RELATIONSHIP OF TEACHER EDUCATORS' PEDAGOGICAL CONTENT KNOWLEDGE AND PEDAGOGICAL SKILLS WITH PEDAGOGICAL DESIGN CAPACITY

Researcher

Samina Rafique

101-FSS/PHDEDU/S13

Supervisor

Dr. Shamsa Aziz

DEPARTMENT OF EDUCATION

FACULTY OF SOCIAL SCIENCES

INTERNATIONAL ISLAMIC UNIVERSITY,

ISLAMABAD

2020

Pedagogical content knowledge
Education
Educational technology

RELATIONSHIP OF TEACHER EDUCATORS' PEDAGOGICAL CONTENT KNOWLEDGE AND PEDAGOGICAL SKILLS WITH PEDAGOGICAL DESIGN CAPACITY

SAMINA RAFIQUE

101-FSS/PHDEDU/S13

This thesis is submitted for the partial fulfillment of the requirements for the degree of

Ph.D. Education at

DEPARTMENT OF EDUCATION

FACULTY OF SOCIAL SCIENCES

INTERNATIONAL ISLAMIC UNIVERSITY,

ISLAMABAD

2020

APPROVAL SHEET

RELATIONSHIP OF TEACHER EDUCATORS' PEDAGOGICAL CONTENT KNOWLEDGE AND PEDAGOGICAL SKILLS WITH PEDAGOGICAL DESIGN CAPACITY

By

Samina Rafique

101-FSS/PHDEDU/S13

This thesis has been accepted by the Department of Education, Faculty of Social Sciences, International Islamic University Islamabad in partial fulfillment of the degree of **PhD Education**.

Supervisor: _____

Dr. Shamsa Aziz

Internal Examiner: _____

Prof. Dr. N. B. Jumani

External Examiner I: _____

Prof. Brig. (R) Dr. Allah Bakhsh Malik

External Examiner II: _____

Prof. Dr. Haroona Jatoi

Dated:

_____

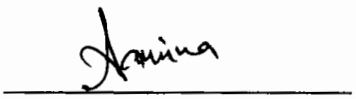
Chairperson
Department of Education
International Islamic University
Islamabad- Pakistan

_____

Dean
Faculty of Social Sciences
International Islamic University
Islamabad- Pakistan

AUTHOR'S DECLARATION

I hereby declare that "Relationship of Teacher Educators' Pedagogical Content Knowledge and Pedagogical Skills with Pedagogical Design Capacity" is my own research work. The sources consulted or referenced are acknowledged properly in-text and out-text. The research is entirely my personal effort done under the sincere guidance of the respectable supervisor. No portion of the work presented herein has been submitted against a publication in any degree or qualification of the same or any other university or institute of learning.



SAMINA RAFIQUE

Reg. No. 101-FSS/PHDEDU/S13

SUPERVISOR'S CERTIFICATE

It is certified that Ms. Samina Rafique Reg # 101-FSS/PHDEDU/S13 has completed her thesis titled "Relationship of Teacher Educators' Pedagogical Content Knowledge and Pedagogical Skills with Pedagogical Design Capacity" under my guidance and supervision. I am satisfied with the quality of student's research work and allow her to submit this for further process as per IIUI rules and regulations.

Dr. Shamsa Aziz

Chairperson, Department of Education

COPYRIGHTS

DEDICATION

I dedicate this research to my Beloved Parents and my Husband

Mr. Habib- Ur- Rehman and then my honorable supervisor: Dr. Shamsa Aziz, for all their love and attention which has made it possible for me to make it up to this point.

Acknowledgments

The journey on this road has been long and bumpy but Almighty Allah has been a researcher's major source of inspiration, courage, and energy. All the praises are for Allah Almighty: the most Beneficial and Merciful, who guide us in the darkness and help us in the difficulties.

Researcher would like to extend her sincere and deepest appreciation and gratitude to the supervisor Dr. Shamsa Aziz, Chairperson, Department of Education for providing exceptional guidance, continuous support, encouragement, wisdom and thoughtful criticism throughout her study, her instant guidance and constructive comments and observations were the real some of the inspiration for the researcher. The researcher wants to convey a very special thanks to her for being supportive.

Researcher is very especially thankful to experts from department of education IIUI Prof. Dr. N. B. Jumani, Dr. Munazza Mahmood and Dr. Zarina Akhter whose valuable suggestions and guidance supported researcher a lot in the finalization of her research work.

Researcher would like to express her gratitude to the students and teachers who participated in this study. Without them, this study would not have taken place. She extends her acknowledgment and appreciation to internal, external examiners and foreign evaluators who had given productive suggestions for improvement of quality of work. The researcher wants to acknowledge all the faculty members (both male and female) who were

involved in various stages of the study. Their willingness to share their time, experiences and wisdom with her was invaluable.

Researcher wants to give special thanks to her father Muhammad Rafique Tahir and mother Hanifan Bibi for their prayers and support. They always support morally and financially in her whole life. Researcher wants to give thanks wholeheartedly to her husband Mr. Habib Ur Rehman whenever the researcher was felt hopeless he is the only person who always stood beside her and encouraged.

Researcher is thankful to her very special friends Ms. Saadia Dilshad, Dr. Fouzia Ajmal, Ms. Humaira Akram and Rafia Tahira who have encouraged her a lot during research work. A very cute little thanks to my brothers Hashir Rafique, Babar Rafique and Noman Nazir for their patience and cooperation and they always available for me whenever I was in tough situation.

May Allah Almighty bless all of them and help her to be as helpful for them in the time of their need. Ameen!

SAMINA RAFIQUE

Abstract

Pedagogical content knowledge is a special type of knowledge possessed by the teachers that not only unravels the teachers' understanding of the content (Knowledge of Content) but also explains how to teach content (Knowledge of Pedagogy) effectively. The purpose of the study was to check the relationship of teacher educators' pedagogical content knowledge and pedagogical skills with their pedagogical design capacity. This study explicated the practices by teachers while teaching pedagogical subjects in universities and colleges of education. All the teachers and students of the Departments of Education of public universities of Punjab and colleges of education constituted the population of this study. A universal sampling technique was applied for selecting research samples. Based on the response rate about the opinion of the respondents, the sample consisted of 1305 students (645 university students and 660 college students) and 200 teachers (100 university teachers and 100 college teachers). Also, 40 teachers (20 university teachers and 20 college teachers) were selected using a purposive sampling technique for taking observational data. A quantitative approach was applied in this study and a survey was conducted to collect the data. Two questionnaires (one for teachers and the other for students) were developed on a five-point Likert scale for taking opinion about teachers' Pedagogical Content Knowledge and Pedagogical Skills, and an observational checklist was used for observing teachers' Pedagogical Design Capacity. Data were collected through personal visits. The researcher used to mean, standard deviation, Pearson's correlation, and independent-sample t-test to analyze the data. It was found that the teachers had the pedagogical content knowledge and pedagogical skills which were necessary for effective teaching. Analysis of data yielded a significant and moderate positive relationship

between teachers' Pedagogical Content Knowledge and their Pedagogical Design Capacity. Also, a significant and strong positive relationship between teachers' Pedagogical Skills and their Pedagogical Design Capacity was observed. The college teachers universally showed significantly better scores as compared to the university teachers on pedagogical content knowledge; while, in case of pedagogical skills, the university teachers showed better scores as compared to the college teachers. Finally, the analysis of the observational data showed that there was no significant difference in the mean scores of university teachers and college teachers on Pedagogical Design Capacity. The study recommended that college teachers needed to utilize their pedagogical content knowledge into practice. Courses should be designed around requirements and needs expressed by the teacher themselves. Revision of pre-service and in-service curricula, with a focus on improving and enhancing the content knowledge and pedagogical skills of the teacher trainees, is also required. Teachers' performance in the classroom should be regularly assessed by the coordinator to evaluate the quality of their training, their subject knowledge as well as their classroom delivery and management skills. Performance-Based teacher evaluation and compensation systems are required to motivate the teachers to strive towards excellence. Peer-observation and self-assessment can be used to identify the weak areas of teaching. This equally requires system improvement and powerful interventions to be addressed at university, provincial organizations, and institutional levels.

Keywords: *Pedagogical content knowledge, pedagogical skills, Pedagogical Design Capacity, teacher educator.*

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AIM	Adaptive Instructional Materials
CK	Content knowledge
DCE	Design Capability Enactment
df	Degree of Freedom
M	Mean Score
HEC	Higher Education Commission
PCK	Pedagogical Content Knowledge
PDC	Pedagogical Design Capacity
PK	Pedagogical Knowledge
PS	Pedagogical Skills
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TPACK	Technological Pedagogical Content Knowledge

CHAPTER 1

INTRODUCTION

Islam promotes knowledge in both theory and practice. Seeking knowledge in Islam is immeasurable in terms of time, place, gender, sense, interest; increase the usefulness and other dimensions. Teaching is a contemplative part of knowledge-based education. It has three main dimensions i.e. what are being taught (body of knowledge); Occupation or profession (practitioners) and Delivery (instruction, management, and assessment). Teaching is an essential part of education. It is a very sacred profession in the world as well as in Pakistan. It is a noble profession because it encompasses Allah's words in human thought or nature or Holy books. The teaching profession enables one to become a capable person according to his taste. It is a special profession because it produces other professions. All other professions originate from this. Teaching is a critical process that focuses on learner's needs, experiences, and feelings, and takes specific interventions to help them understand specific things.

Over time, people's perceptions of teachers have changed. For instance, Shulman (1986) claims that about 100 years ago a teacher was considered as effective only if he/she had a better knowledge of the content that taught to the students. Nevertheless, the above-discussed term (content knowledge) is indeed one of the most important terms in the teaching-learning process (Shulman, 1987). For instance, it is necessary to understand the teachers' knowledge of the content so that the teacher educator can easily catch the ground to improve the understanding of their imminent teaching content (Käpylä, Heikkinen, & Asunta, 2009). Moreover, if inexperienced teachers have this skill, they may learn the content of the lesson, which may improve their ability to clarify the theme of the subject

more clearly and effectively (Rollnick et al., 2008). In addition, as long as content knowledge and practice complement each other, it can help inexpert teachers to discover innovative ways to address teaching problems. According to research, knowledge of content also helps the teachers to create new ways of self-development (Loughran, Mulhall, & Berry, 2008).

With time, it is notice that content knowledge is far exceeded by teaching methods that considered the second most important part of teachers' qualifications. In this connection, the second part of the twentieth century reveals that ideas for teaching have been changed and the ability to teach knowledge has equally become demanding emergence of many teaching theories, models, several methods, questioning techniques, discussions, debates assessment, and classroom management have emerged. In addition, some research studies have been done on exploring the relationship between students' achievement and teachers'' teaching behavior. Hence, knowing only the content knowledge to be an effective teacher has become obsolete. In this connection, the quote "The person can do, does. He can't, but knows some teaching procedures, teach" of George Bernard Shaw has been used by Shulman (1986). Shulman found that something is missing in the paradigm of teaching the content to the students. He further viewed that there is a need to combine content knowledge (CK) and pedagogical knowledge (PK) to complete the missing paradigm. Shulman (1986) named this as teachers' pedagogical content knowledge (PCK). Furthermore, the teachers' PCK means that they can use teaching skills for comparisons, illustrations, and patterns to create content easier, comprehensible and effective for long lasting in teaching learning process.

Gess-Newsome (1999) added to Shulman's (1986) idea and stated that an effective teacher needed to have a good understanding of students' needs and having good and valid information on their teaching approaches, evaluation and assessment tactics and curriculum instructions should be broad in addition to having a detailed understanding of the subject. This PCK can be leaned throughout the educational career by the teacher, which may ultimately support their professional career. Hence, teacher education programs need to improve teachers' efficiency, so students may be able to learn more. Therefore, for the development of teachers, there is a dire need to research on teachers' knowledge because it may play positive and essential role in providing comprehensive and broad facts for refining teacher education programs (Avraamidou & Zembal-Saul, 2005; Friedrichsen, 2008; van Driel, Verloop, & de Vos, 1998; van Dijk & Kattmann, 2007).

Teaching is both science and the arts. As a science, it provides principles, laws, procedures and systematic sequencing. As an art, it refers to the delivery of content knowledge. This is termed as pedagogy. In addition to a simple understanding of the content of the course, pedagogy includes the capability to communicate knowledge and skills in a way that students can realize, apply and remember (van Driel, Verloop, & de Vos, 1998). This enlightens that only PK is not enough to be learned by the teachers. They also need to learn pedagogical skills (PS) to improve their teaching. This employed that the teachers' PCK needs to be transformed into PS for effective teaching (Treagust, 1987). In this connection, teachers' knowledge, in practical terms can be considered as the wisdom of practice developed through classroom experience. Feiman-Nemser (2001) have pointed out that the teachers' wisdom associates their knowledge and understanding about students with their content knowledge. In addition, the concepts are easy to understand and teaching

knowledge develops with the development of experience. Thus, subject content and pedagogical treatment go hand in hand. Teaching this point further Verloop, van Driel, and Meijers (2001) argue that teachers' knowledge is closely related to personal experience and background and is therefore unique to individuals. Successful teachers can transform their knowledge into skills so that knowledge can be understood by learners (Shulman, 1987). To be effective, teachers need to (a) activate their prior knowledge, (b) predict student difficulty related to the content being taught, (c) adjust teaching approaches and strategies to better address diverse student learning needs, (e) make connections between concepts, (f) identify relevant connections between content and student lives, (g) provide opportunities for students to assess their learning, (h) use feedback on formative assessments to improve instruction, and (i) align instructional goals and methods with the topics being taught (Barnett & Hodson, 2001; Lee, Brown, Luft, & Roehrig, 2007). These seven facet components from the content and scope of knowledge-based skills of instruction.

In addition to teachers' knowledge, the first major task the teachers have to deal with is to learn how to regulate students' behavior by managing classroom control and discipline (Lee, Brown, Luft, & Roehrig, 2007; Shaheen. (2011) in this connection, the teachers may use several skills that encompass the establishment of well-defined rules for the classroom and their expectations from the students. It is because of the reason that the students who don't know what is expected from them are more likely to misbehave (Luft, Roehrig, & Patterson, 2003). Pre-established expectations may lead to prevent the classroom from the occurrence of many problems (Doyle, 1985). However, when behavioral problems occur in the classroom, skilled teachers can deal with these problems

with minimal disruption to the learning environment (Shaheen, Khan, Tariq, Mahmood, & Hamid, 2013).

At times, teachers need to modify the teaching materials while teaching in a classroom. To handle this, a related term 'Pedagogical Design Capacity (PDC)' was introduced by Brown and Edelson (2003) and Brown (2009). It provides us an opportunity to understand how teachers observe and mobilize existing resources to design instruction. Here, the term 'observe' represents the ability of teachers to identify or focus on potential resources. Moreover, it allows the teachers to mobilize them to take action on these resources. Therefore, Brown & Edelson (2003) stated that the ability of teachers to make effective changes to course materials using personal resources and resources embedded in materials is called 'Pedagogical Design Capacity'. Here, it is important to note that some teachers have the ability to make effective changes to the course materials to support and improve the content of the resources, while other teachers (such as those who do not have a deep understanding of the theoretical basis behind the modifications stimulated in certain materials) may make changes which may not have good effects on teaching-learning process (Remillard, 2005). This and other aspects constitute the teacher's role in curriculum, which constitutes his or her views regarding the use of course materials (Forbes & Davis, 2009; Lee & Luft, 2008). On the other hand, undeniably as stated by and Bullough (2001), some teachers consider course materials as 'providing scripts', so curriculum adaptation is not considered as a part of their work.

Researchers believed that teachers' classroom practices are affected by their beliefs. In this connection, Pajares (1992) summarizes the results of a research study by pointing out the close relationship between teachers' teaching beliefs, teaching plans, teaching

decisions, and classroom practice. In this respect, the teachers' PDC plays an important role (Brown & Edelson, 2003). Furthermore, modification of the course material by the teachers becomes the center of attention, especially for new teachers (Grossman & Thompson, 2004) while teaching in the classroom (Remillard, 2005). Often, there is a need for some adjustments in the teaching materials to make learning more effective (Barab & Luehmann, 2003; Tabak & Baumgartner, 2004). Adaptation can be based on the learning objectives, teachers' background knowledge and beliefs, their identity and direction (Pintó, Couso, & Gutierrez, 2005; Valencia, Place, Martin, & Grossman, 2006; Drake & Sherin, 2006). Hence, the role of teachers' PDC becomes critical and needs to be intensively researched.

Many developing countries have developed many reforms in teacher education programs. Typically they combined different aspects such as redesigning the curriculum, textbook provision, and teacher guides containing pedagogical examples to be used in the class. As an example, we can quote Bangladesh has revised the curriculum for teacher training at primary training institutes (PTI). India and Nepal are working to improve school infrastructure, provision of teaching-learning materials, and availing three teachers for 100 students (Student-teacher ratio). In the same scenario, Nepal is using innovative teaching methods and the Maldives is emphasizing the change in curricula. Above all Pakistan is working most in innovative teaching methods and teacher evaluation programs for the development of quality teachers having the command on PDC at higher education levels (Iyengar, Witenstein, & Byker. 2014).

In Pakistan, teacher education carries drastic changes according to the need assessment of the society and to meet the challenges of international standards in this field. It was ignored in the past, now as the scenario has changed drastically and it is accessible

for all the teachers. So it is a dire need to highlight the issue and put a strong effort into its implementation in the educational institutions for teachers. The government is providing different teacher education programs at different colleges and universities level. Educator preparing projects are organized practically all initiates in Pakistan. That shows an extraordinary change in the instructive universe of the nation. Now teacher education promotes quality education which must bring changes from primary to higher education level. Teacher education is necessary to enhance the professional skills, knowledge and practice or training required in teaching. Pedagogical approaches make educators more progressive, innovative and capable to make development for better and successful changes (Gopang, 2016).

1.1 Rationale of the Study

In the knowledge-building age, teaching emerged from the scholarship of teacher; he was knowledgeable- guider (curriculum planner), knowledge implementer (educator, an instructor, a classroom teacher, managing practitioners and evaluator (curriculum) students learning and feedback to system improvement). All those roles emerged from the scholarship, wisdom, experience gained through instruction with the learners.

In this context, Abell (2007) pointed out, "Understanding the development of teachers' discipline and PCK is critical to our success in teacher education". Historically, the role of teacher educators has been to provide potential and novice teachers with insights into the content, causes, and methods of teaching (DeBoer, 2000). To understand the knowledge required for teaching, it is important to investigate the knowledge of the teaching content, the nature of the teaching skills and the ability to design the teaching, and how these teachings are reported to them.

Much of what is missing from the literature is the study of the knowledge and beliefs of experienced teachers, and how they use their teaching and learning beliefs in teaching and reflection. Furthermore, their knowledge of learners, teaching strategies, expressions, courses, and assessment are also critical for researchers. Examining the teaching knowledge and skills of experienced teachers can describe the design of the teacher's educational program. A deeper understanding of the knowledge acquired by teachers in teaching and planning provides important insights for teacher educators as they define goals, design courses and coursework for future teachers (Abell, 2008). Learning to teach does not mean learning to survive in the classroom. It means to organize teachers' knowledge systematically so that it can be used in new situations (Berliner, 2001). The research conducted by Loughran, Berry, and Mulhall (2006) do not adequately document experienced teacher knowledge: "A real and serious question in teaching is the ability to capture, portray, and share in ways that are meaningful and significant to others practical knowledge".

Teaching has become a complex and uncertain career. Teachers need to constantly adjust their teaching strategies and presentations to ensure that they meet the needs of students effectively and enable students to learn in the classroom (Barnett, & Hodson, 2001). There are no simple instructions to prepare the teachers to meet all pedagogical challenges (Barnett, & Hodson, 2001). The model of successful teaching practice is most likely to provide information for teachers to prepare courses; such models can be developed by investigating and analyzing the practices of experienced teachers (Barnett, & Hodson, 2001; National Research Council, 1997; Sternberg & Horvath, 1995). Only through an investigation of experienced teachers, we can understand the nature of teachers' PK and

how to use the components of teachers' PK in teaching (Westerman, 1991; Berliner, 1986; Shulman, 1986). Contrary, prospective teachers lack the expertise of teaching skills (Magnusson, Krajcik, & Borko, 1999) and therefore rely on their planning and teaching experience as learners. Hence, there is a dire need to look into the challenges faced by those teachers while teaching in the classrooms (Iyengar, Witenstein & Byker. 2014).

In Pakistan, the government introduced different teacher education programs to train the prospective teachers and build their knowledge and polished their skills according to the need of the updated society. The government also focused to maintain the quality of teacher education. Many teacher education programs/ projects are introduced by Higher education commission (HEC) at university and college level in Pakistan. HEC mainly focus on the teacher professional development and identify where teacher faced problem while getting the training for teaching. The directorate of staff development is working on the improvement of teachers' quality. So different aspects may be noticed while doing an action plan e.g. Content of teacher education programs, availability of instructional material, maintain the quality standards of the training, etc.

Every teacher practices his knowledge and skills while teaching and utilizing the available resources to make his teaching effective. Effective teaching needs to build a connection between capabilities, content knowledge and utilization of instructional material in the classroom. So If a teacher has specific knowledge (regarding subject-matter), having polished skills and know-how to utilize different methodologies and strategies to make the teaching effective can build better conceptual learning of students. If some gaps exist after this study so further researches can be conducted in a specific area.

So this study explicated the challenges faced by teachers while teaching pedagogical subjects in universities and colleges of education. By examining the pedagogy, content knowledge, skills and PDC of teacher educators, this study aimed to examine the relationship between PCK, PS, and PDC which had been utilized by teacher educators in colleges and universities. More specifically, it focused on teachers' PS and PCK in the context of PDC.

1.2 Statement of the Problem

The purpose of the study was to find out the relationship between pedagogical content knowledge (PCK) and pedagogical skills (PS) with pedagogical design capacity (PDC) of teacher educators. So the study was to find out the Pedagogical skills and PDC being practiced by teacher educators and also to explore the PCK possessed by teacher educators. It is the need of the hour to explore what skills and knowledge a professional has and what he/she is performing. This study explored the teacher educators' performance, to what extent they practiced according to their knowledge, skills, and PDC and examined its effect on types of institutions. This research explore the beliefs and practices of teacher educators' about their content knowledge (i.e. knowledge of subject- matter, knowledge of pedagogy) skills (assessment and evaluation, control and discipline in classroom) and ability to select the best instructional resources and use those resources for making their teaching effective (PDC i.e. representation, delivery of lesson, teaching strategies and skills, student engagement, goals and beliefs).

1.3 Objectives of the Study

Objectives of this study were:

1. To explore the Pedagogical Content Knowledge of teacher educators.
2. To identify the Pedagogical Skills practiced by teacher educators.
3. To observe the Pedagogical Design Capacity of teacher Educators.
4. To find out the relationship between Pedagogical Content Knowledge, Pedagogical Skills and Pedagogical Design Capacity of teacher educators.
5. To compare the college and university teacher educators on Pedagogical Skills, Pedagogical Content Knowledge and Pedagogical Design Capacity.

1.4 Research Questions and Hypotheses

The study attempted to answer the following questions and hypotheses:

Question 1. What type of Pedagogical Content Knowledge did teachers possess?

Question 2. What are the pedagogical skills practiced by teacher educators?

Question 3. What is the Pedagogical Design Capacity of teacher Educators?

- Two null hypotheses were formulated for Objective 4.

H_{01}: There is no significant relationship between Pedagogical Content Knowledge scores and pedagogical design capacity scores of teacher educators.

H_{02}: There is no significant relationship between pedagogical skills scores and pedagogical design capacity scores of teacher educators.

- Three null hypotheses were formulated for Objective 5.

H_{03}: There is no significant difference in the mean scores of Pedagogical Content Knowledge of the teacher educators teaching in college and universities.

H_{04}: There is no significant difference in the mean scores of pedagogical skills of the teacher educators teaching in college and universities.

H_{05}: There is no significant difference in the mean scores of pedagogical design capacity of the teacher educators teaching in college and universities.

