=131) teacher trainees from the education department of Aligarh Muslim University (AMU) through probability sampling procedure of simple random sampling. The data collection was carried out through TPACK assessment test designed by Hosseini Z & Anand, K (2012), administered to sample teachers in person by the researcher. The data was examined

employed statistical tests t –test and ANOVA. Results revealed that teacher trainees possess high score on the technological knowledge domain (TK) and low scores on technological content knowledge domain (TCK). Moreover, the study also revealed that technological knowledge (TK) differs among teacher trainees in relation to their gender (M/F). Overall techno-integrated teaching knowledge (TPACK) among male and female respondents showed no statistical significant difference. Lastly, the teachers techno-integrated teaching competency depicted no statistical significant difference in relation to their streams i.e. Science, arts and social science teachers.

Ojha (2018) was interested to explore the impact of (ICT) material resources in modern education system”. Research was qualitative in nature and focused to identify the benefits and challenges of information and communication technologies (ICT) in Indian school system. Researcher used both primary and secondary sources of data including interview data from teachers, students and teacher educators along with some peer reviewed journal articles. The results of the study mentioned that information and communication technologies (ICT) play a significant role in effective teaching-learning process of schools, improve the learning outcome of students and provide a greater access to teacher and students to wider range of learning resources. The study also revealed that the major challenges in successful incorporation of (ICT) digital resources in schools are 1.Insufficiency of infrastructure facilities 2.Financial problems 3.Unskilled teachers 4. Lack of administrative support

Qasen & Vishwanathappa (2018) carried out a research studied ‘Blended learning approach to enhance teachers’ techno-integrated teaching knowledge (TPACK) and competency’. This research work followed the pattern of non-randomized control group

design. The objective was to identify the teacher's TPACK for designing online courses through blended learning approach. The experiment included a sample of sixty (n=60) secondary school science teachers comprising of thirty (30) teachers in experimental and thirty (30) in control group. This experimental study was carried out in secondary school in Yemen. An information and communication technology (ICT) intervention program of eight week duration was provided to teachers in experimental group. The TPACK scale developed by Schidment was employed for data collection purpose. The scale was administered to both groups. The collected data was examined through SPSS 20.0. The results of this experimental study revealed statistical significant difference was found between experimental and control group teachers mean score on TPACK knowledge. The study basically showed that teachers who design online courses are sound in information and communication technology knowledge with respect to their counterparts.

Bala & Tao (2018) studied "An examination of techno-pedagogical (TPACK) capability and anxiety towards using digital aids in teaching among higher secondary school teachers". Study was framed to forecast the techno-pedagogy competence and anxiety of higher secondary school teachers towards usage of instructional aids. The researcher used two standardized scales i.e. teachers techno-pedagogical competency scale and scale for anxiety towards use of instructional aids developed by Rajeshekar & K. Sathiyares for the data collection process. The data was collected from one hundred (n=100) teachers who were included through the stratified random procedure. Results revealed that 54% of teachers are with high techno-pedagogical competence, 8% with low and 38% average. The results also revealed that 31% teachers showed average and 69% showed low level of anxiety towards the instructional usage anxiety. Moreover, the

research mentioned no variations were found in their competency with respect to gender i.e. between male and female sample respondent teachers. But a statistical significant difference was found in teachers' competency when compared on the basis of number of years teachers are teaching.

Kumar & Gangmei (2018) conducted a study "Techno-integrated teaching knowledge (TPACK) of secondary school teacher educators". Based on objective of assessing techno-integrated teaching skills of these teacher educators and compare their skills in relation to the demographic variable of gender i.e. between male and female teachers.. The research was carried out in Jharkhand and descriptive-survey based in nature. A sample of fifty (n=50) teacher educators were randomly included in the study from two universities of Jharkhand namely Ranchi university and Nilamber Pitamber university teacher education departments (TED). The researcher standardized a self-prepared questionnaire assessing techno-integrated teaching knowledge and competency and administered for selected sample for data collection purpose. Data analysis was carried out with the help of descriptive statistical tests of percentage method (%), t-test, frequency rate, graphic tables and mean scores. The results of the study revealed that sixteen (16) % of teacher possess more than sixty (60) % (TPACK) and rest sample possess less than forty (40) % of techno-integrated teaching knowledge. Moreover, data depicted that no variation was depicted in techno-integrated teaching knowledge & competency with respect to gender variable of sample respondents.

Li & Xia (2016) made an empirical study on perception of college teacher's towards techno-integrated teaching. The researcher in this empirical study conducted an interview of five (n=05) college teachers teaching the language subject English. The study was

carried out in China. The major points concluded from the responses of these five teachers regarding ICT integration in classrooms were summed up by the researcher. These include- 1. overall attitude of teachers towards integration of technologies in classrooms was positive. 2. Digital resources usage in classrooms boosts & enhances learning outcomes of students. 3. Using techno-integrated approach in classrooms is helpful in presenting the content material effectively before students and students understand the content very well.

Erdurana & Ince (2016) carried out a research studied “Identifying mathematics teachers difficulties in technology integration in terms of technological pedagogical and content knowledge (TPACK)”. This was a case study and focused to identify/investigate problems high school teachers teaching subject ‘Math’ face while integrating technology into their actual classroom teaching-learning process. For this purpose the researcher selected five (n=05) teachers teaching the subject mathematics through purposive sampling procedure. The researcher used multiple tools for data collection procedure including semi-structured interview and focus group discussion (FGD). The data was analyzed through constant-comparative method of coding. Results are that teachers face difficulties in integrating technology in accordance with TPACK model. The major difficulties are – there is a lack of planning the lessons in accordance to TPACK, difficulty in incorporating three aspects i.e. TK, PK and CK and there is a lack of fundamental knowledge about the seven dimensions/components of TPACK and mostly in successful and effective integration.

Ozdemir (2016) conducted a survey which studied the techno-integrated teaching competency (TPACK) of teacher trainees at their elementary and high school level. The research work focused to assess techno-integrated teaching competency of elementary and high school teacher trainees in relation to their level of teaching i.e. elementary and high

school level, and subject of teaching. For this purpose the researcher included a sample of nine hundred ninety five (n=995) teachers who were enrolled in teacher education courses (TEC) at three universities of Gazi, Mugle and Bulent. Simple random procedure employed by the investigator for sample selection. Researcher used, for data collection purpose, TPACK scale developed by Yurduakel (2012). The statistical techniques, for data analysis purpose, t-test and ANOVA used by the researcher. The results were that no variation was found in the technological, pedagogical and content knowledge (TPACK) including all its seven dimensions in sample teachers in comparison to their teaching levels i.e. elementary and high school teachers. Significant statistical difference was found when compared in comparison to number of years in experience and teaching subject/s.

Philomina & Amutha (2016) studied “Information and communication technology (ICT) awareness among teacher educators”. Obj. to assess (ICT) technology awareness of teacher trainees and also make their awareness comparisons in terms of their gender and level of study or educational qualifications. Researcher goes for a descriptive –survey based research design. A total of forty two (n=42) comprising of PhD =8, MPhil=17 and MED=17 trainees were selected by the researcher through simple random sampling procedure. In order to collect data, the researcher develop a questionnaire of 20 close ended questions of 3 point Likert scale containing Yes, to some extent and No response options. The results of this survey study after employing t-test revealed that teacher trainees ICT awareness varies when compared on the basis of their subject of teaching and gender. Moreover, the study also revealed that teacher trainees’ awareness showed a statistical significant difference in relation to their educational qualifications. In conclusion, the

researcher recommended that awareness and skill towards ICT should be improved through regular training programs.

Kihoza et.al (2016) made an investigation which studied “ICT integration in classroom teaching-learning- exploration of opportunities and challenges from perspectives of TPACK and SAMR models of teaching”. Researcher was interested to highlight the opportunities and challenges tutors and teacher trainees’ face in information and communication (ICT) integrated classrooms with respect to two technology integration models of teaching i.e. TPACK and SAMR models. In order to carry out this research study, two hundred six (n=206) teachers comprising of 12 tutors and 194 teacher trainees were selected randomly. The sample was selected from teacher education college (TEC) of Morogore and Muzambe Universities. The data was collected from respondents through multiple ways through survey, interview and observation. Examination of data depicted that low level of techno-integrated teaching competency among majority of the teachers was prominent. The results also revealed that tutors possess good understanding in all TPACK and SAMR constructs than their counterparts. Moreover, the most important factor affected by TPACK and SAMR models is the poor planning of technology use in classrooms and in designing of lessons. Importantly, insufficiency in technological facilities and lack of competency among trainees to effectively integrate ICT in classrooms.