1.5 Significance of the Study

Exploring PCK, PS, and PDC of teachers has always been a hot cake for the researchers as these are considered as important features of effective teaching. This study would help the teachers to understand the pedagogical problems rooted in content knowledge and find ways to teach efficiently, as the results of the study on provided gaps the neglected aspects of the PCK, PS, and PDC were necessary to the outlook for increased gains in learning. This study also provided a strong implication for the teachers to utilize their PCK into practice. It might also help the teachers by utilizing the findings of the study which provided ways to manage control and discipline of the classroom for creating a conducive learning environment. The study also provided comparative data and substance about university and college teachers regarding their PCK, PS, and PDC, it provided the opportunity to compare the aspects which were possessed by college teachers and which one were strong aspects of their counterparts. The results of the study should add a healthy segment in the existing literature as it was first attempt to study PCK, PS, and PDC in a single study. Finally, this study might provide a way for other researchers to find out the other murky areas where improvement could be done for teachers' pedagogical problems. At the policy level, the results of this study would be implications for reforming teacher education programs to focus on PK and PS concerning PDC.

The previous studies reported that the pedagogy of teacher education is a matter of great significance. This study is significant as it shows the importance and relationship of pedagogical knowledge as a source of professional development at university and college levels. Furthermore, the study also revealed that teacher education programs are very meaningful because these tend to enhance teachers" quality of teaching and better their pedagogical knowledge, pedagogical skills and pedagogical design capacity for effective learning. This study also helps the department of education at university and college level to provide innovative methods for teaching practice of prospective teachers and conduct action research to overcome the gaps between theory and practice in teaching profession.

The study results might also be beneficial to teacher resource centers, university & college teachers, administration and researchers. It will be helpful in teachers' selection and professional development and to provide instructional materials to teachers. The teacher resource centers will attain awareness about pedagogical design capacity for providing instructional materials to the teachers and support for different kinds of artifacts used in teaching. The results of this study might open up new avenues of research on teaching. Above all, statistically analyzed data would promote that pedagogical knowledge improvement of teacher education at higher education level would bring change towards better Pakistan.

1.6 Delimitation of the Study

The study was delimited to:

- The students and teacher educators of colleges of education and education department of public universities of Punjab.
- The students enrolled in the departments of education during the 2016-2018

academic session.

1.7 Operational Definitions of the Key Terms

Following are the operational definitions of the key terms used in the study:

1.7.1 Pedagogical Content Knowledge (PCK)

PCK is described as a combination of content knowledge and PK (Shulman, 1987). It is generally considered to be a transformation of at least two knowledge components: general teaching knowledge and subject knowledge. In this context, the views of Tamir (1988) are most interesting who view that PCK includes teaching knowledge and subject knowledge. Hence, two aspects of PCK were investigated in this study i.e. Subject-Matter Knowledge and Pedagogy Knowledge.

1.7.2 Pedagogical Skills (PS)

Teaching methods involve the dissemination of knowledge and skills in a way that students can understand, remember and apply. PS can often be divided into classroom management skills and content-related skills. Hence, this study investigated the two aspects of teachers' PS i.e. assessment and evaluation, and control and Discipline.

1.7.3 Pedagogical Design Capacity (PDC)

Pedagogical Design Capacity (PDC) is defined as the teacher's competence in recognizing the availability of resources and decide to what extent it will use for producing a teaching experience that will achieve its goals (Brown, 2009). This study investigated five aspects of PDC i.e. Domain Representations; Delivery of Lesson; Strategies and Skills; Student Engagement; and Goals and Beliefs.

1.7.4 Teacher Educator

Teacher trainers or educators are defined as people "who provide instruction or who give guidance and support to student teachers and who thus render a substantial contribution to the development of students into competent teachers" (Koster, Brekelmans, Korthagen & Wubbels (2005). In this study, the teachers teaching in universities and college of education were considered as teacher educators.

1.8 Relationship Framework of the Study

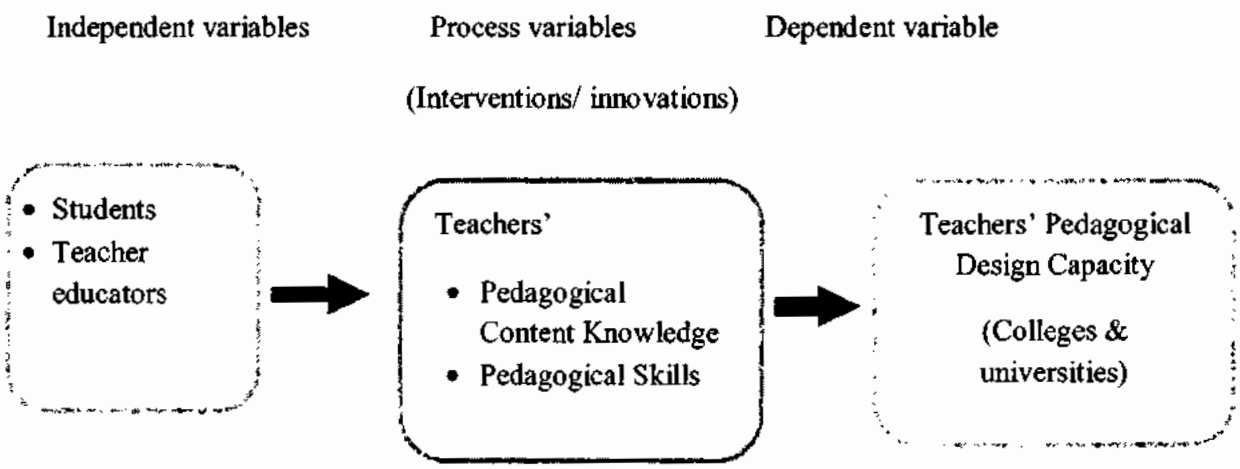


Figure 1.1. Relationship framework of the study

Figure 1.1 throws light on the phenomenon followed during the research most directly. It can be seen that in the list of independent variables covering teachers, students' and teacher educators. In the process, Teachers' PS and their PCK were included. On the top Teachers' PDC was considered as a dependent variable. The arrow in the figure displays the relationship of inputs (students and teacher educators) with strong innovations and intervention in terms of PCK and PS and their impact on research variable i.e. teachers' PDC. Diagrammatically, it is explained in the paradigm of the study (Figure 3.1).

1.9 Research Methodology

A brief description of the methodology is described as below.

1.9.1 Research Design

The study was descriptive in nature and a survey method was conducted for data collection.

1.9.2 Population of the Study

The accessible population of this study consisted of all teachers (219) and students (1508) of Departments of Education of eleven public universities of Punjab and nine colleges of education.

1.9.3 Sample of the Study

Universal sampling technique was used to select all teachers (219) and students (1508) of Departments of Education of eleven public universities of Punjab and nine colleges of education as a research sample for taking their opinion regarding teachers' PS, PCK and PDC. Moreover, 40 teachers (20 university teachers and 20 college teachers) were selected using a purposive sampling technique for taking observational data.

1.9.4 Instrumentation

Two self-developed questionnaires (One for teachers and the other for students) were used on a five-point Likert scale for taking opinion about teachers' PCK and PS, and an observational checklist was used for observing teachers' PDC.

1.9.5 Data Collection

Data were collected through questionnaire and direct observation of the sample of the study.

1.9.6 Data Analysis

This study used descriptive and inferential statistics to analyze data. Data were analyzed using mean, standard deviation, independent sample t-test, and Pearson product moment correlation coefficient.

1.10 Summary

Teaching is calling a second duty. It is a human undertaking. It combines both perennial and intellectual development. Knowledge-based body of learning provides pedagogical science; a curriculum. Its skillful delivery reflects the art of teaching. Teaching is a time-based contract between a student and a teacher. They are in agreement one provides learning, experiences, and wisdom. The other acquire, share it, shows it and builds it through the thread of empathy in the words of Imam Ghazali (a Muslim philosopher of 10th century). Global perspectives are changing content-based knowledge. Inexperience of teachers, memory, stresses, increased learner perceptions, paced learning, assessment of learning, teachers\ efficiency, pedagogical approaches, touching the science and art of teaching, brought about new ways of learning: culminating in active adjustment, teaching predictions, connectivity, assessing learning, formative interventions, and other alignments. Cognitive research further yielded managing learning, regulating student behavior, mapping students' expectations and PDC, associated with instructional goals in terms of learning methods, their availability and generating scripts. In this endeavor research also provided data on teachers'' beliefs, teaching plans and teaching decisions on sites. This was supported by more demanding roles of teachers on the modification of course materials for novice teachers. Thus, PDC has increased the teachers' teaching role manifold.

In this perspective, the present study designed the conceptual framework reflected in figure 1.1. Thus, the study attempted to explore the nature of knowledge and skills of professional performance, the level of practicing the needed skills, like PDC, in the context of institutional types. Initially, the study focused on how teacher educator content addresses the PCK. Five objectives and hypotheses were drawn up to deal with the data and substance of the study.

In the next chapter literature review has been discussed sequentially. All main concepts about pedagogy, teacher's knowledge, related theories, pedagogical skills, design capability enactment (DCE) and concept of PDC. And at the end a complete audit of the Related Studies to investigate how different specialists utilized PCK, PS, and PDC as research factors in their examinations.

CHAPTER 2

LITERATURE REVIEW

This chapter presents a review of the related literature to provide theoretical underpinnings to the current study. The topics discussed in the review of the literature are as follows.

In the first section, the researcher has discussed pedagogy and two important models of pedagogy to provide an overview of the concepts to the readers.

The second section of the review discusses teacher's knowledge especially focusing on teachers' content knowledge, Pedagogical Knowledge and pedagogical content knowledge (PCK). Furthermore, theories related to PCK and the research status of PCK have been also discussed.

The third section talks over teachers' PS especially focusing on maintaining control and discipline in the classroom and teachers' role in the assessment and evaluation of students. Furthermore, the researcher has discussed the use of various sources to improve PS in the same section.

The fourth section represents the Design Capability Enactment (DCE) Framework which provides a baseline to teachers' PDC. Further, the implications of teachers' PDC in classrooms are also discussed.

The last section provides a comprehensive review of the Related Studies to explore how other researchers used PCK, PS, and PDC as research variables in their studies.

2.1 Pedagogy

The pedagogy is often accompanied by the teaching behavior of the teachers. In this connection, Clutterbuck and Hirst (2002) make two very important points about teaching. The first is the intention to let someone learn, and the second is to consider people's needs, experiences, and feelings. In much modern usage, the words teaching, and teachers are wrapped up with schooling and schools. Moreover, teachers need to know about the content to be taught and the skills they need to master to prove that the different types of decisions to take during teaching are correct (Imogie, 2001). Teaching is the art and science that helps others grow in knowledge and understanding. Teaching involves giving yourself to others so that the work given by one person can thrive in the heart of the others, and most importantly, let others bloom.

According to Onyejemezi (2001) and Watkins, Dahlin, and Ekholm (2005), pedagogy is considered as a conscious effort of a person to let others learn something. Another definition of pedagogy considers it as the teaching behavior and its accompanying discourse to let the students teach (Alexander, 2003). It considers teachers' knowledge and skills to solve educational problems and believes in engaging students to participate in ongoing classroom activities. According to Goldston (2004), pedagogy is the "how" of teaching and learning. Students are not empty boats and are full of expertise. They must build their understanding through their learning experiences.

Pedagogy itself is a controversial term but involves activities that lead to change learners' behavior. In this connection, Bernstein (2000) defined pedagogy as an ongoing process of acquiring new forms from someone, or developing existing behaviors, knowledge, practices and standards, or being considered suitable workers and evaluators.

Emmanuel (2010) and Leach and Scott (2003) further expand the possibilities of defining pedagogy by describing the teaching environment as creative, lively, and full of teaching-learning experiences of a group of teachers and specific learners. However, they further state that although pedagogy is a joint activity, the role of learners becomes important as they have to participate actively in classroom activities. This provides a different perspective than the previously provided definition and absorbs the social interaction between the teacher and the learner. Many others recognize that the variables that help to understand teachers' pedagogical practices are complex and suggest that there are many factors that affect pedagogical practices (Mkpa, 2001; Loveless, 2002; Sotoyinbo, 2009; Bruner, 1999; Ireson et al., 2002; Cowie, 2005; Black & Wiliam, 1998; Brown & McIntyre, 1993). These practices may be affected by some factors such as the school environment, the location of the school, previous teaching experiences, teacher training, and the teacher's own learning experience. Teachers also bring more than just the pre-defined philosophy of how to teach the classroom. Therefore, the teachers' ideas and concepts are reflected in their overall teaching methods. They get these ideas from their educational experiences, initial teacher education (ITE), courses shared by colleagues in the classroom, continuous professional development (CPD) and meeting the existing institutional approach. Furthermore, it is clear from recent trends of teacher education that there has been a shift from "teacher-centered" teaching methods to more "child-centered" or "student learners" or "positive" learning methods. Teachers who demonstrate resistance to teaching change will say that they prefer to give lectures, assign individual works to students, and/or students must first "get content" to be allowed to perform any kind of activity or experiment. Teachers may also show resistance to teaching change because they

lack confidence and/or knowledge and skills to minimize the use of communication skills during the teaching model (Lortie, 1975). Not so clear, and sometimes even further, educational methods are inspired by learning theories, such as behaviorism and social constructivism.

The next section will discuss the comparison between two very important pedagogical models.

2.1.1 Models of Pedagogy

To provide a useful theoretical framework to understand different teaching methods, Bernstein (2000) contrasts two teaching models that focus on teachers' responses to students, organizing and managing the classrooms and discourse. Following is a brief contrast between the said models.

2.1.1.1 Performance Model

This includes visible teaching methods, teachers clearly explain to students the content and methods of their learning, with an identifiable strong framework or curriculum structure, collective behavior and standardized results (Adeniyi, 2009).

2.1.1.2 Competence Model

Contrary to the performance model the competence model focuses on an ostensibly more informal approach where the teacher responds to an individual's needs, with hidden or unfocused learning outcomes. It involves invisible pedagogies with weaker framing of teaching methods and teachers usually adopt flexible ways to meet the needs of the learners (Bernstein, 1990; Yara & Wanjohi, 2011).

Although the best models are poles apart, yet they focus on making learning possible in the classroom. Hence, the teachers need to adjust their teaching methods according to the situation.

To sum up, as Alexander (2003) proposed that pedagogy is both an act and a discourse a qualitative intervention while teaching is just an act, the pedagogy is hence considered more important to learn. Furthermore, pedagogy involves various teaching methods, teacher's curriculum, the teaching process, and the students' thoughts, beliefs, attitudes, knowledge, and understanding, as well as the content that influences their "teaching practice", i.e. actual thinking, action, and presentation. Pedagogy also includes teachers' beliefs including social, cultural, and political aspects.

As discussed earlier, teachers' knowledge is important for their teaching practices in the classroom. Hence, the next section will discuss the knowledge of teachers especially in the context of PCK.

2.2 Teachers' Knowledge

Teachers' knowledge is considered an important feature of the teaching-learning process. Shulman (1987) defines seven categories that provide a framework for teacher knowledge:

1. Knowledge of content being taught
2. General knowledge about teaching, (e.g. classroom control, using group work, etc.)
3. PCK
4. Course knowledge
5. Understand learners and their characteristics

6. Understand the community involvement in institutional activities and educational background of the institutes
7. Understand the drive, purpose, and values of education

A lengthy debate is required to explain each category of 'knowledge'. However, to provide the theoretical background of the current study, the combination of Content Knowledge (CK) and Pedagogical Knowledge (PK) which is known as Pedagogical Content Knowledge (PCK) is found the most interesting for the researcher. These three terms are discussed ahead.

2.2.1 Content Knowledge

It purely involves the subject matter knowledge to be taught or studied in a classroom. Furthermore, this also considers the procedures, frameworks, and concepts to explain a specific field of study. In this connection, the quote "teaching must begin with the teacher's understanding of what he or she has learned" by Shulman (1987) is considered significant. Furthermore, to be effective teachers, the teachers need to know and understand what is being taught in the classroom (Ibe & Maduabum, 2001). For this, they are required to master the teaching subject. Hence, they also need to consider both "process" and "product" of the course being taught in the classroom (Grossman, 1990; van Zee & Minstrell, 1997). According to Harris, Mishra & Koehler (2009) effective teachers also require to teach concepts and theories, explain observations to students, organize and supervise work meetings, organize field trips and guide them to make effective and reliable conclusions. Hence, in a broader sense, the CK is subject-specific and needs to be mastered by the subject teachers. Precisely, it involves "what" to teach in the classroom i.e. curriculum in the classroom.

2.2.2 Pedagogical Knowledge

For effective teaching, the teachers are required to be skillful. PK includes teaching methods, theory and teaching foundation. According to Abbitt (2011) PK includes knowledge of the teaching and learning process. Grossman (1990) added by stating that it also includes knowledge about teaching skills, beliefs, and concepts. Shulman (1987) argues that teachers' understanding of basic philosophy and methods constitutes their PK. However, educating students' intellectual initiatives and values in practice has always been a subtext for the learning outcomes of most disciplines (Offorma, 2005). Some teachers and departments teach their students to be more like subject matter experts, while others focus on subject content and related skills (Enem, 2005; Akiri & Ugborugbo, 2009). Expert thinking is an implicit goal. However, this goal requires specific teaching techniques, which may be unique to the discipline – known "signature teaching method." However, educators do not often systematically investigate "whether a student has mastered a variety of ways of thinking that is critical to a particular discipline" (Pace & Middendorf, 2004). According to Harris et al. (2009), teachers need to possess a sound PK to have appropriate and different ways to judge students. Furthermore, it enables the teachers to understand how their students build knowledge and learning through classroom activities. For making it happen, the teachers need to define requirements and distribute the tasks to promote effective learning for the students (Oladele, 2010). Hence, this knowledge guides the teachers "how" to teach in the classroom.

2.3 Pedagogical Content Knowledge (PCK)

It is considered as a mixture of content and pedagogy. It is uniquely constructed by teachers and is, therefore, a "special" form of educator's expertise and understanding. PCK

is also called 'process knowledge'. It contains comprehensive knowledge of the wisdom that teachers have accumulated in teaching practice. The four elements i.e. education, students, subjects and courses are considered by the teachers while considering PCK. It needs to be addressed in the context of a diverse approach to teaching (Chou, 2008).

Shulman (1986) who was the pioneer of introducing this term states that the concept of PCK is not new in the field of education. He was interested in expanding and improving the knowledge of teaching and teachers' preparation. He views that the content of the curriculum ignores the pedagogical practices of the teachers. Furthermore, education only emphasizes CK while he believes that the development of general teaching skills is not enough to prepare for content teachers. In his view, the key to distinguish the basis of teaching knowledge lies in the intersection of content and pedagogy (Shulman, 1986; Iyewarun, 1989).

Shulman also throws light on the purpose of PCK lies in the interpretation and transformation of the subject knowledge by the teacher in the context of promoting students' learning. The key elements of PCK mentioned by Shulman (1986) are as under.

- General teaching knowledge (or teaching strategy).
- Topic representation knowledge (CK)
- Understand the theme of the student and the meaning of learning and teaching related to a specific topic; (teaching needs).

To achieve what he calls teaching-based knowledge, he includes other elements such as course knowledge, educational background knowledge and knowledge of educational purposes (Shulman, 1987). Singh and Rana (2004) and Abuseji (2007) suggested that if a teacher wants to be effective in the classroom he/she needs to be more

than subject-oriented. He/she has to be more concerned about the pupil rather than to be only good at the subject. It is certain that if one tries wholeheartedly and consciously, one can become quite effective and accomplish wonders in the class.

The knowledge of teaching content is deeply rooted in the daily work of teachers (Opasola, 2009). However, it is not the opposite of theoretical knowledge. It includes theories learned during teachers' preparation and the experience gained from ongoing school education activities (Nkuuhe, 1995). The development of knowledge of teaching content is influenced by factors related to the teacher's background and work environment. PCK is deeply rooted in the experience and assets of students, their families and communities (Prosser, & Trigwell, 1999; Raheem, 2010). Hence, the next section will discuss the theory-based PCK development.

2.3.1 Theories related to Pedagogical Content Knowledge

PCK is generally considered to be a transformation of at least two knowledge components: general teaching knowledge and subject knowledge. In this context, the views of Tamir (1988) are most interesting who view that PCK includes teaching knowledge and subject knowledge. Furthermore, the knowledge possessed by the teachers in Tamir's point of view consists of two sub-groups i.e. professional teaching knowledge and general teaching knowledge. PCK explains how to change the theme of a particular topic to communicate with learners. It includes an understanding of what is difficult to understand on a particular topic, the concepts students bring to learn these concepts, and the teaching strategies tailored to this particular teaching situation. To teach all students to meet today's standards, teachers need to understand the depth and flexibility in the subject so that they can help students to draw their ideas, connect one idea to another,

and redirect their thinking to create powerful learning. Teachers also need to understand how to provoke thoughts in the field and everyday life. These are the cornerstones of the knowledge of teaching content. Also, teachers must implicitly or explicitly ask students not only to learn the basics but also to learn and practice the ideas or terms of the discipline. But do the individual disciplines have unique pedagogies that foster these ways of thinking? Do psychologists teach in ways to make their students more likely to think like psychologists? Does the English professor teach his/her students to read literary texts as literary scholars do? Does the physicist employ strategies to ensure his/her student understands the world as physicists do? Similar questions have been directly asked of (and mostly answered in) the professional programs (Shulman, 2005). Therefore, it is necessary to keep in mind the knowledge of the content and how to teach students in a positive way for effective teaching.

The PCK understood by Grossman (1990) is the core of the teacher's knowledge model. She views that contextual knowledge, subject knowledge, and general teaching knowledge are three components of knowledge that constitute teachers PCK. She further opinions that these components affect the development of PCK and vice versa. Hence these components are required to be considered as important while preparing the novice teachers. This understanding has produced effects of PCK research on explaining the classroom behavior of the teachers.

Cochran, Deruiter, and King (1993) emphasize that the teaching process is dynamic and requires different components of knowledge, such as knowledge of teaching, subject, and real-time contextual, to explain difficult topics to specific students in a particular learning environment. Furthermore, they criticize those teachers who consider teaching

knowledge to be a static entity. Moreover, Cochran, Deruiter, and King (1993) are also against the use of using predefined knowledge by the teachers and suggest them to modify it according to the needs of students and to achieve the learning goals. They believe that PCK is constantly being built into a dynamic teaching process in the context of teachers.

The developers of the layered model (Veal & MaKinnester, 2001) claim that former models lack clarity of 'knowledge'. They consider that the knowledge of teaching content is the product of three kinds of knowledge: the subject, teaching knowledge, context knowledge. Furthermore, they view that PCK may be used in similar settings also.

Magnusson et al. (1999) defined PCK in the context of students' centered teaching approach. They view that an effective teacher with a high level of PCK may help his/her to learn specific subject matter with ease. It involves organizing, representing, and adapting the knowledge related to a specific subject for corresponding to the needs, interests, and abilities of learners. The idea of Grossman (1990) that "the other components of knowledge transform PCK of the teachers" was the main reason for the development of the model presented by Magnusson et al. (1999). Knowledge of the subject, knowledge of pedagogy, knowledge of context, and PCK are the main components of this model. Although these components of teachers' knowledge model were similar to the components proposed by Grossman (1990), yet, this model includes teachers' beliefs as an important component that affects teacher's knowledge.

Park and Oliver (2008) claim that the teacher's PCK was developed with reflection. For example, often the influence of learners leads to problems beyond the scope of the teacher's subject knowledge and classroom teaching strategies, which help teachers to find new and useful ways for future courses. According to Park and Oliver (2008), one of the

characteristics of PCK is that the development of one component in the model may activate the development of other components and eventually lead to the development of PCK. They stress that this does not mean that the development of PCK is very simple. It is graded and cumulative, like Bloom's tree of the taxonomy of knowledge. It proceeds from an accessible baseline towards difficult and demanding.

In summary, there are many definitions, perceptions, and models of PCK in the literature. Although many researchers have studied the nature of PCK, still the definitions and components are unclear or ambiguous (Abell, 2007; Gess-Newsome, 1999; Hashweh, 1987). To understand the teaching process and understand the influence of teacher knowledge on teaching, it is necessary to reduce the complexity of teaching concepts and context: "Scholars must narrow the scope, focus on thinking, and formulate problems in a simple not a complex way" (Shulman 1986). Each researcher defines and interprets PCK through different models and components. Therefore, each model of PCK has different knowledge components and subcomponents and provides a different interpretation of the relationships between these components. However, subject knowledge and teaching knowledge are common in every model. Therefore, this study includes these two components of the PCK and considers them important for research because:

- When teaching a topic, the teacher's behavior depends to a large extent on their in-depth knowledge of the content of the lesson, making it an important part of their continuous learning.
- Research on teachers' CK links PK with the subject matter knowledge. Hence PCK is a strong knowledge base for creating skillful teachers.

- In this connection, the next section will discuss the research status of PCK and its impact on the development of teacher education programs.

2.3.2 Research Status of Pedagogical Content Knowledge

Friedrichsen (2008) views that PCK is an exclusive form of knowledge that directed by the teacher educators as well as researchers about what type of knowledge is required for effective teaching. As mentioned earlier, Shulman (1986) maintained out that teachers should have specific knowledge about the subject matter, program-related content through the introduction of the concept of Pedagogical Knowledge in the area of teacher education. He continues PCK is the unique knowledge that needs to transform the knowledge required for teaching. Moreover, it is also required to express subject knowledge which is a unique component of the teaching-learning process. Also, Magnusson et al. (1999) unambiguously adopted Shulman's point of view and commented that PCK is a transformation of several forms of teaching knowledge (including subject knowledge). It also symbolizes the specific areas required for the teacher's knowledge. In contrast, Mark (1990) argues that PCK and CK cannot be discernible as components of knowledge. Cochran et al. (1993) also agreed and stated that teachers' General Pedagogical Content Knowledge (PCK) evolved because the teachers became aware of the needs of students with the passage of time and experience. Fernandez, Balboa, & Stiehl (1995) also achieved the same results while taking university lecturers as a sample of the study. Koballa & Crawley (1985) also concluded from data collected by internship chemistry teachers at the German Gymnasium School. Veal and MaKinster (2001) referred to another level of knowledge that contributed to the development of teachers' PCK. It ranges from

the lowest general PCK to PCK for specific topics and also from the domain-specific PCK to PCK for specific topics.

Loughran, Milroy, Gunstone & Mulhall (2001) have studied theoretical aspects of the components of PCK and identified 12 interactive elements of the PCK. Padilla et al. (2008) investigated four elements of PCK. On the other hand, Halim and Meerah (2002) surveyed 12 in-service teachers from different scientific backgrounds. They asserted that rich CK was critical to develop a comprehensive PCK. De Jong et al. (2005) and van Driel et al. (2002) studied novice chemistry teachers engaged in macro/micro change and found that university workshops and high-quality coaches helped to focus on their tendency to rebound between macro and micro levels. Geddis et al. (1993) compared novice and experienced teachers. They concluded that teachers need a wide range of knowledge types to transform subject knowledge into students. Angell, Ryder, and Scott (2005) compared the PCK of experts and novice teachers in the same physical field. The results showed that experts had established extensive connections between different contexts and had demonstrated a set of valuable teaching skills rather than novice teachers who focus on disseminating content. In the context of PCK, few studies can be considered, such as the illustration training package developed by Yadav (2012). Jagtap (1999) pointed out in his research on "Content and Methodology" that content representation was a necessary condition for effective teachers. Verma and Chabra (1996) found a causal relationship between educational knowledge, adaptable skills, and classroom processes. However, they considered very little knowledge of the content of teaching in their study.

Some more researches on PCK indicated that it influenced teaching interaction and experience (de Jong, van Driel, & Verloop, 2005; van Driel et al. 2002), helped teachers to

develop expertise through longitudinal research (Mulholland & Wallace, 2001). Most importantly, PCK could further develop PCK by determining the experience of the content (Van Driel, De Jong, & Verloop, 2002).

2.3.3 Other Implications

Since the structure of PCK has been developed, refined and researched in the research literature, it is also used for the curriculum development and evaluation of teachers. The teacher preparation plan described by Zembal-Saul, Starr, and Krajcik (1999) used the components of the PCK as a guide to design curriculum, coursework and field-based activities. The key planning function was to coordinate the content, methods, and courses of general education, homework, and on-site internships. The findings indicated that there was no specific consideration of the impact of the program on the PCK, but three assessments were used to analyze the learning of pre-service teachers. These components included the content used in the teaching, an indication of the learner's needs and the quality of the classroom implementation. Although pre-service teachers made progress in developing accurate content representations, from 'teacher-centered teaching' to 'student-centered teaching' and improved management skills, it was still difficult to link students' prior knowledge to teaching, and students could respond appropriately. The authors concluded that comprehensive courses and assignments may help to synthesize knowledge gained from a variety of program sources, but acknowledge that there was a limited transfer between content and teaching.

From a Pakistani perspective, PCK has not yet been identified as a high research area. A lot of research has been done on the knowledge of teachers, and various teaching techniques and methods have been proposed. But PCK has not yet been studied adequately;

hence the researcher included teachers' PCK (PCK) as a research variable in the current study.

The next section will discuss the PS of teachers.

2.4 Pedagogical Skills

Skills constitute a set of abilities of communication, delivery and managing learning in the classroom. Clark and Walsh (2002) argue that with the rise of professional teachers rather than trainee ones, especially classical Greek sophistry, the distinction between topic preparation and subject teaching creates the concept of skills and knowledge. These are independent of discipline and focus especially on pedagogy. Therefore, teachers' knowledge about classrooms, personal knowledge about specific students and their families, assessments, students' motivation, and social interaction skills are considered as PS by Clark and Walsh (2002). Hence, they consider managing the classroom as an important pedagogical skill to be learned by the teachers besides seeking PCK.

Classroom management is a generic term that encompasses all class activities that a teacher must apply so that the class can continue to function well and with minimal disturbance. Effective management of the classroom certifies that learning outcomes are directly related to the learning environment within the classroom created by the teacher (Mansor, Eng, Rasul, Hamzah & Hamid, 2012).

A qualitative study by Richardson and Fallon (2001) found that classroom management is interconnected with the teacher's goals and beliefs and ways. Manners referred to the character traits of teachers as revealed in a class and considered important for teaching students (Richardson & Fallon, 2001). Therefore, classroom management includes the global learning environment in which students can facilitate their learning.

Content experience seems to be a factor that plays a role in creating effective classroom learning environments. Barrie Bennett, an expert in pedagogy said, "Students have a low tolerance for teachers who do not understand their field and do not like teaching this content" (Gayson, 2000). Consequently, it is also important that teachers reflect on their characteristics and the knowledge, they bring to the classroom.

The presence of a teacher in the classroom has a considerable influence on students and their behavior within a class. Good classroom management allows teachers to work with students positively and encouragingly, as well as taking preventive measures to avoid unnecessary interruptions (Schwartz & Pollishuke, 2013). As a consequence, the management of the class includes everything from the physical aspect to the configuration of the class, the routines, and rules of the class, the responsibilities of the students for the teacher, the relationships with the students, disciplinary actions, teaching strategies, and personalities.

According to Dugguh (2007), classroom management is the action taken by a teacher to create an environment that promotes and facilitates didactic learning, as well as academic, social and emotional learning. It is about creating favorable conditions to facilitate the instructions and adjust the social behavior of the students. The teachers in the classroom are, by the nature of their profession, the managers of the activities in the classroom. Unlike other professionals, the work of teachers consists of maintaining order, allocating resources, regulating the sequence of events and directing their attention towards achieving educational goals. Also there is need to practice critical thinking skills activities while teaching which makes the teaching effective (Furman, Luzuriaga, Taylor, Anauati, & Podestá, 2018).

The management of the class consisted of a "diligent" teacher, who includes an effective and stimulating transition of lessons. Research shows that effective management strategies have a link with the academic achievements of the students (Roskos & Neumann, 2012). Roskos and Neumann (2012) adopted various measures and treatments during their study. They found that the teachers struggled to take an interest in class management. Although they seemed to perform classroom activities, they encountered problems with implementation in the classroom.

It is, therefore, a serious problem of academic success for students. Therefore, evaluating class management activities to identify the impact of classroom management on students' development is important (Dugguh, 2007). Classroom management is a prerequisite for achieving educational goals and preserving the well-being of students for whom teaching and learning activities are concentrated. Classroom management involves the planning, supervision, control, and coordination of student activities in the learning process. Emmer and Gerwels (2006) have well described the overall value of effective management of the class and its positive effect in ensuring exceptional educational outcomes. They argued that teachers' ability to organize classes and manage their students' behavior is essential for positive educational outcomes. Although good behavior management does not guarantee effective teaching, it establishes the environmental context for quality education. Classroom management aims to create a supportive learning environment for students so that learning objectives are achieved effectively (Morgan & Watson, 2002). When the lesson is interrupted, the teacher needs to overcome them so that the conditions of the class can be favorable and that the teaching and learning process proceeds smoothly. The general objective of class management is to provide facilities for

a variety of student learning activities in the social, emotional and intellectual realms of the classroom (Doyle, 2011).

Froyen and Iverson (1999) have suggested three major components of classroom management. They include (i) space, materials, equipment, the movement of people, and lessons that are part of a curriculum or program of studies. (ii) a set of procedural skills that teachers employ in their attempt to address and resolve discipline problems in the classroom and (iii) focus on the classroom group as a social system that has its features that teachers have to take into account when managing interpersonal relationships in the classroom.

Excellent classroom management relies only on one step (i.e. Content-focused). It involves a smooth flow of the transitions by the effective classroom manager. Doyle (1986) stated that the good classroom manager tends to focus more on the curriculum content rather than misbehavior, while on the other hand, less successful manager tends to do the opposite.

To sum up, the concept of class management has a wider scope than that implicit in more traditional terms such as discipline or control. Brophy (2006) proposes a similar definition, "Class management refers to the actions taken to create and maintain a learning environment conducive to successful teaching" (to organize the physical environment, establish rules and procedures, keep students' attention to lessons and participation in the activities).

The PS enables teachers to understand how to create, organize and relate to other areas of knowledge. Also, teaching skills enable teachers to understand the preconceptions and background knowledge that students typically bring to each subject. Furthermore, they

focus on the strategies and instructional materials, rather than understanding and resolving possible difficulties in the classroom. On a multidimensional scale, Mckenzie (2003) identified seven elements (categories) that are necessary for developing PS of the teachers. These elements include needs assessment, establishing classroom culture, using appropriate teaching strategy, nurturing problem-solving ability, ensuring professional development, managing resources, and orchestration. On the administrative aspect, Clark and Walsh (2002) identified teachers' skills to maintain control and discipline in the classroom and the use of teaching resources to assess and evaluate the students are the key components to determine the PS of the teachers. Hence, this study included 'maintaining control and discipline' and 'assessing and evaluating the students' as key PS.

The next section will discuss the said categories of the PS.

2.4.1 Maintaining Control and Discipline in the Classroom

Garrett (2014) identified certain strategies that would enable teachers to create a caring and orderly environment in the classrooms. Some of these strategies are: establishing rules and routines, teaching and demonstrating each rule explicitly, imposing clear limits, using explicit directives, etc. Creating an environment where the students feel cared for help in building this relationship further. Sending a welcome message, allowing students to get to know the teachers, participating in extracurricular activities, conducting community-building activities, etc., allow students to build a rapport with their teachers. Beginning teachers should understand that showing care and maintaining order in the classroom complement one another as components of effective classroom management. In this connection, Ming-tak and Wai-Shing (2008) assert that classroom management is a necessary condition for creating a respectful learning environment. Effective teaching and

learning can only exist if there are good order and a positive learning atmosphere in the classroom. Control and discipline are crucial dimensions of classroom management and are essentially means of creating a necessary condition for classroom learning.

Beginning teachers often look at care and order as separate entities (Garrett, 2014). They are constantly striving to strike a balance between cultivating order in the classroom and developing a caring relationship with their students (Weinstein, 2006). Beginning teachers need to be able to merge these two concepts of care and order in their classroom management approach. Obidah and Teel (2001) pointed out that new teachers often face problems to manage the class well. They stated that one particularly troubling weakness among novice teachers is their lack of assertiveness with students. Often teachers expect students' obedience and to be treated with respect merely because they are teachers. Furthermore, Preston and Shakelford (2005) commented that most teachers enter the profession, and preserve in it, with little or no training in school discipline techniques. This is indeed strange when discipline problems are so frequently cited as the greatest dilemma facing public schools.

Advising the teachers, Leach (2006) conveyed them to take a look into their own experience of education, when they were the students of that age. Ozdemir (2016) reveals in his research that students are more likely to follow classroom rules and routines when they believe their teachers care about them. Furthermore, Cothran and Ennis (2000) asserted that students are more likely to cooperate with caring and respectful teachers.

Leach (2006) states that it is important that the teachers develop an understanding of what affects pupils' performance and behavior in the classroom, and in school generally, and that the teachers continue through their career to refine and modify this understanding.

It is therefore also important that the teachers recognize the centrality of learning in their approach to working with pupils, and some intention paid at a more theoretical level to the psychology of learning will be of advantage the teachers continue to their teacher identity. This is particularly useful in reflecting on those pupils who appear to be 'lazy'. The quite common practice on the part of teachers of talking about pupils as lazy is a shorthand way of saying a great many things about the pupil, which may not be much to do with actual laziness. There are several reasons why pupils do not do what teachers want them to do at the time teachers want them to do it. The list includes genuine tiredness, no energy due to lack of adequate nutrition, lack of understanding of the task, inability to see properly, lack of motivation and the genuine effect of puberty on adolescents, producing all sorts of feelings of alienation, self-doubt, uncertainties about relationships, family problems.

In this connection, Sajjad (2007) emphasizes to train students' self-control and states that the students' self-control means that the students are self-reliant and responsible. They demonstrate self-reliance through planning, decision making timely action and self-evaluation. They demonstrate responsibility by fulfilling their obligation to other people as well as to themselves, without being prompted or asked. Teachers can develop self-reliance through various techniques like offering various activities and allow students to select activity of their interest, correction of their own work (e.g. Assignments, tests, quizzes, etc.), encouraging students to set their personal goals, consulting with the students about class governance, evaluating teachers by students, encouraging students to keep their own progress record and encouraging students to organize their own learning.

Moreover, Mishra (2007) states the importance of knowing students by their names that this might seem to be so obvious that it does not need mentioning. In terms of

establishing relationships with pupils, the teachers must attempt to learn all pupils' names within the first two weeks of the time with new classes. There are various ways in which the teachers can do this e.g. name tags, labels, name learning games, getting pupils individually as they come into the room, using mnemonics, and matching their names as the teachers go through the register. If for no other reason, the teachers need to know names as quickly as possible in order that they can build supportive relationships with their classes, keep proper records of pupils' attainment and know who these records refer to (particularly important when they are reporting to parents), manage their classes efficiently, encourage the active participation of all pupils in lessons and demonstrate that the teachers care about their pupils in a fully professional way. Furthermore, Killen (2003) pointed out that knowing students by name is vital to good classroom control. The teachers need to think seriously about the psychological advantage of getting to know a pupil's name and using it. Once a pupil has been addressed by his/her personal name feel a sense of status and involvement – a bond has been established and an informal contract has been forged. This is the first step in getting the pupils on the side the teachers and in making they feel special.

Research by Wilson and Cameron (1996) found that beginning teachers begin their career espousing humanistic views and student-centered relationships before moving to more managerial behaviorist approaches which emphasize instructional outcomes and academic performance. The study found that student teachers and junior teachers value children's personal development and the relationship between children and teachers, attach importance to "care" as an important attribute of effective teachers, attach importance to "student-centered attention", and enter vocational education and humanitarianism (Wilson

& Cameron, 1996). Leach (2006) proposed that the teachers should deploy rules right from their first day of the class. He advised them that before the teachers enter new classes, they must have decided on the rules, routines, and codes of behavior they will expect to have adhered to in your classroom. Their rules should fall within the general policies operating in your school, as should your codes of behavior.

2.4.2 Teachers' Role in the Assessment and Evaluation of Students

William (2006) displays through early research examples that the quality of students' assessment and evaluation affects the learning environment of the classroom. Leach (2006) suggests that the ongoing classroom assessment helps the teachers in managing their classrooms. He advises the teachers that they are likely to make quick assessments of pupils' learning by observing how they perform and react, and by looking at written work they may be involved in. It is advisable to have predicted problems that might occur and should plan what to do to overcome those hurdles. Furthermore, he states that if ongoing assessment tells the teachers that some pupils have not grasped the learning intentions of the lesson, they will need to have some means of working out why this is so. However, Watson's (2006) study of informal assessments of two teachers shows that teachers' beliefs about students are more important for teachers to comprehend student understanding rather than the actual information that is drawn through formal procedures of assessment and evaluation.

Similarly, when investigating the ability of pre-service teachers to explain student conceptual errors, Son (2013) found that most of them believed that the error stemmed from the procedural aspect. Identifying errors does not help to determine how to handle them. In this connection, a study on the sixth-grade students to determine the task restricted

mathematical ideas is of great importance. The study explored how to explain the student's answers and how to respond or plan the next step in teaching. The results found that using the assessment information to plan the next instructional step is often the most difficult step (Heritage, 2007; Heritage, 2010).

Schneider and Gowan (2013) conducted a similar survey of elementary school mathematics teachers and found that these teachers also have skills in three areas of investigation i.e. identifying measurement projects, analyzing students' work, and determining the next step in teaching. Also, providing targeted feedback to students is the most difficult task in teacher research. These findings suggest that the interpretation and adjustment phase of formative assessment is not an easy task for teachers.

Falk (2012) uses students' real answers to study the professional development of science teachers and concludes that through collaborative work, teachers use teaching skills as an integral part of assessment practices. The results found that knowledge of the curriculum and instructional strategies are the most common properties possessed by the teachers. Furthermore, the proper use of knowledge that students understand when interpreting their assignments is important to be considered by the teachers. Teachers who implement formative assessments should also support students in acquiring the skills needed to improve their learning (Dixon & Haigh, 2009)

Ruiz-Primo (2011) proposed that students also connect their discourse with the discourse of other students (s) and they reflectively answer, promote and respond to other student's questions. In this connection, Heritage (2010) and also Brookhart (2011) view that lack of understanding of these characteristics used by the teachers was the hurdle in the implementation of assessments of knowledge and skills in the classroom.

Furthermore, Northouse (2010) explains that evaluation skill in teaching involves the ability to define goals and establish standards by which the teachers may judge the amount of change already taken place. Moreover, they may make a judgment about the worth and value of this change.

The teachers need to establish a standard of the appraisal to review their performance in the light of their task as well as the context in which they are working. Without the skill of evaluation, most teachers will be forced to rely on guesswork rather than on systematic evidence of the teaching-learning situation. The head teachers need to form a self-rating check which has a set of criteria by which they can judge their work. The teachers are required to evaluate themselves to know the progress they are making, and which procedures decrease or increases their effectiveness (Sergiovanni & Starrat, 2006).

To sum up, Pedagogical content knowledge (PCK) is an area of teachers' knowledge and has been identified as playing an important role in the assessment practice, but the contribution of PCK has not yet been empirically studied in the classroom (Falk, 2012). However, research into the development of specific teaching knowledge of content suggests that this knowledge can be developed through formative assessment practices or similar activities (Drageset, 2009). Teachers and scholars who have received their teaching survey have also written many methods to make a new understanding and reflection on the students' strategies through careful attention to the students' responses (Lampert, 2001). Although these different studies suggest that close attention to student thinking may yield aspects of CK, Falk (2012) points out that no research explicitly examines the way teachers develop knowledge of specific instructional content through specific assessment practices. Hence, this aspect was also considered in this study.

The upcoming section will discuss the Design Capacity for Enactment Framework which is the baseline of teachers' PDC.

2.5 Design Capability Enactment (DCE) Framework

Design Capability Enactment (DCE) Framework by Brown (2002) seeks to describe various aspects that affect teachers' resources and explore how teachers interact with course materials in a variety of ways. The DCE framework encompasses three basic elements of the curriculum: physical objects, task (process) representations and conceptual representations (domain representations).

Physical objects include material properties for the course materials, including additional materials and recommended materials. The tasks are illustrated by instructions and procedures that allow teachers and students to use the materials, such as course instructions or sets of suggested homework problems. Representations on routes include ways of organizing materials using diagrams, models, analogs and subject sequences.

Brown identified three training resources for the DCE. The first information includes domain knowledge (Ball 1991, Stodolsky & Grossman 2000), and combines the pedagogical subject knowledge (Shulman, 1986) general information about teaching with specific knowledge of the subject having a separate domain. Objectives and Beliefs (Ball and Cohen, 1999) describe teachers' motivation to teach a particular subject in a particular way. Sometimes goals and beliefs are at odds with teaching methods (Spillane, 1999, Wilson, & Cameron, 1996), which may be a barrier to implementing reforms (Cohen, 1988).

The three-course factors and the three teacher factors enable the delivery, adaptation or improvement of the teacher's curriculum resources to be understood. These

factors are not exhaustive, as other researchers have studied (Herbel-Eisenmann, 2007), appropriate features (Grossman, 1990), cultural and pedagogical norms (Stigler & Hiebert, 1998), major distinctiveness (McClain, Zhao, Visnovska, & Bowen, 2009; Smith et al., 2006) or/and teacher orientation of course materials (Remillard & Bryans, 2004).

This leads to conclude that the teachers have to improvise while teaching specific topics in the classroom. The ability of a teacher to decide how to use teaching resources to produce a teaching episode that achieves educational goals is known as the teacher's "PDC," which is discussed in the next section.

2.5.1 Pedagogical Design Capacity

Brown (2002) describes PDC as the capability of teachers to recognize materials and decide how to practice them to develop teaching activities that achieve their goals. Furthermore, Brown further concisely outlines it by considering it as an ability of teachers to detect and mobilize existing resources to create educational plays. While the Design Capability Enactment (DCE) framework is primarily about resources and Brown calls it the terminology of communication between teachers and resources, PDC spread over to collaborating verbs and teachers' capability to use their knowledge to complete new things (Ball & Cohen, 1999). Explaining this, Brown adds that PDC represents the skills of teachers in recognizing usability, creating resolutions or decisions and implementing strategies. However these design choices are manifested by way of delivery, adaptation or improvisation is a distinct matter. This is a technique for weaving various modes of use, as well as techniques for weaving several portions of the classroom arrangement, which are markers of teachers with great PDC, rather than they are unloaded, modified or improvised

at any given moment. Instead, the PDC describes how teachers create conscious and effective designs to help in achieving their teaching or educational goals.

Brown (2002) uses PDC to describe the differences between the two teachers in terms of the curriculum through comparable properties or instructions designated by the framework of DCE. Although the DCE framework describes different resources, the PDC is also used to describe teachers with similar developments. While Brown has shown that over time, PDCs can know about resources, further research is needed to understand how PDCs are developed. It is also necessary to develop measures for the PDC and to better recognize its role in attaining results.

PDC is the ability of teachers to participate in instructional design activities through two actions: perceiving and mobilizing existing resources (individuals and courses) to produce instructional drama (Pea, 1993; Ball & Cohen, 1999; Brown, 2002; Brown & Edelson, 2003; Brown, 2009). Referring to Brown and Edelson (2003), perception is defined as the ability of teachers to identify and interpret existing resources, assess the limitations of classroom settings, and balance teaching-learning activities. Remillard (2005) describes it as the ability of teachers' identification and attention to potential resources. On the other hand, mobilization emphasizes teachers developing "strategies" and relying on assets or resources (Brown & Edelson, 2003; Land, 2011). To be more specific, ideas and mobilizations are forward-looking and interactive (Clark & Peterson, 1986; Richards, 1996; Borg, 2006; Remillard, 2005). To enter the background of the research, active perception means that teachers identify, care, explain and evaluate curriculum resources and student behavior before teaching, while interactive perception represents all actions taken in the course. Similarly, the selection and adaptation of course

materials by teachers before class is called pre-school activities, and the selection and adaptation of materials completed during the course are called interactive mobilization.