Yadav (2015) conducted a survey study to ascertain the “secondary level teachers’ attitude towards ICT usage”. The researcher selected a sample of two hundred (n=200) secondary school teachers through random probability process. The study was conducted in secondary schools of Rewari district of Haryana. The data was collected through self-prepared questionnaire. Simple percentage method and mean was employed for examining

data. Outcome showed that attitude of female teachers was higher than their counterparts, urban teachers also exceed with their counterparts and private secondary school teachers also possess higher attitude in comparison with government secondary school teachers. Finally, secondary school teachers ICT competency showed increase with the increase in their services as depicted by the results.

Byker (2014) researched an exploratory study “vision and realities of ICT - India’s elementary schools”. The research study was based on the exploration of the objective of problems/challenges faced by India’s elementary schools in implementing ICT effectively. Study was a review based in nature i.e. completely based on secondary sources of data. For this purpose, the researcher included in this review study only those research papers which are confined / limited to the computer technology usage in elementary schools of India only and excluded all the other research works/ studies where meanings related to the concept of ICT refer to technologies other than computers. The research papers/studies were searched through JSTOR, ERIC, Pro Quest, Taylor & Franciscisco, and search engines Google scholar using the key words ICT, ET, computer use, elementary schools in India. Articles in English language were included in this review study. Snowball sampling procedure was used for the selection of peer-reviewed journals. Finally, the study included fourteen (n=14) research articles/papers for the research purpose of the study. For the analysis of data, constant -comparative coding method by Glasser and Strauss (1967) was employed. The findings of this review study mentioned that the major challenges/problems elementary schools in India face in effective implementation of information and communication technologies (ICT) are lack of technological resources and lack of teachers training and understanding. The study also made recommendations that how these barriers should be

removed. Importantly recommended that sharing of information and communication technologies (ICT) among teachers, students and non government organizations (NGO'S) and providing training to teachers through workshops and professional development program.

Alzahrani (2014) studied "Teachers and students techno integrated teaching knowledge (TPACK) in online teaching-learning program. Study was carried out in King Abdul Aziz University in Saudi Arabia. The objective of the research study focused on examining the techno-integrated teaching knowledge (TPACK) among students and teachers who are involved in online teaching-learning courses. The study was a descriptive-survey based in nature. In order to carry out this survey, the researcher selected a total sample of six hundred sixty four (n=664) comprising of forty six (46) online instructors and six hundred eighteen (618) online students through a non probability technique i.e. purposive sampling. Two questionnaires (one for instructors and another for learners) were mailed to the selected respondents for data gathering purpose i.e. online procedure for data collection and examined along with the use of statistical techniques t-test and ANOVAs. Data revealed no variation in seven dimensions/components of TPACK in online instructors. Statistical variation was depicted by online learners in these seven domains/components of TPACK. Moreover, no correlation was depicted between online instructors and online student's techno-integrated teaching (TPACK) perceptions.

Ramorola (2014) made a research study to identify the challenges/issues higher secondary school (HSS) teachers face while making incorporation of technology in their actual classroom teaching. For this purpose, the researcher conducted semi-structured interviews of seven (n=07) randomly chosen second level teachers who were selected by

the researcher through purposive sampling procedure.. The major challenges secondary school teachers face while integrating technological facilities in their actual classroom teaching are lack of technological facilities and lack of skill in teachers in making technological integration.

Sahin et al (2014) conducted a research study on “analysis of relationship between techno-integrated teaching knowledge (TPACK) and educational internet use”. Analysis examined association among two variables-teachers techno-integrated teaching knowledge (TPACK) and self-efficacy usage of internet. In order to carry out this research, the researcher selected one hundred sixty (n=160) teacher trainees from the teacher education college (TEC) in Central University of Turkey using simple random sampling procedure. Two Likert scales were administered to the selected sample for data collection purpose. The two scales were Self-efficacy scale of internet usage and TPACK scale developed by Sachin (2009; 2011). The researcher employed descriptive statistical tests, correlation and canonical correlation for data analysis procedure. Data depicted that association exists between trainees techno-integrated teaching understanding (TPACK). Further, results also revealed that there is a strong correlation between all the dimensions of techno-integrated teaching model i.e. TPACK and confidence in internet usage. Moreover, at the end of this analysis, the researcher also mentioned that technological, content and pedagogical knowledge are the important three knowledge domains for the improvement of trainee’s confidence towards internet usage, statistically verified.