Some research conducted in the context of education has examined PDC and how it can be developed among novice and experienced teachers. Davis, Beyer, Forbes, and Stevens (2007) studied how to promote PDC through teacher narrative. When investigating how four expert teachers mobilized their resource design teaching activities to attract students, Land (2011) found that these advanced PDC expert teachers showed strong knowledge about students. The above studies reveal the possibility of developing a teacher's PDC through on-the-job and ongoing teacher professional development, as well as knowledge of teachers about their students, results in high teachers' PDC. These studies confirm that there is a bridge between the two research lines: teachers use PCK and PSI. Nonetheless, their focus is on education and only one type of teacher knowledge is identified. The next section will address the implications of PDC in the classroom.

2.5.2 Implication of Pedagogical Design Capacity in the Classroom

A better understanding of PDC will have an impact on the preparation of teachers, curriculum policy and research procedures. If course instructions have PDC awareness, they can provide diverse types of usage that will be supported by consistent qualified professional progress. There is a usual pressure among the flexible, undeveloped instructional strategy and stable teaching framework that course authors expect. Brown et al. (2009) developed a system online called Adaptive Instructional Materials (AIM) that integrates a resource record or database for courses and lesson plans. A similar "learning object" study also explores this modular resource, in distinction to the study of teachers' resistance to scripting and rigorous courses (Ben-Peretz, 1990).

Three key principles have been applied in the method used by Brown et al (2009). For AIM. The first principle accesses resources in a variety of ways to support a range of teacher expertise through content and coaching. Experts can browse or search for resources to use pre-written courses or selecting a combination of plans. In the case of teachers with little or no experience, pre-written documents sent by developers to emphasize the availability and boundaries of support for teacher learning and decision-making. Secondly, materials are resource-based; that is, materials are organized around concepts, encouraged to be used in different environments, and avoid a process-centric approach. When materials are used in pre-written courses, the designer attempts to be transparent by an explanation of the decision to practice the instructional materials in the selected technique (Davis & Krajcik, 2005). Finally, to motivate for the utilization of resources and providing customization, an endeavor of designers to maintain the balance the need for materials to be context-dependent, but versatility is sufficient to function in different parts of the course. This is done by describing teaching support and avoiding the use of a single strategy to limit teachers.

The impact of PDC on career development reflects the need to help teachers identify and use the resources they choose. Brown advises teachers to get support in assessing the characteristics besides the usability of resources and necessary changes to align them with the teaching objectives. That professional development will bring additional benefits and will provide a framework for teachers to better understand students' teaching and learning.

Hence, the PDC has a great impact on the teaching-learning process as it allows teachers to come up with their ideas to be implemented in the classroom. The next section will

review the related studies to give a comprehensive view that how the study variables were researched by other researchers.

2.6 Review of the Related Studies

Several research studies have been conducted using PCK, PS, and PDC as research variables. Following is a review of a few studies.

Sibuyi (2012) investigated the teaching content of two teachers teaching in the 11th grade. The criteria for choosing those two teachers was that in the past three years or longer, they had consistently achieved good results in the 12th Grade exams of the National Advanced Certificate (the overall pass rate was 80% or higher). Therefore, they were classified such as valid. Two teachers who arranged and trained the 11th grade, quadratic function course while the researcher observed them. The study focused on a teacher's basic knowledge, such as a teacher's knowledge of teaching content (i.e. PCK). The researcher investigated the three elements of PCK; i.e. (i) knowledge of learners' concepts; (ii) understanding of the subject; and (iii) knowledge of teaching strategies. The results of the study found that the teachers had sufficient knowledge of the subject matter. On the other hand, they did not have clear concepts of the topics they taught to their students. At times, they showed ambiguity while teaching difficult concepts. Furthermore, they had limited knowledge of using the teaching strategies in the classroom. The study suggested that the teachers should participate in seminars that focus on specific instructional strategies for a variety of topics, as well as learners' knowledge of the concepts and misunderstandings.

Yusof and Zakaria (2010) in their study explored and described the level of CK possessed by three teachers. This study used a case study research design to explore the PCK of the three teachers. Document analysis, interviews and classroom observations were

used to gather data about teachers' PCK. The results of the study found that the teachers lacked a conceptual understanding of the content being taught to the students. Hence, the students were also ambiguous to describe a concept as a result of the curriculum designed by those teachers was also inaccurate. Consequently, the students lacked an understanding of the subject. This study also aimed to explore the communication skills of the teachers while teaching in the classroom. The researcher observed that the teachers could use of symbols and examples, explanations or demonstrations and learning of the analogies as a part of PCK elements for providing concepts and procedures to explain or describe, and how teachers could motivate the teaching process.

The subject of Chick, Pham and Baker's research (2006) dealt with the content of teachers. The study used a case study approach and questionnaires, classroom observations and interviews were used to collect qualitative data. Furthermore, the researchers aimed to follow a framework that enabled them to evaluate the three attributes of the PCK possessed by the teachers. First of the said attributes states that if the teacher has an understanding of the subject then it is obvious that he/she has a thorough and conceptual understanding of the teaching subject. The teacher will apply the basics of the concept and demonstrate the skills to solve the problem. Secondly, if the teacher has mastered the teaching strategy and applied knowledge, then it is obvious that the teacher uses suitable practices in the teaching-learning stage; using realistic experiences; applying numerous teaching tactics during the performance if needed; also using in the instructions a different representation. Third, if the teacher has an understanding of the learner's concept and shows interest in the learner's prior knowledge, the evidence will be obvious; the learner's difficulties will be dealt with in the course; misunderstanding of the topic; and tools to measure pupils' level

of learning about the topic. The study concluded that these teachers had sufficient knowledge about the course but required the information to recognize and correct students' misunderstandings.

Bukova-Güzel (2010) investigated the teaching content of pre-service teachers by using physical objects. In the study, the data were collected through student-prepared course plan analysis, semi-structured interviews and video recordings of instructional applications. The PCK analysis framework was applied in this study using teaching strategy knowledge, learner knowledge, and curriculum. The study consisted of two components i.e. teachers' PCK and the knowledge about learners. It was found that the teachers were unable to deal with the students' misunderstandings of the concepts being taught to them.

In another study conducted by Turnuklu and Yesildere (2007), the mastery of CK by the pre-service primary school teachers was studied. Their research showed that there was a connection between teachers' subject knowledge and effective teaching and to teach effectively, the teachers should have a command on its topic or subject which is going to be taught. They believed, if teachers had a good conceptual understanding regarding the subject, then their impact on the excellence of teaching and positive guidance used and provided.

The same type of study conducted by Mishra and Koehler (2006) produced the same results. They were of the view that the teachers had to use various teaching techniques to create students' learning in the classroom. For this, the teachers must have a deep knowledge of the subject-matter which is being taught to the students. Furthermore, they

need to be aware of how to use various PS in the classroom which ultimately produces good results for the students.

Lim (2007) pointed out in his research on the characteristics of Shanghai teachers that the success of teachers in teaching specific topics depended on the depth and breadth of individual teachers' PCK. It is because in the first lesson before the teacher starts teaching the class he/she desires to (i) strategy of course; (ii) select a container that is appropriate for the learner's level of understanding; and (iii) choose an appropriate teaching strategy. All three activities are considered part of the PCK. They found that the teachers who had a deep understanding of PCK elements selected a teaching strategy that suited their learner's development level.

Cockburn (2008) asserts that while CK is critical to the effectiveness of educators in teaching, teaching methods play a correspondingly significant part if whatever education is to be carried out.

The study conducted by Westwood (2004) stated, "Research shows that although the actual teaching and management styles of expert teachers are different, they all use teaching strategies to (i) maximize student learning time and participation; (ii) encouragement of students to actively participate in the course. In addition, (iii) they ensure that students understand what they need to do; (iv) they set tasks and activities at the right level to ensure high success rates; (v) they create a positive and supportive classroom environment; (vi) they are good behavior managers; (vii) they are good at motivating students to learn." The study also examined in what way teachers used instructional tactics to help the learners by examining the use of different methods like; notification methods,

teamwork and self-exploratory instruction methods to investigate the strategies utilized by the contributing educators in classroom presentations.

Tanner, Bottoms, Feagin & Bearman (2003) believed that a good teaching strategy should: (i) actively participate learners in it; (ii) support them to use previous information and abilities to resolve the difficulties; (iii) encourage students to contribute in the curriculum; and (iv) creates suitable atmosphere for learning.

According to Ingvarson, Beavis, Bishop, Peck & Elsworth (2004), brilliant educators/ teachers are aware of a range of effective teaching strategies and techniques that can promote students' enjoyment. Also, these teachers often choose a teaching strategy that tends to create the best learning experience for each learner. According to De Miranda (2008), "The teachers' PCK allows them how to use different teaching methods to make the learning experience best for learners. This includes flexibility and adjustment in teaching, taking into account various learning styles, and taking the abilities and interests of the students under consideration. Furthermore, the teachers understand how to teach a concept so that learners get the best learning experience. The different teaching methods used vary from teacher to teacher, but always revolve around students' learning."

A research conducted by Kiliç (2011) investigated the understanding of pre-service teachers of secondary school and found that it is essential to have a strong command on subject matter to become a brilliant teacher but it is very much hard and not enough for efficient teaching. In this study, interviews, observations, and courses were used as data collection tools. The findings suggest that teachers should know: (i) how to teach learners, specific concepts; (ii) how to express specific concepts; and (iii) how to answer learners' questions. Kiliç (2011) cites the views of An, Kulm & Wu (2004) and Masters (2010), who

described that the "PCK is considered to teach professors how to teach specific topics and subject knowledge. Knowledge is not sufficient to achieve effective teaching practices that do not understand learners." Kilić (2011) used direct observations in class, adapted questionnaires, planned interviews, and periodicals for collection of data. The study showed the results that the teachers poorly understood concepts of learners in pre-service. Kili (2011) found that teachers recruited upstream got examples of learner errors when trying to solve them, explained how to apply mathematical rules or facts to solve problems rather than explain the correct way to solve them. Hence, the concepts allowed the learners to eliminate their mistakes.

As studied by Tanner et al. (2003) that learners were seen as having varying degrees of knowledge and interest in the themes that teachers bring into the classroom. Their prior knowledge of the subject (preconceived) may interfere with their new learning experience. This may lead learners to misunderstand the concept. In this study, the teacher's curriculum plan was analyzed to examine which concepts were taught.

Researchers Anthony & Walshaw (2009) claim that efficient teachers practice different instructional strategies and representatives to improve teaching efficiency. They stated that the learners had to listen passively when a teacher used the lecture method and acted as the primary message transmitter. The same authors (Anthony & Walshaw) pointed out that efficient teachers encouraged students for communication and arranged planned queries and encouraged students to tell ideas about the subject. In such kind of learning environment, the teacher would be understood as a learner's guide to the subject, and the learner himself needed to be the main contributor to the course.

Star (2005) believed that project learning must be linked to conceptual knowledge to promote the development of conceptual understanding. Bosse & Bahr (2008) pointed out that uncertainty teachers applied the combination of factual knowledge, proficiency, and conceptual understanding, it would provide learners with an effective way to learn. Also, learners who only studied courses without understanding concepts were often unsure of how they would practice, what they identify, and this knowledge was delicate or unproductive.

An Kulm & Wu (2004) argued, "Teachers with a strong knowledge base in the field know which concepts are difficult to grasp, which concepts the learners often misunderstand and also know the possible sources of their learner errors."

Madeira (2010) conducted a design-based study to investigate the development of PCK among nine teacher participants (N = 9) in three design phases. PCK is a special type of teacher knowledge that not only solves the teacher's understanding of the content of the guide but also solves how to effectively teach the content. This knowledge has been well documented for decades and is seen as the core of teacher expertise. However, it is difficult for researchers to investigate their actual development. Hence, Madeira (2010) detailed how teachers could develop PCK by participating in course planning and developing project-based technology improvement courses. The study included two specific interventions aimed at strengthening the development of teachers' PCK: (1) scaffolding reflections throughout the practice; (2) classmates exchange curriculum plans, formulating ideas and thinking about completion. The survey results showed that teachers improved the planning and formulation of project-based technology improvement courses through scaffolding reflection and peer communication. There was a positive correlation between

teachers' participation in reflection and the quality of the curriculum plan. Teachers who were more deeply involved in scaffolding reflections could understand how their curriculum plans and development models promoted students' understanding of relevant scientific concepts. There was also a positive correlation between community impact and teachers' curriculum planning and development. Also, there was a positive correlation between the level of teachers' participation in communication activities among peers and the quality of curriculum planning and development. Teachers who made more in-depth contributions to online, face-to-face and peer-to-peer community meetings could benefit from peers' different perspectives. This study provided insight into how PCK evolved through the involvement of teachers in the complex activities that made up the curriculum and development practices. The main implication of this study was that it allowed teachers to participate in scaffolding reflection and peer communication which may be proved valuable professional development activities. Teacher learning - especially the development of PCK - was considered to be the key to promote students' understanding of scientific concepts. This paper laid a possible foundation for promoting the professional development model of effective teacher learning.

In a study, Mudzimiri (2012) was committed to developing Technological Pedagogical Content Knowledge (TPACK) among pre-service teachers. In a single university course, it was difficult to adequately address technical, teaching and content issues. Therefore, the study proposed the use of three collaborative courses, mathematics teaching method courses, technology-intensive content-rich mathematical modeling courses and internship courses to study the development of the link between technology, content, and teaching. For this multi-case study, TPACK changes for five pre-service

teachers were tracked in approximately 15 weeks. Data were collected using TPACK surveys, teaching philosophy statements, lesson plans, student instructional episodes, and weekly instructor meeting minutes. A detailed analysis of the results showed that the development of pre-service teachers' math TPACK was complex and many factors were involved. Such as the technical experience of pre-service teachers, their mathematical background and their views on the technology used.

Stevens and Stewart (2005) studied the role of cooperation, curriculum and classroom environment in the development of CK for teaching interns. Also, the researcher investigated the nature of the collaborative process between the teaching intern and his mentor, who collaborated in action (at the structured time) and on the action (student presence). Using existing research, a conceptual framework was developed that analyzed multiple data sources (recording collaboration, practice teaching observations, semi-structured interviews, and assessments) to understand the development of instructional strategies in teaching interns. The results revealed many of the dilemmas associated with planning and implementation. Although the teaching interns developed knowledge of the teaching content, they often encountered teaching difficulties. Through collaboration, curriculum, and classroom environment, the teaching interns learned to incorporate their knowledge of teaching content into the teaching. The analysis showed that as they gained new knowledge, they were able to use instructional strategies to shift their focus from content to teaching and learning. Cooperation in action and cooperation on action proved to be essential elements in the development of PCK.

Murnane & Ganimian (2014) conducted survey research on the enhancement of academic performance across developing nations. This research defined 115 difficult

impacts on the evaluation of educational creativities in underdeveloped and developing nations. The major conclusions of the research were, firstly provide better options to traditional public schools to achieve their goals. Secondly, improve school quality and more concentration should be given to students to increase their achievement so they can undoubtedly figure out how to perform. Third, Allowances should be given to the teacher to increase their effort. The major result was, specific training should be given to low gifted or less skillful teachers to achieve a level of satisfaction. Teachers must need comprehensive training (regarding subject matter, teaching-learning process). It may beneficial for the outcomes of the students' achievement.

Gopang (2016) conducted survey research and collected data from 25 teachers through a questionnaire. The main purpose of the research was to investigate the situation of teacher education and the efforts of professional development programs in Pakistan. The result of the study showed that teachers are interested to participate in short term training for their professional development. The result of the study suggested that increase the duration of teacher training or workshop. Give more importance to the development of knowledge of content/ subject matter. Use authentic and available instructional materials for effective learning in class. Teacher training must be integrated with technical aspects that focus on cognitive and affective development.

Albornoz, Anauati, Furman, Luzuriaga, Podesta & Taylor (2018) researched to investigate the learning effects of different instructors preparing techniques utilizing an irregular controlled preliminary executed in 70 state schools in Buenos Aires, Argentina. It was experimental research. The results of the research showed that instructors who got training through planned curriculum effects on student achievements. The results of the

trained group showed a significant effect on teachers' confidence and make meaningful changes in teaching. This study recommended that organized and well-planned programs of teachers for specific training can bring tremendous changes in teaching practice.

A similar study also conducted by Popova, Evans, Breeding & Arancibia (2019) about the connection among teachers' thinking skills and teaching practice. The result of this study showed that compelling class time must be given to science teachers, most of the time teachers need more time for a class lesson. The study recommended that an effective and large portion of the time brings an effective impact on the teaching of science.

2.7 Summary

Several studies, empirical, experimental narrative and investigational in the comparative PCK, PS, and PDC both in composite and discrete domains were reviewed in chapter 2. Key findings are described briefly here.

A study conducted by Stevens and Stewart (2005) about the multi-dimensional role of cooperation, curriculum and teaching environment for developing CK for teaching interns. Heavily using a qualitative approach. The results yielded that the interns gained new knowledge abled to new strategies to shift their focus from the content of teaching to learning. Cooperation was found positive in developing PCK.

Similarly, study (Chick, Pham, and Baker. 2006) examined the content richness of teachers using qualitative data. Found the teacher's strategic teaching skills could only yield tangible results when having adequate mastery in the content area. Mishra and Koehler (2006) also found similar results. Found that teaching methodology creates a teaching environment, connected with the understanding of subject matter. PS could ultimately produce tangible results. Lim (2007) also found similar phenomena. The depth of PCK

would develop a deep understanding of PCK, elements associated with teaching strategy. Westwood (2004) in their doctoral dissertation examined teaching and management styles: time of expert teachers' overtime, associated with instructional strategies. Research found that modification of methods, group work, and self-discovery yielded positive results in classroom presentations.

Turnuklu and Yesildere (2007) also examined the mastery of content areas of pre-service education of teachers. Found connectionism in knowledge and delivery. Found that the teachers' fair understanding of the content depth and conceptual understanding would yield the quality of teaching and student motivation. An Kulm and Wu (2004). Madeira (2010) linked the conceptual development of knowledge promoted conceptual understanding of the subject. The level of subject knowledge is directly linked with a high understanding of the subject. Teaching styles only facilitate the teachers in presentation and exemplification and level of motivation.

Bukova-Güzel (2010) studied pre-service education of teachers in physical sciences, used both qualitative and quantitative approaches in PCK. Found that the teachers were unable to deal with the misunderstandings of the concepts and structure of the course.

Yusof and Zakaria (2010) explored CK in science at Secondary level. Using a case study approach. Found inadequacy of conceptual understanding in CK, although the teachers were using communication skills fairly well but lacked the content building.

Sibuyi (2012) examined three key elements in the area of Maths in the National Advanced Certificate in Maths; CK, understanding teaching strategies, found a deficiency in teaching strategies. Mudzimiri (2012) developed Technological Pedagogical Content Knowledge (TPACK) for pre-service training of teachers. Found it difficult to integrate the

three courses in term of technical, teaching and content issues proposed collaborative courses than a link with technology. Murnane & Ganimian (2014) described that specific training is needed to give direction on what and how teachers should educate and build their teaching skills. Teachers' capabilities can make an effective teaching-learning process.

To sum up, the researchers have claimed that the PCK, PS, and PDC as research variables have worth to be researched. But none of these researchers studied the said three variables collectively in a single study. Hence, it is well-meaning to study the three variables in a single study and the researcher tried to attempt the same in this study. Chapter three will hence provide the details of the methodological underpinning of the current study.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter presents an account of the methods and procedures used for the conduction of the study. It includes research design, selection of population and sample of the study, instrumentation process, data collection, and analysis. Following is a detailed description of the said topics.

3.1 Nature and Design of the Study

Research design is the hub of an investigational endeavor. The rationale is two-fold. One the researcher examined the issues, questions, objectives, and hypotheses from a universal structure of research. It provides a thought process. It is a glue to hold all the elements together. It is an action plan with a philosophy. It is a strategy combing plan and structure. The primary purpose here is to ensure that the evidence obtained adequately answers the questions raised into inquiry. Two, the findings of the study must add to the body of knowledge. This has to be solid and substantial learning some questions encountered in the course of study to be followed by other researchers. This is the intent of the research design.

Black (2002) holds that this is said to be the era of science and technology and all the walks of life seem to be influenced by science. Furthermore, a scientific method called research is adopted to explore the things happening around us. Research is a systematic and positive approach to finding solutions for human activities and interactions. The social sciences specifically analyze issues related to human behavior, cognition, and career. Social science inquiry techniques are used in educational disciplines (Oliver, 2010). Furthermore, the researchers of the field of education use techniques of educational

research to explore the educational problems. To investigate various issues in the field of education, issues and events require selecting/developing various research designs. Here the problem related to select a design to check the relationship of teacher educators' PCK and PS with their PDC.

The current study was reflected by the post- positivist paradigm which investigate the multiple realities in natural settings. It is most appropriate paradigm to investigate the human behavior without any control. So a quantitative approach was being used to conduct the research. Descriptive type of research was used. Survey method and quantified observation was done for data collection. The survey permits to collect information from a larger sample of people. It combines both primary groups and others. Secondary and tertiary ones. It fixes time framework, single and longitudinal. The current study as such is descriptive: combining qualitative, larger samples, using descriptive statistics and qualitative, employing inferential data, predicting beyond data in terms of Metaphysics. The data obtained during the study was quantitative and the nature of the study was descriptive. Within the framework of the quantitative sample, data were collected using two questionnaires and one observation checklist. The sample size of the study was large enough and several aspects of PCK and PS based on objectives, research questions and hypotheses were explored during this survey study. So in this study, the questionnaire was considered the most appropriate research technique. Another advantage of the questionnaire was that it can collect a lot of information in a short time (Zwozdiak-Myers, 2009). Also, anonymous participants could respond without worrying about recognition. Additionally, to observe teachers' PDC an observational checklist was used as a research instrument. To realize the objectives of this study, questionnaires and observational

checklist were constructed to generate data. Thus the design focuses on immediate issues and finding a place for sustainability and generalizability. These form the critical concepts and structures in the design of the current study.

3.2 Population of the Study

The standard definition of the population includes all cases that meet definite specifications. Demographic factors are the only members or units that can include people, social behaviors and situations, litigation, locations, and occasions (Balikie, 2010). In other words, a population refers to the entire set of people/ persons, objects, events or entities that the researcher intends to study. It is known to target population in theoretical and research contexts. It is usually the ideal population or universe to which research results are to be generalized.

In this study, the population consisted of all the teachers and students of Colleges of education in Punjab and the students and teachers of the Departments of Education in public sector universities of Punjab. The entry requirements of the students and teachers in colleges of education in Punjab and the department of education in public universities are identical. Thus, the baseline is the same except for some institutional characteristics and variations.

The university and college teachers provided opinionated judgments about the PCK and PS which they possessed. While the university and college, students reported upon the PCK and PS of their teachers. The university and college teachers were also observed in a real classroom environment by the researcher to judge their PDC and instructional environment.

The accessible population of research encompassed the teachers and students belonging to 11 public universities in Punjab (see annexure IV) and 9 colleges of Education from Punjab (see Annexure V). These institutes were preferred for the inquirer's convenience. The description of the accessible population is given in Table 3.1.

Table 3.1

Accessible Population of the Study

Category	University	College	Total
Teachers	107	112	219
Students	742	766	1508
Total	849	878	1727

3.3 Sample and Sampling Technique

The practice of selecting subgroups in a group to reflect the entire population is called sampling (Collins, 2010). Various forms and stages are involved in sampling. Adequate care is taken that the sample represents the target population. Generating the study results to the rest of the target population can be made. The current study sample consisted of teachers and the students from the 11 public universities in Punjab and 9 colleges of education from Punjab. The stepwise description of the sample and sampling methods used are as under.

Different criteria were used for selecting a sample from an accessible population for questionnaires and observation. A universal sampling technique was used to select all the students from the targeted public universities and colleges of education from Punjab was used to get fill survey questionnaire. Hence, all 1508 students (742 students from

Universities and 766 from Colleges of Education were selected as a sample of the study. Out of 1508 students 1305 (86.54%) students from which 660 (86.16%) from Colleges and 645 (86.92%) from Universities gave their responses. Thus, the final turn out of the students was 1305 from which 660 students were from Colleges and the remaining 645 students were from Universities. Likewise, 219 teachers from universities and colleges of education (107 teachers from Universities and 112 from Colleges of Education) were taken as a sample of study using a universal sampling technique. Out of the 200 teachers from which 100 teachers from Colleges and 100 from Universities gave their responses. Again, the turn out for the teachers comprised of 200 teachers (100 from universities and 100 from colleges). For selecting the sample for observation rule of thumb by John Curry (1984) was used. According to John Curry if the size of the population range between 101-1000 than the sample size maybe 10%. Keeping in view the above reference researcher had the choice of taking more than 22 as a sample but to make the analysis of the data more authentic and to have a clear picture of the situation researcher select 40 teachers. The rationale for using a purposive sample from an accessible population to select only those teachers for observation who taught pedagogical courses. So, the researcher selected 40 teachers (20 from universities and 20 from colleges) while using a purposive sampling technique for the observations.