Lee & Lee (2014) carried out a research which studied ‘Enhancing Pre-service teachers (teacher trainees) self efficacy beliefs for techno-integrated teaching through lesson planning practice’. Here, researcher focused to highlight how teacher trainees’

confidence for techno-integrated teaching during their training course gets improved. The study also focused to investigate the important factors that are affective for techno-integrated teaching confidence. In order to carry out this research study, the researcher selected one hundred thirty six (n=136) student teachers admitted in South Korean University (ICT) programme. Data gathered through 5 point Likert scale i.e. Self Efficacy beliefs for technology integration scale (SETI) developed by Wang et.al (2004), teachers attitude towards computers scale (5 point Likert scale) developed by Voogt & Agyel (2011) and observation rubric for content plan evaluation. Analysis mentioned teacher trainees' confidence of techno-integrated teaching improved after their completion of training course. The research study also revealed that most important dominating factor for successful integration of technology in classrooms is planning of lessons before actual teaching in classrooms. In addition to this, the study also recommended that teacher trainees possessing positive attitude towards computer technology and capacity of effective lesson planning, their confidence in techno-integrated teaching developed very increasingly.

Yousuf & Balogan (2014) carried out a research study on "Student teacher's competency and outlook towards (ICT). Moreover, the study made comparisons of teacher trainees' competency and attitude of ICT usage with respect to their gender differences. The study was descriptive-survey based in nature. A total of three hundred sixty (n=360) comprising of one hundred eighty male (180M) and two hundred female (200F) teacher trainees were included in the study as a sample by the researcher through random process. The study was conducted in teacher education department (TED) of Ilorin University, Nigeria. Likert scale was developed and used for data gathering by the investigator.

Percentages and a non-parametric chi-square test was employed. The outcome of the study was that more than fifty (50) % of teachers reacted positively towards ICT usage. Also, there was no statistical significant difference found in teacher trainees' competency and attitude towards ICT usage in terms of their gender differences. The researcher recommended that universities and teacher education departments should focus on boosting of teacher trainees competency by redesigning the curriculum. The major emphasis should be given to the techno-integrated teaching knowledge of teacher trainees.

Thakur (2014) surveyed “awareness of trained teachers in relation to information and communication technology (ICT)”. In this survey research, the researcher selected a sample of three hundred (n=300) teachers from different high schools of West Bengal through simple random method. A self prepared questionnaire containing twenty four (24) items with responses very poor, poor, average, good, very good response items employed. The scale was administered to the selected respondents by the researcher in person. Statistical method of average, standard deviation and t-test was used for data analysis purpose for deriving results. The findings of the study exhibit that overall awareness of the sample teachers towards ICT was very good. Moreover, the results also revealed that the awareness of selected trainees was not statistically significant in relation to their gender. Statistical significance was found when compare their awareness on the basis of teachers locale.

Chang & Jang (2014) assessed the Taiwan and China instructors of subject Physics, TPACK differences. Also, the study aimed to explore the changes in students perceptions in a physics course taught to them through TPACK method of teaching. The participants of this study were two physics instructors- one from university of Taiwan and other from

china. In addition to this, one hundred eight (n=108) students comprising of 56 from John's class and 52 from Mike's class. The data was collected from instructors and students through multiple methods including survey methodology, interview and observation tools. Students' perception regarding their teachers TPACK was collected through survey after 18 weeks duration course. The two observations of two classes and interview of Jhon and Mike after completion of course were also made. The data was analyzed again through multiple ways-qualitative data through statistical test t-test and qualitative data of observations and interview through constant comparative method of coding. The results of this assessment revealed that both instructors TPACK confidence increased at the end of their courses. The results also revealed that Jhon gave more emphasis on day to day examples and on the technological usage where as Mike on knowledge and assessment of students learning outcomes. Both instructors instructional method significantly improved during the course.

Zascerinska (2014) studied web technologies usage among teachers with special reference to enterprise 3.0 applications. In order to carry out this survey, the researcher first explained the concept of enterprise 3.0 application. Then it was followed by a questionnaire administered to fifty nine (n=59) teachers of the Birmingham University, United Kingdom. The sample comprised of sixteen male (16m) and forty three female teachers (43f) who were randomly selected. The data was analyzed on the basis of percentage method. Teachers primarily use web technologies especially enterprise 3.0 for 1) interaction to others 2) business purposes 3) learning purpose.

Dedun (2013) was interested to explore the awareness of secondary school teachers towards the educational technology (ET) and also make teachers comparison of awareness

towards education technology in relation to their gender and type of institution. A total sample of two hundred seventy three (n=273) comprising of one hundred twenty eight (128) primary teachers and one hundred forty five (145) secondary teachers were randomly selected by the researcher from the Mahasana district of Gujarat state. For the purpose of data collection, the researcher adopted education technology awareness scale developed by Amardeep & Singh (2011)- a 5 point Likert with options - not heard, heard only, know, can use and can explain response items. Simple percentage method was used by the researcher for result findings. Results depicted variation in awareness of rural and urban teachers towards educational technology i.e. on the basis of teachers locale, differences were found. Moreover, the results revealed that on the basis of gender, variations were not found. Also statistical significant difference was found in govt. and private secondary school teachers i.e. in relation to the type of institution teachers are working.

Tondeur et.al (2012) carried out a survey research which studied 'Technological pedagogical content knowledge in teacher education colleges: in search of a new curriculum'. The researcher in this case study was interested to investigate that how teacher education college (TEC) teacher trainees adopt techno-integrated teaching in their internship and actual classroom teaching practices. For this research study (survey), the researcher selected three (03) teacher education colleges in Belgium. A random sample of forty two (n=42) teachers comprising of twenty six (26) trainees and sixteen (16) educators from three TEC studied. Data fetched from the selected sample through multiple data collection tools including semi-structured interviews and focus group discussions (FGD). The results of this exploratory study revealed that teacher education colleges should not focus only on introducing ICT as a standalone subject. The curriculum should be

redesigned in such a way that it should focus majorly on integration of technological knowledge in almost all the dimensions of teacher education programmes. These three colleges are in transition of adopting the new integrated approach i.e. TPACK in the curriculum.

Rana (2012) made an evaluative study on teacher educators' attitude towards technology integration in their classroom teaching. Researcher was interested in evaluating teacher educators perspectives towards the techno-integrated teaching in actual classroom settings. This research study was a descriptive – survey based in nature. The researcher selected a sample of twenty one (n=21) teacher educators comprising of seven male (M=7) and fourteen female (F=14) teachers. The sample was selected from teacher education college (TEC) in north India by employing area (cluster) sampling procedure. For data collection purpose, the researcher employed a standard scale of (ICT) , Sharma (2010). Collected data examined through with the help of statistical techniques of t-test and ANOVA in SPSS 20.0 software. Results depicted teachers' positive outlook towards techno-integrated teaching. Moreover, variation was shown by teachers' outlook ICT incorporation i.e. in relation to their gender & no variation when compared on the basis of their different age groups and locale groups.

Ertmer et al (2011) conducted a research study on – “Exploration of the beliefs of teacher trainees about using Web 2.0 technologies in K-12”. Exploratory study highlighted beliefs comprising of- normative belief, control belief and behavioral belief of teacher trainees towards Web 2.0 technological facilities. The researcher basically investigated on the teacher trainee's belief in terms of future. The study was quantitative in nature on random sample of two hundred fourteen (n=214) trainees in Midwestern University. The

researcher employed open-ended questionnaire and semi-structured interview for data collection process. The data was analyzed through multiple methods including content analysis and constant-comparative coding method. The results of the study revealed that teacher trainees hold the positive belief about integration of technological facilities in K12. Because they hold the belief that these technological facilities increase the learning outcome of learners, they are easy to use in the teaching learning process, they provide greater access to students for learning anytime and anywhere and develop confidence in learners for usage.