The sample of the study based on the return rate of the participants is described in Table 3.2.

Table 3.2

Sample of the Study

Category	Actual Sampling		Proposed sampling (For questionnaires)		For observations	
	University	Colleges	University	College	University	College
Teachers	107	112	100	100	20	20
Students	742	766	645	660	-	-
Total	849	878	745	760	20	20

3.4 Instrumentation

The instrument is the most rigorous device of the course of the study. It is all the most important when the researcher constructs his/her tools. This study neither borrowed nor modified nor used intact the instruments. The survey was descriptive. It permitted questions of quantitative measure and qualitative dimension.

Briefly simplify, understandability, exactitudes, assumption, research-based variables, ethical code, size, seeking insights and objective-based focused some of the criteria for constructing the survey questions. This was a one-time study, the contents, forms, and structure were shaped with care. The study envisaged three tools, two questionnaires and an observation checklist for collecting quantitative data.

Questionnaires were chosen to collect data because they have many advantages, such as collecting data from large samples and collecting information about their beliefs, practices, and values directly from respondents (Denscombe, 2007). They also included a

set of statements related to the logic of the problem and lead to well-designed answers. Also, the observations provided in-depth data on the real-time practices of respondents.

3.4.1 Research Instruments of the Study

To seek the views of teachers and students about teachers' PCK and PS, two questionnaires were used in the current study. Also, an observational checklist was used to observe the PDC of the teachers. The researcher reviewed the related literature to develop the instruments of the current research study to meet the objectives of the study. Simple and easy English language was used to develop the said questionnaires and observational checklist. Five-point Likert scale (i.e. strongly disagree, disagree, neutral, agree, strongly agree) was adopted in the questionnaire to take responses of the students and teachers about teachers' PCK and PS. Furthermore, an observational checklist was developed for the teachers seeking supporting evidence regarding PDC. It used a four-point Likert scale i.e. always, frequently, often and seldom. The researcher has used four-point liker scale for observation because the direct observation method was used so no need of neutral point whereas in a questionnaire, it was to be answered by the respondent (they reply on self-reported data) so to keep him/her on the track fifth point (neutral) was added. More details are outlined below.

3.4.1.1 Questionnaire for the Teachers

The first questionnaire was developed to take the responses of the teacher educators. It consisted of three parts (Annexure I). Following is the description of the instrument.

1. The demographic characteristics of teachers were encompassed in Section A of the questionnaire. These included two optional characteristics such as the name of the

teacher and the name of college/university. Furthermore, this section included options to ask about the teacher's gender, age, job status, location of the institute, salary scale, total pay, academic and professional qualification, teaching experience and whether in-service training received or not.

2. Section B of the questionnaire was about teachers' PCK. It has further consisted of two subsections.

   a) Sub-section one addressed teachers' knowledge of the subject matter. It consisted of sixteen (16) statements on the five-point Likert scale related to the subject matter knowledge of the teachers covering different aspects of the CK for professional development. They focused on a concept, structure, sequences, mastery, delivery, real-life, related positivity, thinking skills, learning connectivity, knowing and using resources.

   b) Sub-section two addressed teachers' knowledge of pedagogy. It consisted of nine (09) statements on the five-point Likert scale related to the PK of the teachers covering a different aspect of the pedagogy. The range of contents included: meeting the teaching needs of all learners, ability developing instructional material aids, adapting teaching styles, grading lesson delivery (focusing a paced learning) and leading learner to learnability.

3. Section C of the questionnaire was about teachers' PS. It has further consisted of two subsections.

   a) Sub-section one addressed teachers' skills of assessment and evaluation. It consisted of nine (09) statements on the five-point Likert scale related to the skills of assessment and evaluation of the teachers covering different aspects of the said

for professional development. The items ranged measuring a variety of assessment skills: knowing relevant types of tests and there uses (focus on diagnostic & formative), using students' feedback to the process of teaching and learning, engaging in testing through a task/ or portfolio-based technique, measuring learning.

b) Sub-section two addressed teachers' skills of control and discipline. It consisted of eight (08) statements on the five-point Likert scale related to the skills of control and discipline. Positive attitude, uploading the kind and amount of responses, distributed justice, engaging students in law-making, integrating technology in teaching, demonstrating role model.

3.4.1.2 Observational Checklist for the Teachers

There were two sections in the observational checklist which was developed for the teachers (Annexure-II). Following is the description of the instrument.

1. Section A of the instrument encompassed demographical characteristics of teachers such as the name of the teacher, name of college/ university, date of observation, subject name, class starting time, ending time and observation session.
2. Section B of the instrument was about teachers' PDC. It has further consisted of five subsections.
   a) Sub-section one addressed teachers' PDC related to domain representations. It consisted of nine (09) statements on the four-point Likert scale. Dress, greeting, voice, tone, facing class, body language, the movement represented this domain.
   b) Sub-section two addressed teachers' PDC related to the delivery of the lesson. It consisted of twelve (12) statements on the four-point Likert scale. Articulating three

parts of lesson delivery, sequencing learning, distributed teaching, balancing traditional and modern strategies, creating higher-order thinking skills were highlighted.

c) Sub-section three addressed teachers' PDC related to skills and strategies. It consisted of nine (09) statements on the four-point Likert scale. Mapping expectations, building questioning to learning, connecting subject contents to relevant themes of allied courses, dissect in lesson delivery found some of the ingredients.

d) Sub-section four addressed teachers' PDC related to students' engagement. It consisted of nine (09) statements on the four-point Likert scale. Interest, participation, respect to the learner, chance, and choice in activities, patience, and tolerance in the process of teaching found the key features.

e) Sub-section five addressed teachers' PDC related to goals and beliefs. It consisted of seven (07) statements on the four-point Likert scale. Modesty, neutrality, making words and actions, admiring his/her profession, accessibility to learners were the key variables in this section.

3.4.1.3 Questionnaire for the Students

This questionnaire was developed to take the responses of the students. It consisted of three parts (Annexure-III). Following is the description of the instrument.

1. The demographic characteristics of teachers were encompassed in Section A of the questionnaire such as the name of the student, name of college/university and degree program.

2. Section B of the questionnaire was about students' views about their teachers' PCK. It has further consisted of two subsections.
    a) Sub-section one addressed students' views about their teachers' knowledge of the subject matter. It consisted of sixteen (16) statements on a five-point Likert scale related to the subject matter knowledge of the teachers covering a different aspect of the CK for professional development.
    b) Sub-section two addressed students' views about their teachers' knowledge of pedagogy. It consisted of nine (09) statements on the five-point Likert scale related to the PK of the teachers covering a different aspect of the pedagogy.
3. Section C of the questionnaire was about students' views about their teachers' PS. It has further consisted of two subsections.
    a) Sub-section one addressed students' views about their teachers' skills of assessment and evaluation. It consisted of nine (09) statements on the five-point Likert scale related to the skills of assessment and evaluation of the teachers covering a different aspect of the said for professional development.
    b) Sub-section two addressed students' views about their teachers' skills of control and discipline. It consisted of eight (08) statements on the five-point Likert scale related to the skills of control and discipline.

The contents and forms of the questionnaire I & II were identical; as described earlier.

3.5 Objectivity of the Instruments

While construction of the instruments, researcher ensured to eliminate the personal biases, feelings, and emotions and construct instruments objectively. Objectivity of instruments were maintained by ensuring reliability and validity of instruments.

3.6 Validity of the Research Instruments

For this study, it was important to consider the reliability and validity. Consequently, researchers are accustomed to maximizing efficiency and improving the reliability of research results. This is important because obtaining a high level of reliability and effectiveness can make research more credible. Gipps (1994) generalizes effectiveness as "the extent to which an assessment measures its intentions." If an assessment cannot measure its design goals, its use can be misleading. However, Gipps (1994) argues that effectiveness is more important than reliability: "If not, then highly reliable testing is almost useless." Avoiding debate, the variables, domains, and representativeness was researched-based, drawn from the literature review in this study. The instruments were self-constructed well familiar with the intent of the study. The opinion of experts, well-connected with the domain of knowledge. Context and culture (both system and stakeholders and time management) were considered a plausible option to validate the instruments. In this perspective, five experts of pedagogy and language validated the instrument. They were asked to validate the instruments in terms of face, content and construct validity. Questionnaire for teachers and students were constructed on same perimeters, total 58 statements were made after proof reading and content and construct validity from experts 42 statements were finalized. For observational checklist out of 65 statements 46 were finalized for conduct the research.

3.7 Pilot Testing

Pilot testing of the tools can provide feedback regarding the use of language, the style, the relevance and stability of internal consistency (Zwozdiak-Myers, 2009). The questionnaires were tested upon 10 teachers and 20 students. Also, five teachers were

observed. These participants were not part of the sample selected for collecting data. The participants viewed that the language of the three statements was difficult to understand. Based on their feedback, the questionnaires and checklist were improved, and the final version was administered to collect data.

3.8 Reliability of the Research Instruments

Gipps (1994) defines reliability as the extent to which the same or similar scores are produced by two instances or two evaluators. The researcher used Cronbach's Alpha to analyze the consistency of the three research instruments used in this study. According to Gay (2009), the alpha value of 0.70 or more is acceptable for the reliability of the instruments.

3.8.1 Reliability of the Questionnaire for the Teachers

Table 3.3 refers to the values of Cronbach's Alpha for the data obtained from teachers.

Table 3.3

Reliability of the Questionnaire for the Teachers

Name of Variable	Number of Items	Cronbach's Alpha
Knowledge of Subject-Matter	16	0.84
Knowledge of Pedagogy	09	0.80
Overall Pedagogical Content Knowledge	25	0.82
Assessment and Evaluation	09	0.88
Control and Discipline	08	0.90
Overall Pedagogical Skills	17	0.88
Overall Reliability of the Questionnaire	42	0.86

Table 3.3 established the reliability of the questionnaire for the teachers as the values of Cronbach's Alpha for each variable ranged between 0.80-0.90.

3.8.2 Reliability of the Observational Checklist for the Teachers

Table 3.4 refers to the values of Cronbach's Alpha for the data obtained from the observation of the teachers.

Table 3.4

Reliability of the Observational Checklist for the Teachers

Name of Variable	Number of Items	Cronbach's Alpha
Domain Representations	09	0.79
Delivery of Lesson	12	0.83
Strategies and Skills	09	0.78
Student Engagement	09	0.88
Goals and Beliefs	07	0.86
Overall Reliability of the Checklist for PDC	46	0.80

Tables 3.4 clearly hold that the observational checklist for the teachers was also reliable as the values of Cronbach's Alpha for each variable were more than 0.70.

3.8.3 Reliability of the questionnaire for the students

Table 3.5 refers the values of Cronbach's Alpha for the data obtained from students.

Table 3.5

Reliability of the Questionnaire for the Students

Name of Variable	Number of Items	Cronbach's Alpha
Knowledge of Subject-Matter +	16	0.82
Knowledge of Pedagogy	09	0.78
Overall Pedagogical Content Knowledge	25	0.80
Assessment and Evaluation	09	0.84
Control and Discipline	08	0.88
Overall Pedagogical Skills	17	0.86
Overall Reliability of the Questionnaire	42	0.86

Table 3.5 clearly described that the questionnaire for the students was reliable as the values of Cronbach's Alpha for each variable were more than 0.70.

3.9 Data Collection

Data collection is the real field undertaking full of pains and pitfalls. It is the linchpin of a study. The prime purposes of data collection are obtained valid information, keep a record, make decisions about issues and disseminate or process it further. The researcher has to demonstrate a responsible role here.

Data were collected by the researcher through personal visits. This was necessary to ensure high rates of return and equally established professional contacts. The questionnaire for students was distributed among all 1508 students (742 students from Universities and 766 from Colleges of Education). After two weeks of distribution, the researcher again visited the institutes and took the responses of the students. On this visit

920 (61%) students submitted their responses to the researcher. The remaining was given a week further to submit their response. After one week the researcher revisited the institutes and collected 180 more responses. Hence, upon second visit total 920 + 180 = 1100 (72.94%) students responded to the researcher. To get more enriched data the researcher again gave one more week and collected 205 more responses from the students. Hence, upon third visit a total of 920 + 180 + 205 = 1305 (86.54%) students from which 660 (86.16%) from Colleges and 645 (86.92%) from Universities gave their response. The response rate i.e. 86.54% was enough to use for analysis.

Similarly, a total of 219 teachers (107 teachers from Universities and 112 from Colleges of Education) were given the questionnaires. Same as in the case of data collection from the students, after two weeks of distribution, the researcher again visited the institutes and took the responses of the teachers. On this visit, only 85 (38.81%) teachers submitted their responses to the researcher. The remaining were given a week more to submit their responses. After one week the researcher revisited the institutes and collected 60 more responses. Hence, upon second visit total 85 + 60 = 145 (69.38%) teachers responded to the researcher. To get more enriched data the researcher again gave one more week and collected 55 more responses from the teachers. Hence, upon third visit a total of 85 + 60 + 55 = 200 (91.32%) teachers from which 100 (89.29%) from Colleges and 100 (93.46%) from Universities gave their response. The response rate i.e. 91.32% was enough to use for analysis. The collected data was self-reported by the respondents.

Likewise, the researcher observed 40 teachers (20 from universities and 20 from colleges) once during real classroom teaching. An observational checklist was used to

record the PDC of the teachers. Those teachers were selected who used to teach a pedagogical subjects. All this was done during the 2017-2018 academic semesters.

3.10 Research Ethics

Morality is an essential element of the development of a theory. Researchers' surveys depend on the participants who participate in the survey to provide valuable services. Therefore, researchers believe that it is beneficial to protect participants (Taylor et al., 1994). Researchers assume that respondents protect them from any departmental violations. Also, the researchers agree that the participants would not want to be named. Both questionnaires were filled anonymously, without the identity of teachers and students and the identity of the organization representing them. Similarly, observational data were also used to interpret the results of the study without providing the identity of the participants. Therefore, confidentiality constitutes the essence of the data collection process. Maintaining the ethical confidentiality of information collected by the sample of the research means that only the researcher and the respondent of the research sample can use the answers specifically for the research purpose.

3.11 Data Analysis

Data analysis is considered as a thoughtful process of organizing, computing, and presenting the results of the study. In the current research, the researcher used SPSS version 16 software to analyze the data. This software is commonly used in social science research, especially for educational cases of statistical analysis research. Both descriptive and inferential statistics were used in the data analysis protocols of current research. Descriptive statistics were constructed to understand the status of collected data and inferential statistics to infer some generalizations for the target population. Precisely, the

researcher used mean and standard deviation to describe the data using descriptive statistics. To make inferences of the data, the researcher used an independent sample t-test and the Pearson correlation inference. The researcher took the following steps to accept/reject the null hypothesis; as suggested by Gorard (2001).

1. State the null hypotheses
2. Calculate t-test/ Pearson's correlation test in SPSS
3. Determine the significance level
4. Decide to accept/reject the null hypothesis
5. Interpret the results

For the research questionnaire, the mean score was calculated from measuring the scores of the three domains of the study: PS, PCK, and PDC. Furthermore, Pearson's correlation was used to calculate the relationship between PS, PCK, and PDC. An independent sample t-test was applied to calculate the mean difference between university and college teachers. Table 3.6 provides detail of analysis according to the objectives.

Table 3.6

Data Analysis according to Objectives

Objectives	Hypotheses/ Research Questions	Analysis
To explore the pedagogical content knowledge of teacher educators.	Q1- What type of pedagogical content knowledge the teachers possess?	Mean score
To identify the pedagogical skills practiced by teacher educators.	Q2- What are the pedagogical skills practiced by teacher educators?	Mean score
To observe the Pedagogical Design Capacity of teacher Educators.	Q3- What is the Pedagogical Design Capacity of teacher Educators?	Mean score
To find out the relationship between pedagogical content knowledge, pedagogical skills and Pedagogical Design Capacity of teacher educators.	H_{01}: There is no significant relationship between pedagogical content knowledge scores and pedagogical design capacity scores of teacher educators.	Pearson product moment correlation coefficient
	H_{02}: There is no significant relationship between pedagogical skills scores and pedagogical design capacity scores of teacher educators.	
To compare the college and university teacher educators on pedagogical skills, pedagogical content knowledge, and Pedagogical Design Capacity.	H_{03}: There is no significant difference in the mean pedagogical content knowledge scores of the teacher educators teaching in college and universities.	Independent Sample t-test
	H_{04} There is no significant difference in the mean pedagogical skills score of the teacher educators teaching in college and universities.	
	H_{05} There is no significant difference in the mean pedagogical design capacity score of the teacher educators teaching in college and universities.	

Chapter four presents the analytic part of the data to achieve the objectives and answer the research questions of the study; followed by testing the null hypotheses.

3.12 Paradigm of the Study

The contents of chapter 3 and review of relevant literature (Chapter 2) read in conjunction with the statement of the problem, objectives, questions, and hypotheses in the context target group lead to the formulation of a paradigm of the current study as reflected in Figure 3.1.

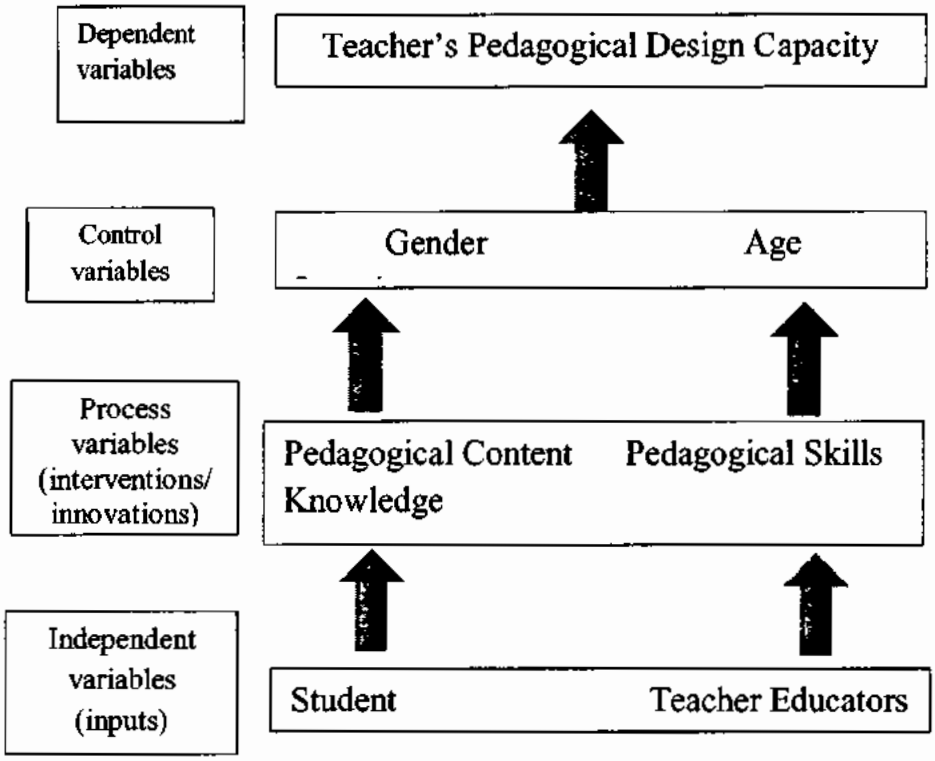


Figure 3.1 Paradigm of the study

The above diagram shows the pattern of the whole process. The diagram explains the up-word linkage between the dependent and independent variables. The baseline depicts the "who" to "which" relation. As we can see a student is directly in need of pedagogical content knowledge. Means as a student-teacher they are first taught about the pedagogical content knowledge but at the same time as a professional, they are acquiring the knowledge about teaching means how to teach others. In this paradigm, the "gender"

"age" and "location" of the "teacher to be a student" are supposed to be the controlled variables. So this shows the direct link of the process of producing a teacher to the out-come "A perfectly trained teacher". The researcher has come to the conclusion that the input of the teacher training institution in the form of "Pedagogical Content knowledge" and "Pedagogical skills" is directly proportional to the product or out-put or the trained teacher who is capable of designing the pedagogical content knowledge and pedagogical skills in his future teaching experiences in the classroom.

3.13 Summary

This chapter mentioned the detail of research procedures which was used for this research. Research design is the center of investigation work. A universal sampling technique was taken to collect data from the students and teachers of colleges of education and universities of Pakistan and purposive sampling was adopted to observe the teachers. For data collection, a self-developed questionnaire and observation sheet were used. Reliability and validity were measured before the conduct of the actual study. The result of the study presented through statistical analysis (mean score, standard deviation, correlation, and t-test. The next chapter describes the analysis and interpretation of data.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

This chapter provides the results including demographic information to determine the relationship between teacher educators' PCK and PS with PDC. The section deals with a detailed description of the presentation and statistical analysis of data.

4.1 Analysis based on Pedagogical Content Knowledge

This section provides an analysis of data based on teachers' PCK. For this, data from teachers and students were analyzed. Following is the detailed description of the data analysis.

Objective 1: To explore the Pedagogical Content Knowledge of teacher educators.

Research Question: What type of Pedagogical Content Knowledge is possessed by the teacher?

Statistical Test: Mean score

As the PCK consists of two subdivisions i.e. Knowledge of Subject-Matter and Knowledge of Pedagogy, which were analyzed as under. The mean scores were analyzed using a scale developed by Faqir, Ayaz, & Shah (2015) i.e. below average (mean range 0 to 2.49), average (mean range 2.50 to 3.49), and above-average (mean range 3.50 to 5.00).

Table 4.1

Knowledge of Subject-Matter: Teachers and Students' Views

S. No	Statements	Teachers		Students	
		Mean	Remarks	Mean	Remarks
1	Updated subject matter knowledge.	3.795	Above average	3.064	Average
2	Use various resources that are available around the University/ college efficiently.	3.58	Above average	2.994	Average
3	Confident about my/her command in the subject matter.	3.57	Above average	3.067	Average
4	Use various resources that are available in University/ College.	3.04	Average	3.824	Above average
5	Understand the central concepts of the subjects I am teaching.	2.96	Average	3.608	Above average
6	Relate concepts with everyday life experiences.	2.205	Below average	3.52	Above average
7	Correlate examples with subject matter.	3.155	Average	3.408	Average
8	Guide students to draw conclusions based on scientific procedures.	2.775	Average	2.782	Average
9	Give details of procedures accurately in subjects.	2.735	Average	2.758	Average
10	Instill positive scientific attitudes in my teaching.	2.7	Average	2.657	Average
11	Create detailed and sequential lesson plans.	2.53	Average	3.064	Average
12	Draw relationships between the subject matter and daily life examples (making a connection between concepts).	3.42	Average	2.454	Below Average
13	Guide students to define and pronounce different terminologies correctly.	3.075	Average	2.451	Below Average
14	Command to explain concepts meaningfully.	2.535	Average	2.137	Below Average
15	Deliver my subject matter confidently.	2.52	Average	2.437	Below Average
16	Develop students thinking skills.	2.17	Below average	2.176	Below Average

It is clear from Table 4.1 that the teachers and students viewed are different as compare to each other, at above-average level they had: updated subject matter knowledge (teacher: Mean= 3.795) (student: Mean= 3.226 (average); ability to use various resources that were available in and around university/ college efficiently (teacher: Mean= 3.58) (student: Mean= 2.994 (average); and confidence about their command in the subject matter (teacher: Mean= 3.57) (student: Mean= 3.067 (average). As compare to students viewed with teachers are different at above-average level: use various resources that were available in and around university/ college efficiently (student: Mean= 3.824) (teacher: Mean= 3.04(average); understand the central concepts of the subjects they taught (student: Mean= 3.608) (teacher: Mean= 2.96(average).