Onasanya et. al (2010) studied 'Higher education lecturer's attitude towards ICT material resources synergizing'. This detailed investigation was carried out in Nigeria. Primarily focused to highlight the view point of higher education institution lecturers towards techno-integrated teaching in classrooms and compare their attitudes with respect to the demographic features of gender, subject of teaching and teaching experience. The study was a descriptive-survey based in nature. For this survey study, the researcher included a sample of one hundred fifty (n=150) lecturers comprising of ninety male (90M) and sixty female (60F) teachers through simple random sampling process. The selected sample was taken from three (3) higher education institutions from the state of Kware in Nigeria. The data was collected through self-prepared questionnaire and analyzed through SPSS 20.0 software with employing statistical techniques of t-test and ANOVAs. Analysis depicted - the attitude of the sample lecturers towards techno-integrated teaching showed no statistical significant difference in relation to their gender. In addition to this, the results also revealed that statistical significant difference in the attitude of sample teachers towards techno-integrated teaching was depicted when compared between science and non-science

teachers i.e. on the basis of teachers teaching subject/s. Again, in relation to their teaching experience, the statistical significant difference in their attitudes towards techno-integrated teaching was found. Lastly, the researcher recommended that seminars, workshop programmers, orientation and refresher courses should be provided to teachers which are quietly focusing on improving the techno-integrated teaching competency among teachers.

Koh, Chai & Tsai (2010) conducted a large scale online survey study to examine outlook of trainees about techno-integrated teaching knowledge. A total of one thousand one hundred sixty four (n=1164) pre-service teachers admitted in teacher training course in Singapore responded in this online survey. The perception of sample respondent teachers was assessed on seven aspects of TPACK through TPACK scale developed by Schmidt, 2009. Findings; pre-service teachers overall TPACK score was on the average score/level on each dimension of TPACK. Moreover, the study mentioned that negative correlation was found between age and four dimensions of TPACK model including technological knowledge, content knowledge, pedagogical knowledge and technological pedagogical knowledge.

Archambault (2010) worked on observing the impact of professional training program on the faculty/ teachers of teacher education college (TEC). The study was carried out in Arizona University. This professional training program was basically designed to improve the instructors competency in blending web 2.0 tools effectively & successfully. Intensive interview process was administered to the faculty members who were enrolled in this course. The data was analyzed through constant-comparative method of coding. The analysis revealed blending web 2.0 digitals improved the techno-integrated teaching competency of teachers. They learn how to integrate social networking tools in specific

content delivery and pedagogies. Also these technologies provide feedback and make a teaching-learning process more students centric. The researcher recommends that integration of web 2.0 technologies is essential features of the 21st century teacher education curriculum.

Arehambault & Crippa (2009) studied K-12 online teachers understanding of techno-integrated teaching knowledge (TPACK). Sample of seventeen hundred ninety five (n=1795) online teachers from 25 states of U.S.A by purposive sampling procedure included. The researcher in this large scale survey study used a mailed questionnaire (self-prepared) and only (596) online filled forms received .Data depicted- (TPACK) among online teachers is very high rated. Also, association among the aspects of TPACK was .829, which is a high degree of association.

Bingimleas (2009) conducted a research study to investigate the problems/challenges in the effective integration of technological facilities in education. Primarily examined the problems - science teachers' face while making integration of technologies in their teaching process. The study was a review based in nature i.e. based on secondary sources of data. The major findings of this review research study were that educational personnel hold firm belief of using modern technological facilities in education in order to improve the efficiency of teaching-learning process. Moreover, the major difficulties teachers face while making integration of technological facilities in education are insufficiency of technological resources especially the latest digital technologies, time shortage, absence of training about use and operate technological tools and lack of technical support. The researcher recommended that authorities should provide necessary facilities

and training for effective integration of technological facilities in education by taking the arrangements of training workshops, refresher and orientation courses.

Linckels et al (2009) researched the concept of ‘teaching with digital technologies (ICT)’. Survey carried out in Luxembourg (European country) highlighted (ICT) usage in education. The survey was basically conducted by Arinastary of Education Department – a nationwide survey in Luxembourg. The data was collected with the help of open-ended – close ended questionnaire. The survey was carried out in online mode. A total of eight hundred twenty one (n=821) teachers ranging from primary to higher level of education participated in this online survey. The important results shown in this survey study were - 1) .schools and teachers have high level of access and availability to information and communication technologies (ICT) 2). Printed documents dominated the scene in classroom teaching process 3). ICT usage was directly related to teachers motivation 4) lack of technological skills/competency among teachers in using technological resources 5) teachers show positive attitude towards e-learning training programs and workshops.