Furthermore, Table 4.1 also affirms that the teachers declared that they were least interested in developing students thinking skills (Mean= 2.17) and relating concepts with everyday life experiences (Mean= 2.205). It may be cause due to work load of teachers and because teacher educators mainly focus to complete the content of subject matter and avoid long discussion during the lecture and cross questioning from students to avoid the arguments. Whereas students opened that their teachers were having the least command: to explain concepts meaningfully (Mean= 2.137); to develop students thinking skills (Mean= 2.176); to deliver their subject matter confidently (Mean= 2.437). The rest of the stalemates at an average level are the same.

It would also be observed that five sets of scales of teachers (3 high & 2 below average) gained extreme positions and the rest medium. The pattern of responses of students is almost identical. Three sets fall at a higher level, 5 below average and the rest

(8) medium. Hence, it can be interpreted that the teachers possessed essential knowledge of the subject matter.

Table 4.2

Knowledge of Pedagogy: Teachers' and Students' Views

S. No	Statement	Teacher		Student	
		Mean	Remarks	Mean	Remarks
1	Know how to use teaching methods effectively.	3.85	Above average	3.947	Above average
2	Know how to lead the child.	3.06	Average	2.867	Average
3	Develop instructional material about the subject easily.	2.95	Average	2.749	Average
4	Prepare and use supplementary materials effectively.	2.705	Average	2.611	Average
5	Deliver lessons in a variety of ways for students.	3.62	Above average	3.127	Average
6	Know how to organize, maintain and manage the classroom.	3.615	Above average	2.812	Average
7	Familiar with common student understandings and misconceptions.	2.93	Average	3.699	Above average
8	Adapt teaching style to different learners.	2.995	Average	3.636	Above average
9	Design effective lesson introductions, transitions, pacing and closing.	2.575	Average	2.483	Below average

It is clear from Table 4.2 that the teachers and students viewed are same at above-average about the use of teaching methods effectively (teacher: Mean= 3.85) (student: Mean= 3.947); at average level the teachers: knew how to lead the child (teacher: Mean= 3.06) (student: Mean= 2.867); and could develop instructional material about subject easily (teacher: Mean= 2.95) (student: Mean= 749). Moreover, teachers' pattern is identical in

upper and medium levels. No lower category was found. Furthermore, Table 4.2 also affirms that the students opened that their teachers were having the least command in designing effective lesson introductions; transitions, pacing, and closing (Mean= 2.483). The results of teachers educators and students are different because teacher mainly focus on lecture and deliver all the aspects of specific topic sometimes, and students thinks about that such knowledge as beyond their capacity. So, they feel uncomfortable and did not take any interest to participate in classroom discussion. Here the upper level of cases was identical and below level was one set, the rest (five sets) were average. Hence, it can be interpreted that the teachers possessed essential knowledge of pedagogy.

4.2 Analysis based on Pedagogical Skills

This section provides an analysis of data based on teachers' PS. For this, data from teachers and students were analyzed. Following is the detailed description of the data analysis.

Objective 2: To identify the Pedagogical Skills practiced by teacher educators.

Research Question: What are the Pedagogical Skills practiced by teacher educators?

Statistical Test: Mean score

The PS consists of two subdivisions i.e. Assessment and Evaluation and Control and Discipline. They are analyzed below. The mean scores were analyzed using a scale developed by Faqir, Ayaz, & Shah (2015) i.e. below average (mean range 0 to 2.49), average (mean range 2.50 to 3.49), and above-average (mean range 3.50 to 5.00).

Table 4.3

Assessment and Evaluation: Teachers' Views

S. No	Statement	Mean	Remarks
1	As a teacher, I have a command on different types of assessments.	4.34	Above average
2	As a teacher, I use content management skills.	4.315	Above average
3	As a teacher, I assess students' understanding of the subject matter.	4.29	Above average
4	As a teacher, I use various measuring techniques for assessment.	4.235	Above average
5	As a teacher, I use effective teaching approaches to guide student thinking and learning in the subject.	4.195	Above average
6	As a teacher, I am ready to adapt to teaching resources that are based on students' learning needs.	4.18	Above average
7	As a teacher, I assign appropriate learning tasks related to subject demand.	4.085	Above average
8	As a teacher, I monitor students effectively while taking their exams.	4.015	Above average
9	As a teacher, I provide feedback to students accordingly.	3.68	Above average

It is clear from Table 4.3 that the teachers viewed that they: had a command on different types of assessments (Mean= 4.34); used cóntent management skills (Mean= 4.315); assessed students' understanding in subject matter (Mean= 4.29); used various measuring techniques for assessment (Mean= 4.235); used effective teaching approaches to guide student thinking and learning in subject (Mean= 4.195); were ready to adapt teaching resources which were based on students' learning needs (Mean= 4.18); assigned appropriate learning tasks related to subject demand (Mean= 4.085); monitored students effectively while taking their exams (Mean= 4.015); provided feedback to students

accordingly (Mean= 3.68). All cases fall under high category abilities. Hence, it can be interpreted that the teachers practiced essential skills of Assessment and Evaluation.

Table 4.4

Assessment and Evaluation: Students' Views

S. No	Statement	Mean	Remarks
1	My teachers assign appropriate learning tasks related to subject demand.	4.575	Above average
2	My teachers assess students' understanding of the subject matter.	4.444	Above average
3	My teachers monitor students effectively while taking their exams.	4.425	Above average
4	My teachers are ready to adapt to teaching resources which are based on students' learning needs.	4.384	Above average
5	My teachers use content management skills.	4.324	Above average
6	My teachers use various measuring techniques for assessment.	4.246	Above average
7	My teachers have a command on different types of assessments.	4.188	Above average
8	My teachers use effective teaching approaches to guide student thinking and learning in the subject.	4.031	Above average
9	My teachers provide feedback to students accordingly.	3.803	Above average

It is clear from Table 4.4 that the students viewed that their teachers: assigned appropriate learning tasks related to subject demand (Mean= 4.575); assessed students' understanding in subject matter (Mean= 4.444); monitored students effectively while taking their exams (Mean= 4.425); were ready to adapt teaching resources which were based on students' learning needs (Mean= 4.384); used content management skills (Mean= 4.324); used various measuring techniques for assessment (Mean= 4.246); had a command

on different types of assessments (Mean= 4.188); used effective teaching approaches to guide students' thinking and learning in subject (Mean= 4.031); provided feedback to students accordingly (Mean= 3.803). The pattern of response is identical as in Table 4.4. Hence, it can be interpreted that the teachers practiced essential skills of Assessment and Evaluation.

Table 4.5

Control and Discipline: Teachers' Views

S. No	Statement	Mean	Remarks
1	As a teacher, I treat all students with respect and concern.	4.29	Above average
2	As a teacher, I try my level best to exhibit a role model to the students.	4.28	Above average
3	As a teacher, I make students partners in setting the classroom rules and regulations.	4.255	Above average
4	As a teacher, I sympathize with students and meet their needs when asked for help.	4.255	Above average
5	As a teacher, I encourage discussions in the classroom concerning the difference of opinion.	4.245	Above average
6	As a teacher, I maintain order and discipline in the classroom.	3.855	Above average
7	As a teacher, I can use ICT for making my lectures effective.	2.555	Average
8	As a teacher, I detect and tackle with respect the differences of opinions among students	1.5	Below average

It is clear from Table 4.5 that the teachers viewed that they: treated all students with respect and concern (Mean= 4.29); tried their level best to exhibit role models to the students (Mean= 4.28); made students partners in setting the classroom rules and regulations (Mean= 4.255); sympathized with students and met their needs when asked for help (Mean= 4.255); encouraged discussions in the classroom with respect to the difference of opinion (Mean= 4.245); maintained order and discipline in the classroom (Mean= 3.855). Moreover, at the average level, they used ICT for making their lectures effective (Mean= 2.555). Furthermore, Table 4.5 also affirms that the teachers declared that they were least interested in detecting and tackling with respect the differences of opinions among students (Mean= 1.5). The result is below average because multi-cultural students are in classroom. Therefore they have different opinions, experience and interest so teacher try their best to avoid their cross arguments and only focus on the specific topic. A high proportion (six sets) showed high performance, ICT as average and holding a difference of opinion at the lowest end. Hence, it can be interpreted that the teachers practiced essential skills of Control and Discipline.

Table 4.6

Control and Discipline: Students' Views

S. No	Statement	Mean	Remarks
1	My teachers treat all students with respect and concern.	4.458	Above average
2	My teachers can use ICT in making their lectures effective.	4.418	Above average
3	My teachers try their level best to exhibit a role model to the students	4.414	Above average
4	My teachers make students partners in setting the classroom rules and regulations	4.407	Above average
5	My teachers sympathize with students and meet their needs when asked for help.	4.407	Above average
6	My teachers maintain order and discipline in the classroom.	3.901	Above average
7	My teachers encourage discussions in the classroom concerning the difference of opinion.	2.473	Below average
8	My teachers detect and tackle with respect the differences of opinions among students	1.388	Below average

It is clear from Table 4.6 that the students viewed that their teachers: treated all students with respect and concern (Mean= 4.458); tried their level best to exhibit role models to the students (Mean= 4.414); made students partners in setting the classroom rules and regulations (Mean= 4.407); sympathized with students and met their needs when asked for help (Mean= 4.407); used ICT for making their lectures effective (Mean= 4.418); maintained order and discipline in the classroom (Mean= 3.901). Furthermore, Table 4.6 also affirms that the students declared that their teachers were least interested in encouraging discussions in the classroom concerning the difference of opinion (Mean= 2.473); detecting and tackling with respect the differences of opinions among students

(Mean= 1.388). The result is below average because to some extent teachers personally avoid arguments with students' that's why he/she did not encourage discussion in the classroom. So teacher try their best to avoid their cross arguments and mange time to cover the specific topic with valid discussion. The patterns indicate that all cases follow at the upper level, except two at the lower. No medium case was observed. Hence, it can be interpreted that the teachers practiced essential skills of Control and Discipline.

4.3 Analysis based on Pedagogical Design Capacity

This section provides an analysis of data based on teachers' PDC. For this, observational data from teachers were analyzed. Following is the detailed description of the data analysis.

Objective 3: To observe the Pedagogical Design Capacity of teacher educators.

Research Question: What is the PDC of teacher Educators?

Statistical Test: Mean score

The PDC consists of five subdivisions i.e. Domain Representations; Delivery of Lesson; Strategies and Skills; Student Engagement; and Goals and Beliefs, they are analyzed as under. As the mean score lied between 0 to 4 for PDC, the mean scores were analyzed after making modifications in the scale developed by Faqir, Ayaz, & Shah (2015) i.e. below average (mean range 0 to 1.49), average (mean range 1.50 to 2.49), and above-average (mean range 2.50 to 4.00).

Table 4.7

Domain Representations

S. No	Statement	Mean	Remarks
1	Feels shame, hyperactivity	3.225	Above Average
2	Faces class while speaking	3.2	Above Average
3	Varies voice pitch and tone	3.175	Above Average
4	Pronounces words clearly	3.15	Above Average
	Uses a voice loud and clear enough to hear easily.	3.125	Above Average
6	Exhibits facial gestures or expressions (smiles)	2.975	Above Average
7	Performs movement in class	2.1	Average
8	Greets the students warmly.	1.275	Below Average

It is clear from the analysis of the observational data given in Table 4.7 that at above-average level the teachers: felt shame, hyperactivity (Mean= 3.225); faced class while speaking (Mean= 3.2); varied voice pitch and tone (Mean= 3.175); pronounced words clearly (Mean= 3.15); used voice loud and clear enough to be heard easily (Mean= 3.125); exhibited facial gestures or expressions (Mean= 2.975). Moreover, at the average level, they performed movement in class (Mean= 2.1). Furthermore, the table also affirms that the teachers were least interested in greeting the students warmly (Mean= 1.275). The social aspect seemed missing. The result is below average because some time teacher is feel personally and physically tense and feel pressure regarding professional commitment so he/she did not take interest at the start of the class.

Table 4.8

Delivery of Lesson

S. No	Statement	Mean	Remarks
1	Prepares lessons very effectively.	3.35	Above Average
2	Uses a variety of appropriate strategies to facilitate higher-order thinking skills.	3.35	Above Average
3	Makes sure that all students understand the subject matter	3.325	Above Average
4	Uses a variety of nontraditional instructional methods	3.325	Above Average
5	Attending lessons on time	3.3	Above Average
6	Guides students to resource learning	3.3	Above Average
7	It provides a consistently well-planned sequence of appropriate instructional strategies.	3.275	Above Average
8	Begins the lesson with a review of previous knowledge.	3.25	Above Average
9	Explains clearly the content and the objectives of the material at the beginning of the class	3.25	Above Average
10	Starts and ends the lesson at the right time	3.15	Above Average
11	Motivates through instruction and presentation	3.15	Above Average
12	Covers all the area needed	3.125	Above Average

It is clear from the analysis of the observational data given in Table 4.8 that the teachers prepared lessons very effectively (Mean= 3.35); used a variety of appropriate strategies to facilitate higher-order thinking skills (Mean= 3.35); made sure that all students understand the subject matter (Mean= 3.325); used a variety of nontraditional instructional

methods (Mean= 3.325); attended lessons in timely manner (Mean= 3.3); guided students to resource learning (Mean= 3.3); provided consistently well-planned sequence of appropriate instructional strategies (Mean= 3.275); began lesson with a review of previous knowledge (Mean= 3.25); explained clearly the content and the objectives of the material at the beginning of the class (Mean= 3.25); started and ended the lesson at the right time (Mean= 3.15); motivated through instruction and presentation (Mean= 3.15); covered all the areas needed (Mean= 3.125).

Table 4.9

Strategies and Skills

S. No	Statement	Mean	Remarks
1	Makes sure materials could be read easily from where the student is sitting.	3.25	Above Average
2	Has a concluding activity	3.225	Above Average
3	Uses effective questioning	3.1	Above Average
4	Summarizes lesson	3.1	Above Average
5	Use of audiovisual aids.	3.1	Above Average
6	Correlates lesson with other subjects	2.625	Above Average
7	Stays on topic	2.475	Average
8	Meets objectives	2.45	Average
9	Carefully directs and explains expectations	2.1	Average

It is clear from the analysis of the observational data given in Table 4.9 that at above-average level the teachers made sure materials could be read easily from where students were sitting (Mean= 3.25); had a concluding activity (Mean= 3.225); used effective questioning (Mean= 3.1); summarized lesson (Mean= 3.1); used of audio-visual

aids (Mean= 3.1); correlated lesson with other subjects (Mean= 2.625). Furthermore, Table 4.9 also affirms that at the average level the teachers: stayed on the topic (Mean= 2.475); met objectives (Mean= 2.45); carefully directed and explained the expectations (Mean= 2.1). No below borderline case was observed.

Table 4.10

Student Engagement

S. No	Statement	Mean	Remarks
1	Listens to students	3.25	Above Average
2	It gives students opportunities to choose appropriate activities.	3.25	Above Average
3	Helps students when needed	3.25	Above Average
4	Does not embarrass	3.25	Above Average
5	Does not argue with students	3.25	Above Average
6	Does not tolerate or dwell on inappropriate behavior	3.25	Above Average
7	Creates interest in students.	3.2	Above Average
8	Respects students	3.15	Above Average
9	Encourages class participation	3.1	Above Average

It is clear from the analysis of the observational data given in Table 4.10 that the teachers listened to students (Mean= 3.25); gave students opportunities to choose appropriate activities (Mean= 3.25); helped students when needed (Mean= 3.25); did not embarrass (Mean= 3.25); did not argue with students (Mean= 3.25); did not tolerate or dwell on inappropriate behavior (Mean= 3.25); created interest in students (Mean= 3.2); respected students (Mean= 3.15); encouraged class participation (Mean= 3.1).

Table 4.11

Goals and Beliefs

S. No	Statement	Mean	Remarks
1	Maintains the respect of the students	3.5	Above average
2	Is approachable to students at any time and willing to help	3.15	Above Average
3	Accepts objective critique	3.125	Above Average
4	Teacher's words and actions match	3.125	Above Average
5	It does not discuss personal life or personal matters with students.	3.125	Above Average
6	Enthusiastic about his/her teaching	3.125	Above Average
7	Exhibits modesty in knowledge	1.175	Below average

It is clear from the analysis of the observational data given in Table 4.11 that at above-average level the teachers: believed in maintaining the respect of the students (Mean= 3.5); were approachable to students at any time and willing to help (Mean= 3.15); accepted objective critique (Mean= 3.125); were consistent in words and actions (Mean= 3.125); did not discuss personal life or personal matters with students (Mean= 3.125); were enthusiastic about their teaching (Mean= 3.125). Furthermore, Table 4.11 also affirms that the teachers were least interested in exhibiting modesty in knowledge (Mean= 1.175).

4.4 Analysis of the Relationship between Pedagogical Content Knowledge, Pedagogical Skills and Pedagogical Design Capacity

This section provides an analysis of data about the relationship between PCK, PS, and PDC. Following is the detailed description of the data analysis.

Objective 4: To find out the relationship between PCK, PS, and PDC of teacher educators.

H_{01}: There is no significant relationship between PCK scores and PDC scores of teacher educators.

Statistical Test: Pearson product-moment correlation coefficient

Table 4.12 is given ahead to test this null hypothesis.

Table 4.12

Correlation between PCK and PDC

Variables	Pearson *r*	*p-value*	Null Hypothesis
Subject Matter Knowledge Pedagogical Design Capacity	0.40	0.011	Rejected
Knowledge of Pedagogy Pedagogical Design Capacity	0.165	0.307	Accepted
Total Pedagogical Content Knowledge Pedagogical Design Capacity	0.367	0.020	Rejected

According to Table 4.12, there was a significant correlation between teachers' Subject Matter Knowledge and PDC as $p = 0.011<0.05$. Furthermore, the value of Pearson $r = 0.40$ showed a significant and moderate relationship between teachers' Subject Matter Knowledge and PDC.

The table also showed that there was no significant correlation between teachers' Knowledge of Pedagogy and PDC as $p = 0.307>0.05$. Furthermore, the value of Pearson $r = 0.165$ showed a non-significant and weak relationship between teachers' Knowledge of Pedagogy and PDC.

Table 4.12 also showed that there was a significant correlation between teachers' PCK and PDC as $p = 0.020 < 0.05$. Furthermore, the value of Pearson $r = 0.367$ showed a significant and moderate relationship between teachers' PCK and PDC. The results are different because subject matter knowledge is mean to teach the specific content and knowledge of pedagogy means how much teacher know about different teaching methodologies and strategies about different subject matter.

Objective 4: To find out the relationship between PCK, PS, and PDC of teacher educators.

H_{02}: There is no significant relationship between PS scores and PDC scores of teacher educators.

Statistical Test: Pearson product-moment correlation coefficient

Table 4.13 is given ahead to test this null hypothesis.

Table 4.13

Correlation between Pedagogical Skills and PDC

Variables	Pearson r	*p-value*	Null Hypothesis
Assessment and Evaluation Pedagogical Design Capacity	0.276	0.085	Accepted
Control and Discipline Pedagogical Design Capacity	0.619	0.00	Rejected
Total Pedagogical Skills Pedagogical Design Capacity	0.667	0.00	Rejected

According to Table 4.13, there was a non-significant correlation between teachers' skills regarding Assessment and Evaluation and PDC as $p = 0.085 > 0.05$. Furthermore, the value of Pearson $r = 0.276$ showed a non-significant and weak relationship between teachers' skills regarding Assessment and Evaluation and PDC.

Table 4.13 also showed that there was a significant correlation between teachers' skills regarding Control and Discipline and PDC as $p = 0.00 < 0.05$. Furthermore, the value of Pearson $r = 0.619$ showed a significant and strong relationship between teachers' skills regarding Control and Discipline and PDC.

Table 4.13 also showed that there was a significant correlation between teachers' PS and PDC as $p = 0.00 < 0.05$. Furthermore, the value of Pearson $r = 0.667$ showed a significant and strong relationship between teachers' PS and PDC.

4.5 Analysis of the Comparison of University and College Teachers

This section provides an analysis of data about the comparison of university and college teachers regarding PCK, PS, and PDC. Following is the detailed description of the data analysis.

Objective 5: To compare the college and university teacher educators on PS, PCK, and PDC.

H_{03}: There is no significant difference in the mean PCK scores of the teacher educators teaching in college and universities.

Statistical Test: Independent Sample t-test

Tables 4.14 to 4.19 given ahead tested the 3rd null hypothesis.

Table 4.14

Subject Matter Knowledge: t-test on Teachers' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	100	46.78	5.285	.041	198	.967
College	100	46.75	5.034			

Table 4.14 showed that according to the views of the teachers about their Subject Matter Knowledge, no significant difference was witnessed in the mean scores of university teachers (Mean=46.78, Standard Deviation=5.285) and college teachers (Mean=46.75, Standard Deviation=5.034) as t (198) = 0.041, p = 0.967>0.05. Table 4.14 also showed that the university there was no significant difference in the mean scores (Mean=46.78, Standard Deviation=5.285) showed slightly better scores as there was no significant difference in the mean scores to the college teachers (Mean=46.75, Standard Deviation=5.034). Moreover, the values of standard deviation i.e. 5.285 and 5.034 showed that the dispersion from mean scores of university and college teachers was slightly different.

Table 4.15

Subject Matter Knowledge: t-test on Students' data

Category	N	Mean	SD	*T*	*Df*	*p-value*
University	645	46.51	5.347	-.359	1303	.720
College	660	46.62	5.234			

Table 4.15 showed that according to the views of the students about their teachers' Subject Matter Knowledge, no significant difference was witnessed in the mean scores of university students (Mean=46.51, Standard Deviation=5.347) and College Students (Mean=46.62, Standard Deviation=5.234) as t (1303) = -0.359, p = 0.720>0.05. Table 4.15 also showed that college students (Mean=46.62, Standard Deviation=5.234) showed a slightly better score as compared to university students (Mean=46.51, Standard Deviation=5.347). Moreover, the values of standard deviation i.e. 5.374 and 5.234 showed that the dispersion from mean scores of university and college students about their teachers' Subject Matter Knowledge was slightly different.

Table 4.16

Knowledge of Pedagogy: t-test on Teachers' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	100	22.61	3.977	-11.688	198	.000
College	100	33.99	8.887			

Table 4.16 showed that according to the views of the teachers about their Knowledge of Pedagogy, a significant difference was witnessed in the mean scores of university teachers (Mean=22.61, Standard Deviation=3.977) and College teachers (Mean=33.99, Standard Deviation=8.887) as t (198) = -11.688, p = 0.00<0.05. Table 4.16 also showed that the college teachers (Mean=33.99, Standard Deviation=8.887) showed significantly better scores as compared to the university teachers (Mean=22.61, Standard Deviation=3.977). Moreover, the values of Standard deviation i.e. 3.977 and 8.887 showed

that the data scores were very adjacent to the mean scores for university teachers, while, in the case of the college teachers there seemed to be a spread in data.

Table 4.17

Knowledge of Pedagogy: t-test on Students' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	645	26.95	8.736	-3.893	1303	.000
College	660	28.89	9.297			

Table 4.17 showed that according to the views of the students about their teachers' Knowledge of Pedagogy, a significant difference was witnessed in the mean scores of university students (Mean=26.95, Standard Deviation=8.736) and College students (Mean=28.89, Standard Deviation=9.297) as t (1303) = -3.893, p = 0.00<0.05. Table 4.17 also showed that college students (Mean=28.89, Standard Deviation=9.297) showed significantly better scores as compared to university students (Mean=26.95, Standard Deviation=8.736). Moreover, the values of Standard deviation i.e. 8.736 and 9.297 showed that the dispersion from mean scores of university and college students about their teachers' Knowledge of Pedagogy was slightly different.

Table 4.18

Total PCK: t-test on Teachers' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	100	69.39	6.657	-8.390	198	.000
College	100	80.74	11.776			

Table 4.18 showed that according to the views of the teachers about their PCK, a significant difference was witnessed in the mean scores of university teachers (Mean=69.39, Standard Deviation=6.657) and college teachers (Mean=80.74, Standard Deviation=11.776) as t (198) = -8.390, p = 0.00<0.05. Table 4.18 also showed that the college teachers (Mean=80.74, Standard Deviation=11.776) showed significantly better scores as compared to the university teachers (Mean=69.39, Standard Deviation=6.657). Moreover, the values of Standard deviation i.e. 6.657 and 11.776 showed that the data scores were very adjacent to the mean scores for university teachers, while, in the case of the college teachers there seemed to be a spread in data.