Teo (2008) made a survey “Pre-service teachers’ outlook towards computer use’. Moreover, compared their outlook in relation to demographic variables of age, gender, teaching subject, computer technology usage in number of years and teacher trainees confidence in using the computer and other technology tools. In order to carry out this investigation, the researcher adopted a descriptive-survey based research design. A total of one hundred forty (n=140) teacher trainees were randomly included as a sample. The sample was selected from the National school of Education, Singapore (NSES). For the data collection purpose, the researcher employed Computer Attitude Scale (CAS) developed by **Jhon Selwyn(1997)**. This Likert scale contains the items divided into four

dimensions including affective component (6 items), perceived usefulness (5 items), perceived control (6 items) and behavioral intention (4 items). The collected data was analyzed in SPSS 20.0 software using statistical method/tests of t-test and MANNOWA. Findings depicted - overall positive outlook towards incorporating computer technology. When researcher compared their attitude in relation to their gender and age, teachers showed no statistical significant differences in their mean scores. But significant statistical mean differences were found in teacher's technological integration attitude in terms of their teaching subject/s and also in terms of their number of years they are using computer technology either for personal use or for classroom teaching purpose.

Albirini (2004) primarily focused in examining the Teacher's point of view towards latest digital (ICT) resources". Moreover, EFL teacher's view of (ICT) usage in relation five (I.V. = 05) variables which are independent in nature. These five independent variables were: 1). computer access 2). Computer attributes 3).Competency in computer 4). Cultural background 5) Teacher's training in computer usage. The inquiry was carried out in Syria and is a descriptive – survey based research design in nature. For this purpose, the researcher included a sample of three hundred twenty six (n=326) in the study through a random sampling procedure. The researcher used a 5 point Likert scale for fetching the data from the selected respondents , examined through regression analysis. The main findings of the analysis included that EFL teachers showed positive attitude in incorporating (ICT) digital resources via classrooms. Moreover, the results also revealed that EFL teacher's view towards integration of technology in classrooms is highly affected by the technological competency/skill they possess and the cultural context where they are using these Information and communication technologies (ICT).

Cox et al (1999) conducted a research study on the motivational issues teachers face while in (ICT) incorporation in their teaching activity'. Research primarily focused on highlighting the most prevalent factors responsible for increasing the motivation of teachers towards information and communication technologies (ICT) usage. Triangulation process for data gathering employed. Multiple sources included were 1) MirindaNet data- a website where registered scholars and students regularly update their digital (ICT) usage, reports and different articles 2.) Questionnaire- survey research design- administered to different experienced teachers and educators 3) semi-structured interviewed data process 4) Focus group interview (FGI) conducted. Also the researcher included the variety of different academic journals, professional journals, newspaper articles, government documents were also analyzed in this study. The data was analyzed by using mixed-methodology approach - survey design and grounded theory research design. The findings of this mixed study revealed that the most frequent motivational factors of teachers towards information and communication technology (ICT) usage are 1) perceived competency/ability of ICT usage 2) technology/resource availability 3) satisfaction towards ICT resources 4) teachers interest/willingness in ICT usage. The negative motivational factor was lack of skill in using ICT effectively. In addition to this, improvement in the learning outcomes of students/learners was identified as the positive motivational factor.

Literature gap

Thakur & Byker (2014), Reuter & Rafedaili (2009) and Dedum (2013) studied teachers awareness and usage of (ICT) digital technologies in classrooms. Li & Xia (2016), Alahirini (2004) and Devanatham & Teo (2008) studied teachers attitude towards ICT integration in classrooms and made their comparisons in relation to their gender. Cox & Cox (1999) studied teachers motivation about ICT integration in classrooms. Khizoza (2016), Williams (2010) and Zascerska (2014) mentioned web 2.0 and web 3.0 incorporation in classrooms by teachers improves their techno-integrated teaching competency and also make the students active learners. Kohler & Mishra (2006), Puentendra (2009), Alahirini (2004) and Shehu (2010) emphasized that effective integration of technologies in classrooms by teachers improves the teaching-learning efficiency. Effective integration of technologies and ICT tools in modern day classrooms very much depends on the teachers' three knowledge domains and their competency i.e. techno-integrated teaching knowledge along with their intersection Kohler & Mishra (2006), Shulman (1987), and Yousuf & Balogan (2014). Arehambault & Crippa (2009) studied secondary teachers TPACK ability. Sharma & Sharma (2018) studied impact of ICT on pre-service teachers TPACK. Arora and Naaz & Khan (2018) studied B.ED student teachers TPACK ability that is in their internship. Bingimleas (2009), Cox & Cox (1999) & Reuter (2009) Khizoza (2016) studied factors affecting techno-integrated teaching in classrooms. In this context, the researcher identified the research gap in the existing literature that perhaps no such study is on assessment of TPACK knowledge/ability of teachers in colleges of higher education. Ozdemier (2016) and Shehu (2010) studied