Table 4.19

Total PCK: t-test on Students' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	645	73.46	11.071	-3.263	1303	.001
College	660	75.51	11.614			

Table 4.19 showed that according to the views of the students about their teachers' PCK, a significant difference was witnessed in the mean scores of university students (Mean=73.46, Standard Deviation=11.071) and college students (Mean=75.51, Standard Deviation=11.614) as t (1303) = -3.263, p = 0.001<0.05. Table 4.19 also showed that college students (Mean=75.51, Standard Deviation=11.614) showed significantly better scores as compared to university students (Mean=73.46, Standard Deviation=11.071). Moreover, the values of Standard deviation i. e. 11.071 and 11.614 showed that the

dispersion from mean scores of university and college students about their teachers' PCK was slightly different.

Objective 5: To compare the college and university teacher educators on PS, PCK, and PDC.

H_{04}: There is no significant difference in the mean PS score of the teacher educators teaching in college and universities.

Statistical Test: Independent Sample t-test

Tables 4.20 to 4.25 tested the 4th null hypothesis.

Table 4.20

Assessment and Evaluation: t-test on Teachers' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	100	37.53	6.343	.409	198	.683
College	100	37.14	7.134			

Table 4.20 showed that according to the views of the teachers about their skills regarding Assessment and Evaluation, no significant difference was witnessed in the mean scores of university teachers (Mean=37.53, Standard Deviation=6.343) and college teachers (Mean=37.14, Standard Deviation=7.134) as t (198) = .409, p = .683>0.05. Table 4.20 also showed that the university teachers (Mean=37.53, Standard Deviation=6.343) showed slightly better scores as compared to the college teachers (Mean=37.14, Standard Deviation=7.134). Moreover, the values of Standard deviation i.e. 6.343 and 7.134 showed that the dispersion from mean scores of university and college teachers was slightly different.

Table 4.21

Assessment and Evaluation: t-test on Students' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	645	38.63	5.491	1.295	1303	.196
College	660	38.21	6.287			

Table 4.21 showed that according to the views of the students about their teachers' skills regarding Assessment and Evaluation, no significant difference was witnessed in the mean scores of university students (Mean=38.63, Standard Deviation=5.491) and college students (Mean=38.21, Standard Deviation=6.287) as t (1303) = 1.295, p = 0.196<0.05. Table 4.21 also showed that the university students (Mean=38.63, Standard Deviation=5.491) showed slightly better scores as compared to the college students (Mean=38.21, Standard Deviation=6.287). Moreover, the values of standard deviation i. e. 5.491 and 6.287 showed that the dispersion from mean scores of university and college students about their teachers' skills regarding Assessment and Evaluation was slightly different.

Table 4.22

Control and Discipline: t-test on Teachers' data

Category	N	Mean	SD	*T*	*df*	*p-value*
University	100	30.07	4.356	2.801	198	.006
College	100	28.40	4.070			

Table 4.22 showed that according to the views of the teachers about their skills regarding Control and Discipline, a significant difference was witnessed in the mean scores

of university teachers (Mean=30.07, Standard Deviation=4.356) and college teachers (Mean=28.40, Standard Deviation=4.070) as t (198) = 2.801, p = .006<0.05. Table 4.22 also showed that the university teachers (Mean=30.07, Standard Deviation=4.356) showed significantly better scores as compared to the college teachers (Mean=28.40, Standard Deviation=4.070). Moreover, the values of standard deviation i.e. 4.356 and 4.070 showed that the dispersion from mean scores of university and college teachers was slightly different.

Table 4.23

Control and Discipline: t-test on Students' data

Category	N	Mean	SD	*t*	*df*	*p-value*
University	645	28.16	4.029	3.428	1303	.001
College	660	27.37	4.352			

Table 4.23 showed that according to the views of the students about their teachers' skills regarding Control and Discipline, a significant difference was witnessed in the mean scores of university students (Mean=28.16, Standard Deviation=4.029) and college students (Mean=27.37, Standard Deviation=4.352) as t (1303) = 3.428, p = 0.001<0.05. Table 4.23 also showed that the university students (Mean=28.16, Standard Deviation=4.029) showed significantly better scores as compared to the college students (Mean=27.37, Standard Deviation=4.352). Moreover, the values of standard deviation i.e. 4.029 and 4.325 showed that the dispersion from mean scores of university and college students about their teachers' skills regarding Control and Discipline was slightly different.

Table 4.24

Total PS: t-test on Teachers' data

Category	N	Mean	SD	*t*	*df*	*p-value*
University	100	67.60	9.666	1.556	198	.121
College	100	65.54	9.047			

Table 4.24 showed that according to the views of the teachers about their PS, no significant difference was witnessed in the mean scores of university teachers (Mean=67.60, Standard Deviation=9.666) and college teachers (Mean=65.54, Standard Deviation=9.047) as t (198) = 1.556, p = .121>0.05. Table 4.24 also showed that the university teachers (Mean=67.60, Standard Deviation=9.666) showed slightly better scores as compared to the college teachers (Mean=65.54, Standard Deviation=9.047). Moreover, the values of standard deviation i.e. 9.666 and 9.047 showed that there was a slight difference in the dispersion from the mean scores of university and college teachers.

Table 4.25

Total PS: t-test on Students' data

Category	N	Mean	SD	*t*	*Df*	*p-value*
University	645	67.38	6.992	4.251	1303	.000
College	660	65.58	8.282			

Table 4.25 showed that according to the views of the students about their teachers' PS, a significant difference was witnessed in the mean scores of university students (Mean=67.38, Standard Deviation=6.992) and college students (Mean=65.58, Standard

Deviation=8.282) as t (1303) = 4.251, p = 0.00<0.05. Table 4.25 also showed that the university students (Mean=67.38, Standard Deviation=6.992) showed significantly better scores as compared to the college students (Mean=65.58, Standard Deviation=8.282). Moreover, the values of standard deviation i.e. 6.992 and 8.282 showed that the data scores were very adjacent to the mean scores for university teachers, while, in the case of the college teachers there seemed to be a spread in data.

Objective 5: To compare the college and university teacher educators on PS, PCK, and PDC.

H_{05}: There is no significant difference in the mean PDC score of teacher educators teaching in colleges and universities.

Statistical Test: Independent Sample t-test

Tables 4.26 to 4.31 tested the 5th null hypothesis.

Table 4.26

t-test Analysis of Domain Representation

Category	N	Mean	SD	*T*	*df*	*p-value*
University	20	22.00	2.362	-.638	38	.527
College	20	22.45	2.089			

Table 4.26 showed that according to the observational data of the teachers about their Domain Representation, no significant difference was witnessed in the mean scores of university teachers (Mean=22.00, Standard Deviation=2.362) and college teachers (Mean=22.45, Standard Deviation=2.089) as t (38) = -.638, p = .527>0.05. Table 4.26 also showed that the college teachers (Mean=22.45, Standard Deviation=2.089) showed slightly better scores as compared to the university teachers (Mean=22.00, Standard

Deviation=2.362). Moreover, the values of standard deviation i.e. 2.362 and 2.089 showed that there was a slight difference in the dispersion from the mean scores of university and college teachers.

Table 4.27

t-test Analysis of Delivery of Lesson

Category	N	Mean	SD	*t*	*df*	*p-value*
University	20	39.60	4.005	.639	38	.526
College	20	38.70	4.857			

Table 4.27 showed that according to the observational data of the teachers about their Delivery of Lesson, no significant difference was witnessed in the mean scores of university teachers (Mean=39.60, Standard Deviation=4.005) and college teachers (Mean=38.70, Standard Deviation=4.857) as t (38) = .639, p = .526>0.05. Table 4.27 also showed that the university teachers (Mean=39.60, Standard Deviation=4.005) showed slightly better scores as compared to the college teachers (Mean=38.70, Standard Deviation=4.857). Moreover, the values of standard deviation i.e. 4.005 and 4.857 showed that there was a slight difference in the dispersion from the mean scores of university and college teachers.

Table 4.28

t-test Analysis of Strategies and Skills

Category	N	Mean	SD	*t*	*df*	*p-value*
University	20	23.65	2.346	-5.105	38	.000
College	20	27.20	2.042			

Table 4.28 showed that according to the observational data of the teachers about their Strategies and Skills, a significant difference was witnessed in the mean scores of university teachers (Mean=23.65, Standard Deviation=2.346) and college teachers (Mean=27.20, Standard Deviation=2.042) as t (38) = -5.105, p = .000<0.05. Table 4.28 also showed that the college teachers (Mean=27.20, Standard Deviation=2.042) showed significantly better scores as compared to the university teachers (Mean=23.65, Standard Deviation=2.346). Moreover, the values of standard deviation i.e. 2.346 and 2.042 showed that there was a slight difference in the dispersion from the mean scores of university and college teachers.

Table 4.29

t-test Analysis of Students' Engagement

Category	N	Mean	SD	*t*	*df*	*p-value*
University	20	29.30	3.643	.636	38	.529
College	20	28.60	3.315			

Table 4.29 showed that according to the observational data of the teachers about their Students' Engagement, no significant difference was witnessed in the mean scores of university teachers (Mean=29.30, Standard Deviation=3.643) and college teachers (Mean=28.60, Standard Deviation=3.315) as t (38) = .636, p = .529>0.05. Table 4.29 also showed that the university teachers (Mean=29.30, Standard Deviation=3.643) showed slightly better scores as compared to the college teachers (Mean=28.60, Standard Deviation=3.315). Moreover, the values of standard deviation i.e. 3.643 and 3.315 showed

that there was a slight difference in the dispersion from the mean scores regarding university and college teachers.

Table 4.30

t-test Analysis of Goals and Beliefs

Category	N	Mean	SD	*t*	*df*	*p-value*
University	20	20.30	1.625	-.093	38	.926
College	20	20.35	1.755			

Table 4.30 showed that according to the observational data of the teachers about their Goals and Beliefs, no significant difference was witnessed in the mean scores of university teachers (Mean=20.30, Standard Deviation=1.625) and college teachers (Mean=20.35, Standard Deviation=1.755) as t (38) = -.093, p = .926>0.05. Table 4.30 also showed that the college teachers (Mean=20.35, Standard Deviation=1.755) showed slightly better scores as compared to the university teachers (Mean=20.30, Standard Deviation=1.625). Moreover, the values of standard deviation i.e. 1.625 and 1.755 showed that there was a slight difference in the dispersion from the mean scores of university and college teachers.

Table 4.31

t-test Analysis of total PDC

Category	N	Mean	SD	*t*	*df*	*p-value*
University	20	134.85	6.081	-1.091	38	.282
College	20	137.30	7.994			

Table 4.31 showed that according to the observational data of the teachers about their PDC, no significant difference was witnessed in the mean scores of university teachers (Mean=134.85, Standard Deviation=6.081) and college teachers (Mean=137.30, Standard Deviation=7.994) as t (38) = -1.091, p = .282>0.05. Table 4.31 also showed that the college teachers (Mean=137.30, Standard Deviation=7.994) showed slightly better scores as compared to the university teachers (Mean=134.85, Standard Deviation=6.081). Moreover, the values of standard deviation i.e. 6.081 and 7.994 showed that the data scores were very adjacent to the mean scores for university teachers, while, in the case of the college teachers there seemed to be a spread in data.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter represents a summary of the study, findings as discussed in chapter 4, discussions based on findings of previous studies, conclusions based on findings and discussions and recommendations for the potential beneficiaries of the study.

5.1 Summary

This study overviewed the concept of teaching. It has been a milestone in the annals of education history. Each civilization had its connotation of education, priority and teaching methods. All the civilizations and eras before Islam had knowledge and education as per the need of time and situation. But the teaching of the Holy Prophet (PBUH) of Islam not only reformed the world but also target through the best methods to the best level. He said when someone tells the people what they do not understand; it becomes a cause of evil to them. The mission was followed by His Caliphs and Muslim scholars in the medial times and the globe. The style of teaching touched the springs of the learners as a focal point. However, terminology and tools hence changed overtime.

Over the past seventy years, teaching has passed through tremendous change. Teaching machines arrived in the sixties with the work of William Schramm (tutorial machine); followed by the works of Bloom's taxonomy and Skinner; teaching machine, causing students and teachers to teach with devices. The seventies saw the advent of technology to make learning productive, individualized and powerful, through the work of the commission on structural technology. The eighties witnessed the drawn of National

Commission on Excellence in Education declaring a nation at risk. Stressing the teaching of computer science. During the last two decades, with the advent of technology as a dynamic term. The system has moved from the industrial revolution to the information age. The information age has provided a different work environment and highly competitive global demands. In the teaching and learning environment, the use of symphonious (online) and asynchronous (face to face), followed by blended learning have made teaching more developing and complex. Many innovations in the form of mobile learning, active, constructive, collaborative, intentional, conversational, contextualized, reflective, digital, virtual, tablets, intent, and emerging trends have pushed the learners and teachers to smart goals of performance.

Perceived in the swift changes of teaching, this study was conducted to examine the relationship of Teacher Educators' PCK and PS with PDC. For conducting this research, descriptive research was designed and a cross-sectional survey was performed. A self-developed questionnaire and observational checklist were used to gather data. After revision by experts, few more items were added in both the questionnaire and the observational checklist. A pilot study was conducted to check, applicability, suitability, and usability of the said instrument. After the pilot study, the reliability of the scale was checked through Cronbach's Alpha.

The sample of the research study was selected by using simple random sampling technique for administrating the instruments. Randomly selected school students and teachers filled a questionnaire for checking Teacher Educators' PCK and PS. Furthermore, to check their PDC, the researcher observed the teachers. Data were scored, coded, analyzed and computed using SPSS, Person's correlation was applied to the data to

determine the existence of a significant relationship between PCK and PS with PDC. An independent sample t-test was applied to compare PCK, PS, and PDC of college and university teachers.

5.2 Findings

Based on data analysis and interpretations, the following are the findings of the study.

Objective 1: To explore the Pedagogical Content Knowledge of teacher educators.

1. The sampled teachers viewed (Table 4.1) that at the above-average level they had updated subject matter knowledge (mean= 3.795); processed ability to use various resources (mean= 3.58); and demonstrated confidence about their command in the subject matter (mean= 3.57). At average level, they could correlate examples with the subject matter (mean= 3.155); guide students to define and pronounce different terminologies correctly (mean= 3.075), and create detailed and sequential lesson plans (mean=). Furthermore, Table 4.1 also affirms that the teachers declared that they were least interested in developing students thinking skills (mean= 2.17) It may be cause due to work load of teachers and lacking in relating concepts with everyday life experiences (mean= 2.205) because teacher educators mainly focus to complete the content of subject matter and avoid long discussion during the lecture and cross questioning from students to avoid the arguments. (Objective 1).
2. Sampled students viewed (Table 4.1) that at the above-average level their teachers were able to use various resources (mean= 3.824); they understood the central concepts of the subjects they taught (mean= 3.608); related concepts with everyday life experiences (mean = 3.52). Moreover, at average level the teachers: had

updated subject matter knowledge (mean = 3.226); could correlate examples with subject matter (mean = 3.408); could create detailed and sequential lesson plans (mean= 3.064); could use various resources (mean= 2.994); and instilled positive scientific attitudes by their teaching (mean= 2.657). Furthermore, Table 4.1 also affirmed that the students opened that their teachers to assessed command inadequate; to explain concepts meaningfully (mean= 2.137); to develop students thinking skills (mean= 2.176); to deliver their subject matter confidently (mean= 2.437); to guide students to define and pronounce different terminologies correctly (mean= 2.451) (Objective 1).

3. The teachers viewed (Table 4.2) that at the above-average level they knew how to use teaching methods effectively (mean= 3.85); they could deliver their lesson in a variety of ways (mean = 3.62); knew how to organize, maintain and management classroom (mean = 3.615). Furthermore, Table 4.2 also affirmed that that at above-average level they knew how to lead the child (mean = 3.06); could adapt their teaching style for different learners (mean = 2.995); could develop instructional material about subject easily (mean = 2.95); prepare and use supplementary materials effectively (mean= 2.705); could design effective lesson introductions, transitions, pacing and closing (mean = 2.575) (Objective 1).
4. The students viewed (Table 4.2) that at the above-average level their teachers knew how to use teaching methods effectively (mean= 3.947); they were familiar with common student understandings and misconceptions (mean = 3.699); could adapt their teaching style for different learners (mean = 3.636). Moreover, at average level the teachers could deliver lesson in a variety of ways (mean = 3.127); knew how to

lead the child (mean = 2.867); could organize, maintain and management classroom transitions (mean = 2.812); could prepare and use supplementary materials effectively (mean = 2.611); could develop instructional material about subject easily (mean = 2.749). Furthermore, Table 4.2 also affirmed that the students opened that their teachers were having the least command in designing effective lesson introductions; transitions, pacing, and closing (mean = 2.483) (Objective 1). The results of teachers educators and students are different because teacher mainly focus on lecture and deliver all the aspects of specific topic sometimes, and students thinks about that such knowledge as beyond their capacity. So, they feel uncomfortable and did not take any interest to participate in classroom discussion.

Objective 2: To identify the Pedagogical Skills practiced by teacher educators.

5. Teachers viewed (Table 4.3) that they hold command on different types of assessments (mean = 4.34); used content management skills (mean = 4.315); assessed students' understanding in subject matter (mean = 4.29); used various measuring techniques for assessment (mean = 4.235); adapted teaching resources depending on learning needs (mean = 4.18); assigned appropriate learning tasks (mean = 4.085); monitored students assessment (mean = 4.015); provided them timely feedback (mean = 3.68) (Objective 2).
6. Students viewed (Table 4.4) that their teachers assigned appropriate learning tasks (mean= 4.575); assessed their understanding in subject matter (mean= 4.444); monitored them effectively while taking their exams (mean= 4.425); adapted teaching resources based on their learning needs (mean= 4.384); used content management skills (mean= 4.324); used various measuring techniques for

assessment (mean= 4.246); had a command on different types of assessments (mean= 4.188), and provided them feedback appropriately (Mean= 3.803) (Objective 2).

7. Teachers viewed (Table 4.5) that they treated all students with respect and concern (mean= 4.29); exhibit role models (mean= 4.28); made them partners in setting the classroom rules and regulations (mean= 4.255); developed sympathy with them to meet their learning needs (mean= 4.255); encouraged discussions independent of the difference of opinion (mean= 4.245); maintained order and discipline (mean= 3.855). Whenever possible they used ICT for making their lectures effective (mean= 2.555). They further maintained that they declared that they were least interested in detecting and tackling with respect the differences of opinions among students (mean= 1.5). The result is below average because multi-cultural students are in classroom. Therefore they have different opinions, experience and interest so teacher try their best to avoid their cross arguments and only focus on the specific topic. (Objective 2).
8. Students viewed (Table 4.6) that their teachers treated all students with respect and concern (mean= 4.458); tried their level best to exhibit role models (mean= 4.414); made students partners in setting the classroom rules and regulations (mean= 4.407); sympathized with students and met their needs when asked for help (mean= 4.407); used ICT for making their lectures effective (mean= 4.418); maintained order and discipline in the classroom (mean= 3.901). Furthermore, Table 4.6 also affirmed that the students declared that their teachers were least interested in encouraging discussions in the classroom concerning the difference of opinion

(mean= 2.473); detecting and tackling with respect the differences of opinions among students (mean= 1.388). The result is below average because to some extent teachers personally avoid arguments with students' that's why he/she did not encourage discussion in the classroom. So teacher try their best to avoid their cross arguments and mange time to cover the specific topic with valid discussion. (Objective 2).

Objective 3: To observe the Pedagogical Design Capacity of teacher Educators.

9. Analysis of the observational data (Table 4.7) showed that on above-average level the teachers felt shame, hyperactivity (mean= 3.225); faced class while speaking (mean= 3.2); varied voice pitch and tone (mean= 3.175); pronounced words clearly (mean= 3.15); used voice loud and clear enough to be heard easily (mean= 3.125); exhibited facial gestures or expressions (mean= 2.975). Moreover, at the average level, they performed movement in class (mean= 2.1). Furthermore, Table 4.7 also affirmed that the teachers were least interested in greeting the students warmly (mean= 1.275). The social aspect seemed missing. The result is below average because some time teacher is feel personally and physically tense and feel pressure regarding professional commitment so he/she did not take interest at the start of the class. (Objective 3).
10. The observational data (Table 4.8) indicated that the teachers prepared lessons very effectively (mean= 3.35); used a variety of appropriate strategies to facilitate higher-order thinking skills (mean= 3.35); made sure that all students understand the subject matter (mean= 3.325); used a variety of nontraditional instructional methods (mean= 3.325); attended lessons in timely manner (mean= 3.3); guided

students to resource learning (mean= 3.3); provided consistently well-planned sequence of appropriate instructional strategies (mean= 3.275); began lesson with a review of previous knowledge (mean= 3.25); explained clearly the content and the objectives of the material at the beginning of the class (mean= 3.25); started and ended the lesson at the right time (mean= 3.15); motivated through instruction and presentation (mean= 3.15); covered all the area needed (mean= 3.125) (Objective 3).

11. Analysis of the observational data (Table 4.9) yielded that on above average level the teachers made sure materials could be read easily from where student were sitting (mean= 3.25); had concluding activity (mean= 3.225); used effective questioning (mean= 3.1); summarized lesson (mean= 3.1); used audio visual aids (mean= 3.1); correlated lesson with other subjects (mean= 2.625). The data also affirmed that on average level the teachers stayed on topic (mean= 2.475); met objectives (mean= 2.45); carefully directed and explained the expectations (mean= 2.1) (Objective 3).
12. Analysis of the observational data (Table 4.10) showed that the teachers listened to students (mean= 3.25); gaye them opportunities to choose appropriate activities (mean= 3.25); helped them when needed (mean= 3.25); did not embarrass (mean= 3.25); did not argue with students (mean= 3.25); did not tolerate or dwell on inappropriate behavior (mean= 3.25); created interest in students (mean= 3.2); respected students (mean= 3.15); encouraged class participation (mean= 3.1) (Objective 3).

13. Analysis of the observational data (Table 4.11) showed that on above-average level the teachers believed in maintaining the respect of the students (mean= 3.5); were approachable to students at any time and willing to help (mean= 3.15); accepted objective critique (mean= 3.125); were consistent in words and actions (mean= 3.125); were enthusiastic about their teaching (mean= 3.125). Furthermore, Table 4.11 also affirms that the teachers were least interested in exhibiting modesty in knowledge (mean= 1.175) (Objective 3).

Objective 4: To find out the relationship between Pedagogical Content Knowledge, Pedagogical Skills and Pedagogical Design Capacity of teacher educators.

14. The data (Table 4.12) showed there was a significant correlation between teachers' Subject Matter Knowledge and PDC as $p = 0.011 < 0.05$. Also, the value of Pearson $r = 0.40$ showed a significant and moderate relationship between teachers' Subject Matter Knowledge and PDC (Objective 4).
15. The data (Table 4.12) also showed that there was no significant correlation between teachers' Knowledge of Pedagogy and PDC as $p = 0.307 > 0.05$. Also, the value of Pearson $r = 0.165$ showed a non-significant and weak relationship between teachers' Knowledge of Pedagogy and PDC. The results are different because subject matter knowledge is mean to teach the specific content and knowledge of pedagogy means how much teacher know about different teaching methodologies and strategies about different subject matter. (Objective 4).
16. Table 4.12 also showed that there was a significant correlation between teachers' PCK and PDC as $p = 0.020 < 0.05$. Also, the value of Pearson $r = 0.367$ showed a

significant and moderate relationship between teachers' PCK and PDC (Objective 4, Hypothesis 1).