differences in secondary teachers TPACK competency in relation to their gender and age. Researcher identified the gap that TPACK variations in college teachers in relation to their experience, status, subject of teaching should be covered in the present study. Researchers, Kumar & Gangmei (2016) and Qasen & Vishwananthapa (2018) assessed teachers TPACK knowledge and competency through self assessed TPACK scales. This study will cover the actual techno-integrated teaching of teachers in their classrooms and lesson plans along with their self assessed TPACK. Also, the study will be carried out in the division of Jammu and Kashmir, which perhaps will be the first one. The study will also explore the factors teachers face in successful integration of technology in their teaching. Another important gap identified that the study will also highlight the intensity of ICT incorporation in classrooms in accordance with the four levels of SAMR techno-integrated teaching model. The important aspect of this study is that most of the studies mentioned above are completely based on the original TPACK model, but this study will propose a suggestive model/theory on the basis of its grounded theory research design. The researcher is of the view that the suggestive model/theory will be fruitful in the area where the research has been conducted and may be applicable to similar other contexts.

Conclusion

The conception of the review of related literature conducted by the researcher i.e. review of different models of technology integration and incorporation in teaching-learning process revealed a consonance of insight and assisted, helped and encouraged the researcher to design & go for the present study. Also, the entire reviews of different international, national and regional studies on the technology and material resource availability, teachers' technology use and teachers' techno-integrated teaching knowledge and concept of integration, incorporation and intensity of technology especially the latest digital technologies broadened and enlarged the scope of the present research study. In view of the reviews done by the researcher, the study on techno-integrated teaching of govt. academic college teachers seems to be new and most reasonable and interesting in the present scenario. The present research study will assess the technological and material resource availability for teachers, their technology use, TPACK knowledge, ability & competency of college teachers in relation to the demographic variables of: gender, teaching experience, teaching position, subject of teaching, locale and between Jammu and Kashmir division college teachers through survey research design i.e. cross-sectional design. Along with teacher's self-assessment of TPACK knowledge, integration of technology in their lesson plans and actual classroom settings will also be assessed in accordance with the TPACK model by the researcher through grounded theory research design. The researcher will propose the suggestive model/theory of techno-integrated teaching that will be applicable in the specific context of the area of study, and may be in similar other contexts. And finally the exploration of factors/issues teacher faces in the

successful and effective techno-integrated teaching. The conception of the review of related literature conducted by the researcher i.e. review of different models of technology integration and incorporation in teaching-learning process revealed a consonance of insight and assisted, helped and encouraged the researcher to design & go for the present study. Also, the entire reviews of different international, national and regional studies on the technology and material resource availability, teachers' technology use and teachers' techno-integrated teaching knowledge and concept of integration, incorporation and intensity of technology especially the latest digital technologies broadened and enlarged the scope of the present research study. In view of the reviews done by the researcher, the study on techno-integrated teaching of govt. academic college teachers seems to be new and most reasonable and interesting in the present scenario. The present research study will assess the technological and material resource availability for teachers, their technology use, TPACK knowledge, ability & competency of college teachers in relation to the demographic variables of: gender, teaching experience, teaching position, subject of teaching, locale and between Jammu and Kashmir division college teachers through survey research design i.e. cross-sectional design. Along with teacher's self-assessment of TPACK knowledge, integration of technology in their lesson plans and actual classroom settings will also be assessed in accordance with the TPACK model by the researcher through grounded theory research design. The researcher will propose the suggestive model/theory of techno-integrated teaching that will be applicable in the specific context of the area of study, and may be in similar other contexts. And finally the exploration of factors/issues teacher faces in the successful and effective techno-integrated teaching.