17. According to Table 4.13, there was a non-significant correlation between teachers' skills regarding Assessment and Evaluation and PDC as $p = 0.085>0.05$. Furthermore, the value of Pearson $r = 0.276$ showed a non-significant and weak relationship between teachers' skills regarding Assessment and Evaluation and PDC (Objective 4).
18. Table 4.13 also showed that there was a significant correlation between teachers' skills regarding Control and Discipline and PDC as $p = 0.00<0.05$. Furthermore, the value of Pearson $r = 0.619$ showed a significant and strong relationship between teachers' skills regarding Control and Discipline and PDC (Objective 4).
19. Table 4.13 also showed that there was a significant correlation between teachers' PS and PDC as $p = 0.00<0.05$. Furthermore, the value of Pearson $r = 0.667$ showed a significant and strong relationship between teachers' PS and PDC (Objective 4, Hypothesis 2).

Objective 5: To compare the college and university teacher educators on Pedagogical Skills, Pedagogical Content Knowledge and Pedagogical Design Capacity.

20. Table 4.14 showed that according to the views of the teachers about their Subject Matter Knowledge, no significant difference was witnessed in the mean scores of university teachers (Mean=46.78, Standard Deviation=5.285) and college teachers (Mean=46.75, Standard Deviation=5.034) as $t(198) = 0.041$, $p = 0.967>0.05$. Table 4.14 also showed that the university teachers (Mean=46.78, Standard

Deviation=5.285) showed slightly better scores as compared to the college teachers (Mean=46.75, Standard Deviation=5.034) (Objective 5, Hypothesis 3).

21. Table 4.15 showed that according to the views of the students about their teachers' Subject Matter Knowledge, no significant difference was witnessed in the mean scores of university students (Mean=46.51, Standard Deviation=5.347) and college students (Mean=46.62, Standard Deviation=5.234) as t (1303) = -0.359, p = 0.720>0.05. Table 4.15 also showed that the college students (Mean=46.62, Standard Deviation=5.234) showed a slightly better score as compared to the university students (Mean=46.51, Standard Deviation=5.347) (Objective 5, Hypothesis 3).
22. Table 4.16 showed that according to the views of the teachers about their Knowledge of Pedagogy, a significant difference was witnessed in the mean scores of university teachers (Mean=22.61, Standard Deviation=3.977) and college teachers (Mean=33.99, Standard Deviation=8.887) as t (198) = -11.688, p = 0.00<0.05. Table 4.16 also showed that the college teachers (Mean=33.99, Standard Deviation=8.887) showed significantly better scores as compared to the university teachers (Mean=22.61, Standard Deviation=3.977) (Objective 5, Hypothesis 3).
23. Table 4.17 showed that according to the views of the students about their teachers' Knowledge of Pedagogy, a significant difference was witnessed in the mean scores of university students (Mean=26.95, Standard Deviation=8.736) and college students (Mean=28.89, Standard Deviation=9.297) as t (1303) = -3.893, p = 0.00<0.05. Table 4.17 also showed that college students (Mean=28.89, Standard

Deviation=9.297) showed significantly better scores as compared to university students (Mean=26.95, Standard Deviation=8.736) (Objective 5, Hypothesis 3).

24. Table 4.18 showed that according to the views of the teachers about their PCK, a significant difference was witnessed in the mean scores of university teachers (Mean=69.39, Standard Deviation=6.657) and college teachers (Mean=80.74, Standard Deviation=11.776) as t (198) = -8.390, p = 0.00<0.05. Table 4.18 also showed that the college teachers (Mean=80.74, Standard Deviation=11.776) showed significantly better scores as compared to the university teachers (Mean=69.39, Standard Deviation=6.657) (Objective 5, Hypothesis 3).
25. Table 4.19 showed that according to the views of the students about their teachers' PCK, a significant difference was witnessed in the mean scores of university students (Mean=73.46, Standard Deviation=11.071) and college students (Mean=75.51, Standard Deviation=11.614) as t (1303) = -3.263, p = 0.001<0.05. Table 4.19 also showed that college students (Mean=75.51, Standard Deviation=11.614) showed significantly better scores as compared to university students (Mean=73.46, Standard Deviation=11.071) (Objective 5, Hypothesis 3).
26. Table 4.20 showed that according to the views of the teachers about their skills regarding Assessment and Evaluation, no significant difference was witnessed in the mean scores of university teachers (Mean=37.53, Standard Deviation=6.343) and college teachers (Mean=37.14, Standard Deviation=7.134) as t (198) = .409, p = .683>0.05. Table 4.20 also showed that the university teachers (Mean=37.53, Standard Deviation=6.343) showed slightly better scores as compared to the

college teachers (Mean=37.14, Standard Deviation=7.134) (Objective 5, Hypothesis 4).

27. Table 4.21 showed that according to the views of the students about their teachers' skills regarding Assessment and Evaluation, no significant difference was witnessed in the mean scores of university students (Mean=38.63, Standard Deviation=5.491) and college students (Mean=38.21, Standard Deviation=6.287) as t (1303) = 1.295, p = 0.196<0.05. Table 4.21 also showed that the university students (Mean=38.63, Standard Deviation=5.491) showed slightly better scores as compared to the college students (Mean=38.21, Standard Deviation=6.287) (Objective 5, Hypothesis 4).
28. Table 4.22 showed that according to the views of the teachers about their skills regarding Control and Discipline, a significant difference was witnessed in the mean scores of university teachers (Mean=30.07, Standard Deviation=4.356) and college teachers (Mean=28.40, Standard Deviation=4.070) as t (198) = 2.801, p = .006<0.05. Table 4.22 also showed that the university teachers (Mean=30.07, Standard Deviation=4.356) showed significantly better scores as compared to the college teachers (Mean=28.40, Standard Deviation=4.070) (Objective 5, Hypothesis 4).
29. Table 4.23 showed that according to the views of the students about their teachers' skills regarding Control and Discipline, a significant difference was witnessed in the mean scores of university students (Mean=28.16, Standard Deviation=4.029) and college students (Mean=27.37, Standard Deviation=4.352) as t (1303) = 3.428, p = 0.001<0.05. Table 4.23 also showed that the university students (Mean=28.16,

Standard Deviation=4.029) showed significantly better scores as compared to the college students (Mean=27.37, Standard Deviation=4.352) (Objective 5, Hypothesis 4).

30. Table 4.24 showed that according to the views of the teachers about their PS, no significant difference was witnessed in the mean scores of university teachers (Mean=67.60, Standard Deviation=9.666) and college teachers (Mean=65.54, Standard Deviation=9.047) as t (198) = 1.556, p = .121>0.05. Table 4.24 also showed that the university teachers (Mean=67.60, Standard Deviation=9.666) showed slightly better scores as compared to the college teachers (Mean=65.54, Standard Deviation=9.047) (Objective 5, Hypothesis 4).
31. Table 4.25 showed that according to the views of the students about their teachers' PS, a significant difference was witnessed in the mean scores of university students (Mean=67.38, Standard Deviation=6.992) and college students (Mean=65.58, Standard Deviation=8.282) as t (1303) = 4.251, p = 0.00<0.05. Table 4.25 also showed that the university students (Mean=67.38, Standard Deviation=6.992) showed significantly better scores as compared to the college students (Mean=65.58, Standard Deviation=8.282) (Objective 5, Hypothesis 4).
32. Table 4.26 showed that according to the observational data of the teachers about their Domain Representation, no significant difference was witnessed in the mean scores of university teachers (Mean=22.00, Standard Deviation=2.362) and college teachers (Mean=22.45, Standard Deviation=2.089) as t (38) = -.638, p = .527>0.05. Table 4.26 also showed that the college teachers (Mean=22.45, Standard

Deviation=2.089) showed slightly better scores as compared to the university teachers (Mean=22.00, Standard Deviation=2.362) (Objective 5, Hypothesis 5).

33. Table 4.27 showed that according to the observational data of the teachers about their Delivery of Lesson, no significant difference was witnessed in the mean scores of university teachers (Mean=39.60, Standard Deviation=4.005) and college teachers (Mean=38.70, Standard Deviation=4.857) as t (38) = .639, p = .526>0.05. Table 4.27 also showed that the university teachers (Mean=39.60, Standard Deviation=4.005) showed slightly better scores as compared to the college teachers (Mean=38.70, Standard Deviation=4.857) (Objective 5, Hypothesis 5).
34. Table 4.28 showed that according to the observational data of the teachers about their Strategies and Skills, a significant difference was witnessed in the mean scores of university teachers (Mean=23.65, Standard Deviation=2.346) and college teachers (Mean=27.20, Standard Deviation=2.042) as t (38) = -5.105, p = .000<0.05. Table 4.28 also showed that the college teachers (Mean=27.20, Standard Deviation=2.042) showed significantly better scores as compared to the university teachers (Mean=23.65, Standard Deviation=2.346) (Objective 5, Hypothesis 5).
35. Table 4.29 showed that according to the observational data of the teachers about their Students' Engagement, no significant difference was witnessed in the mean scores of university teachers (Mean=29.30, Standard Deviation=3.643) and college teachers (Mean=28.60, Standard Deviation=3.315) as t (38) = .636, p = .529>0.05. Table 4.29 also showed that the university teachers (Mean=29.30, Standard Deviation=3.643) showed slightly better scores as compared to the college teachers (Mean=28.60, Standard Deviation=3.315) (Objective 5, Hypothesis 5).

36. Table 4.30 showed that according to the observational data of the teachers about their Goals and Beliefs, no significant difference was witnessed in the mean scores of university teachers (Mean=20.30, Standard Deviation=1.625) and college teachers (Mean=20.35, Standard Deviation=1.755) as t (38) = -.093, p = .926>0.05. Table 4.30 also showed that the college teachers (Mean=20.35, Standard Deviation=1.755) showed slightly better scores as compared to the university teachers (Mean=20.30, Standard Deviation=1.625) (Objective 5, Hypothesis 5).
37. Table 4.31 showed that according to the observational data of the teachers about their PDC, no significant difference was witnessed in the mean scores of university teachers (Mean=134.85, Standard Deviation=6.081) and college teachers (Mean=137.30, Standard Deviation=7.994) as t (38) = -1.091, p = .282>0.05. Table 4.31 also showed that the college teachers (Mean=137.30, Standard Deviation=7.994) showed slightly better scores as compared to the university teachers (Mean=134.85, Standard Deviation=6.081) (Objective 5, Hypothesis 5).

5.3 Discussion

The main purpose of conducting this study was to explore the relationship of Teacher Educators' PCK and PS with PDC. It was also intended to observe the correlation between Teacher Educators' PCK and PS with PDC beside their comparison based on college and university. This is the first study in this regard which compare the three main variable in a single study and also compare the performance of teacher educator from colleges and universities so this study is valuable. There are different research conducted on teacher educators with different perspectives. Some results of different researcher shows similarities in their results as compare with current research.

The first objective of this study was to explore the PCK of teacher educators. The results of the study yielded that the teachers who had updated subject matter knowledge were able to use various resources that were available in and around university/ college efficiently. They were confident about their command in the subject matter, knew how to use teaching methods effectively; were familiar with common student understandings and misconceptions; could adapt their teaching style for different learners; and could deliver the lesson in a variety of ways.

For the support of the results of current research, similar study conducted by Westwood (2004) asserted that although the actual management style of expert teachers was different, they were good behavior managers and they were good at motivating learners to learn. In addition, teacher ensure that students understand what they need to do and they set tasks and activities at the right level to ensure high success rates. Also teachers created a positive and supportive classroom environment.

Similar study conducted by An Kulm and Wu (2004). They point out in their qualitative research that teachers with a strong knowledge base in this field know which concepts were difficult to grasp. Star (2005) believed that project learning must be linked to content knowledge to promote the development of conceptual understanding.

Another study by Chick, Pham, and Baker (2006) involved teachers' understanding of teaching content. A qualitative research methodology using a case study design was used in the study. Data were collected through questionnaires, course observations, and interviews. The findings of the study yielded that the teacher knew the subject matter, as the teacher exhibited a deep and thorough conceptual understanding of the subject matter;

and identified the key components of the topic, which was the basis for understanding and applying concepts.

The research conducted by Chick, Pham, and Baker (2006) involved teaching techniques for teachers. A qualitative research methodology using a case study design was used in the study. Data were collected through questionnaires, course observations, and interviews. The results show that teachers demonstrated problem-solving skills and had the tools to measure students' learning in the subject. Although Mishra and Koehler (2006) argued that teachers who had a good understanding of the subject would find a different way to express it and gave learners access to it.

Lim (2007) pointed out in his research on the characteristics of Shanghai mathematics teaching that the success of teachers in teaching specific mathematics topics depended on the depth and breadth of individual teachers' teaching content knowledge. A trend of collaborative studies supported by the findings of this study establishes the fact the PCK is necessary for effective teaching and promotes teaching capability. Sibuyi (2012) used a case study method to examine the PCK of effective teachers and collected qualitative data through classroom observations, course plan analysis, and interviews. The results of the study showed that teachers had sufficient subject knowledge, seemed consistent with the results of the current research.

With the difference in results of this current study a research conducted by Yusof and Zakaria (2010). This study explored and described the level of CK possessed by three teachers. This study used a case study research design to explore the PCK of the three teachers. Document analysis, interviews and classroom observations were used to gather data about teachers' PCK. The results of the study found that the teachers lacked a

conceptual understanding of the content being taught to the students. Hence, the students were also ambiguous to describe a concept as a result of the curriculum designed by those teachers was also inaccurate. Consequently, the students lacked an understanding of the subject.

The current study also found that both teachers and students seemed least interested in developing students thinking skills; thinking learners, relating learning experiences with the real world; guiding students to define and pronounce different terminologies correctly; preparing and using supplementary materials effectively; and developing instructional material about subject easily. It may be cause due to work load of teachers and because teacher educators mainly focus to complete the content of subject matter and avoid long discussion during the lecture and cross questioning from students to avoid the arguments. With the support of these results, Gopang (2016) conducted survey research and collected data from 25 teachers through a questionnaire. The result of the study suggested that increase the duration of teacher training or workshop. Give more importance to the development of knowledge of content/ subject matter. Use authentic and available instructional materials for effective learning in class. Teacher training must be integrated with technical aspects that focus on cognitive and affective development.

The second objective of this study was to identify the PS practiced by teacher educators. The results of this study stated that the teachers possessed a command on different types of assessments; used content management skills; assessed students' understanding in subject matter; treated all students with respect and concern; used ICT for making their lectures effective; and tried their level best to exhibit a role model to the student. Anthony and Walshaw (2009) investigated that effective teachers used tools and

presentations to improve their teaching efficiency. Westwood (2004) asserted that although the actual management style of expert teachers was different, they were good behavior managers and they were good at motivating learners to learn. The research conducted by Chick, Pham, and Baker (2006) involved teaching techniques for teachers. A qualitative research methodology using a case study design was used in the study. Data were collected through questionnaires, course observations, and interviews. The results show that teachers demonstrated problem-solving skills and had the tools to measure students' learning in the subject. Kiliç (2011) used classroom observations, structured interviews, questionnaires, and journals as data collection tools to investigate teachers' PS. Kiliç (2011) investigated in his research that pre-service secondary school teachers needed strong subject knowledge to become a good teacher, but this was not enough for effective teaching. The findings suggested that teachers should also know how to teach specific concepts to specific learners, how to express specific ideas, how to answer learners' questions, and which course materials and tasks to use to engage students in new topics.

The series of these studies supported by the results of the current study, provide empirical evidence that the teachers having necessary PS besides PCK was equally necessary for effective teaching.

Whereas current study also found that the teachers and students declared that the teachers were least interested in providing feedback to students suitably; using effective teaching approaches to guide student thinking and learning in subject; detecting and tackling with respect the differences of opinions among students; encouraging discussions in the classroom with respect to the difference of opinion, and maintaining order and discipline in the classroom. The result is less because multi-cultural students are in

classroom. Therefore they have different opinions, experience and interest so teacher try

their best to avoid their cross arguments and only focus on the specific topic. To some extent teachers personally avoid arguments with students' that's why he/she did not encourage discussion in the classroom. So teacher try their best to avoid their cross arguments and mange time to cover the specific topic with valid discussion.

The third objective of this study was to observe the PDC of teacher educators. The results of the present study deduced that the teachers prepared lessons effectively; used a variety of appropriate strategies to facilitate higher-order thinking skills; made sure that all students understood the subject matter; listened to students; had a concluding activity; used effective questioning; summarized lesson; gave students opportunities to choose appropriate activities, and helped students when needed. Westwood (2004) asserted that although expert teachers have different practical teaching styles, they all used teaching strategies to maximize student learning time and participate in learning tasks. Furthermore, they encouraged students to actively participate in the classroom. Also, they ensured that students understood what they needed to do. They also set tasks and activities at the right level to ensure high success rates. Cockburn (2008) declared that while content knowledge was critical to the effectiveness of educators in pedagogy, teaching methods played an equally important role if any learning was to be carried out. The research conducted by Chick, Pham, and Baker (2006) involved teaching techniques for teachers. A qualitative research methodology using a case study design was used in the study. Data were collected through questionnaires, course observations, and interviews. The findings suggested that teachers demonstrated the ability to solve problems, used real-life examples, applied different instructional strategies in presentations, used different illustrations in

presentations, and dealt with learners' difficulties in the curriculum. According to Ingvarson, Beavis, Bishop, Peck, and Elsworth (2004), excellent teachers understood a variety of effective teaching strategies and teaching techniques that could help learners to enjoy. According to De Miranda (2008), effective teachers used different teaching methods to make the learning experience best for learners. The variables included: flexibility, adjustment, guidance, using various learning styles, abilities and interests. From this discussion, it is concluded that the teachers using PDC effectively demonstrate their teaching ability more powerfully and findings of this study collaborate with this trend. Murnane & Ganimian (2014) also suggested that specific training can help the teachers to improve their knowledge and their teaching. Teachers must need comprehensive training (regarding subject matter, teaching-learning process). It could be beneficial for the outcomes of the students' achievement.

The results of current study showed different regarding the social aspect (greeting students). Which seemed missing. Because some time teacher is feel personally and physically tense and feel pressure regarding professional commitment so he/she did not take interest at the start of the class.

Another objective of this study was to find out the relationship between PCK, PS, and PDC of teacher educators. The results revealed that a significant and moderate relationship between teachers' Subject Matter Knowledge and PDC and a non-significant and weak relationship between teachers' Knowledge of Pedagogy and PDC. The results are different because subject matter knowledge is mean to teach the specific content and knowledge of pedagogy means how much teacher know about different teaching methodologies and strategies about different subject matter. Overall a significant and

moderate relationship existed between teachers' PCK and PDC. Furthermore, a significant and strong relationship exhibited between teachers' PS and PDC.

The results of this study are in line with the study conducted by Madeira (2010). The study conducted design-based research which investigated the development of PCK among nine teacher-participants. The results of the study yielded that there was a positive relationship between PCK and PDC of teacher educators. Furthermore, there was also a positive relationship between PS and PDC of teacher educators. Another study conducted by Maryani, Martaningsih, & Bhakti (2017) about to build the creativity, commitment, and capacity of prospective teachers while planning the lesson utilizing modules dependent on educational substance information. A major issue of teacher education is the unavailability of proper instructional teaching resources while prospective teachers practicing specific courses. So while planning the instructional material for lesson planning, the involvement of prospective teachers was not very effective. The results of this study were collected through direct observation, self-reported and face to face conversations. The results of the study showed that the module regarding the subject matter (PCK) can able prospective teachers to engage and build their creative thinking to make effective lesson planning.

With the support of the results of current study, Albornoz, Anauati, Furman, Luzuriaga, Podesta & Taylor (2018) conducted research to investigate the learning effects of different instructors preparing techniques utilizing an irregular controlled. The results of the research showed that instructors who got training through planned curriculum effects on student achievements. This study recommended that organized and well-planned programs of teachers for specific training can bring tremendous changes in teaching practice.

Furthermore Murnane & Ganimian (2014) conducted survey research on the enhancement of academic performance across developing nations. The major result was, specific training should be given to low gifted or less skillful teachers to achieve a level of satisfaction. Teachers must need comprehensive training (regarding subject matter, teaching-learning process). It may beneficial for the outcomes of the students' achievement.

To sum up, the researchers have claimed that the PCK, PS, and PDC as research variables have worth to be researched. But none of these researchers studied the said three variables collectively in a single study. Hence, it is well-meaning to study the three variables in a single study and the researcher tried to attempt the same in this study.

5.4 Conclusions

As the observation and questionnaire were based on the same indicators so the findings were mostly on the same plane. Although there was some difference in the results, which was obvious due to the objectivity indirect observation and response of the
The findings of the study followed by a cross-sectional discussion lead to draw the following conclusions.

1. It is concluded from the findings 1 to 2 of this study that both the teachers and students responded that the teachers had updated subject matter knowledge; can able to use available resources efficiently; were confident about their command in the subject matter; knew how to use teaching methods effectively; could deliver the lesson in a variety of ways; knew how to organize, maintain and management classroom; and knew how to lead the learner and could integrate interdisciplinary learning. It was also concluded that both teachers and students reported that mostly they were least interested in developing students thinking skills; thinking learners,

relating learning experiences with the real world; guiding students to define and pronounce different terminologies correctly; preparing and using supplementary materials effectively; and developing instructional material about subject easily. Furthermore, the discussions of the study also affirmed that the teachers claimed to possess, yet gaps in actuality were observed (Objective 1).

2. It is concluded from the Findings 3 to 6 of this study that both the teachers and students reported that the teachers held command on different types of assessments; used content management skills; assessed students' understanding in subject matter; assigned appropriate learning tasks; monitored students evaluation adapted teaching resources which are based on students' learning needs; treated all students with respect and concern; tried their level best to exhibit a role model to the students; made students partners in setting the classroom rules and regulations; and used various measuring techniques for assessment. It was also affirmed that the teachers and students declared that the teachers were least interested in providing feedback to students suitably; using effective teaching approaches to guide student thinking and learning in subject; detecting and tackling with respect the differences of opinions among students; encouraging discussions in the classroom with respect to the difference of opinion, and maintaining order and discipline in the classroom. Although the teachers claimed to possess PS in reality, some gaps existed. (Objective 2).
3. It is concluded from the analysis of observational data presented in the findings 7 to 11 that the teachers felt shame and hyperactivity; faced class while speaking; varied voice pitch and tone; prepared lessons very effectively; used a variety of

appropriate strategies to facilitate higher-order thinking skills; pronounced words clearly; had a concluding activity; summarized lesson; used effective questioning; gave students opportunities to choose appropriate activities; helped students when needed; were approachable to students at any time and willing to help; and accepted objective critique mad by the students. However, it was affirmed that the teachers were least interested in covering all the area needed; motivating through instruction and presentation, and starting and ending the lesson at the right time; carefully directing and explaining expectations; meeting objectives; staying on topic; encouraging class participation; avoiding discussion about their personal life or personal matters with students, and correlating lesson with other subjects. Additionally, the discussions of the study also affirmed that the teachers used their PDC effectively in the classrooms (Objective 3).

4. From the findings 12 and 13, it is concluded that there was a significant and moderate relationship between teachers' PCK and their PDC (Hypothesis 1). Likewise, there was a significant and strong relationship between teachers' PS and their PDC (Hypothesis 2). Also, the discussions of the study confirmed positive correlation existed between teachers' PCK, PS and their PDC (Objective 4).
5. From the Findings 14 to 31, it is concluded that both the teachers and students mentioned that a significant difference was witnessed in the mean scores of university and college teachers regarding teachers' PCK. It is also concluded that college teachers showed significantly better scores as compared to university teachers (Hypothesis 3). Also, from the views of the teachers, it is concluded that the university teachers showed slightly but not significantly better scores as

compared to the college teachers on PS. Contrary, according to the views of the students regarding their teachers PS, a significant difference was witnessed in the mean scores of university teachers and college teachers, in favor of the university teachers. Hence, it is concluded that university teachers showed better PS as compared to college teachers (Hypothesis 4). Finally, the analysis of the observational data showed that no significant difference was witnessed in the mean scores of university teachers and college teachers regarding PDC (Objective 5, Hypothesis 5).

As the observation and questionnaire were based on the same indicators so the findings were mostly on the same plane. Although there was some difference in the results, which was obvious due to the objectivity indirect observation and responses of the respondent, the baseline findings were the same .i.e. the observation results showed the same output as that of analysis of the questionnaire.

6. The relationship among PCK, PS, and PDC showed that teacher knowledge about pedagogy was non-significant and weak, while overall moderate relationships existing between teachers' PCK and PDC. Furthermore, teachers' PS with PDC regarding assessment and evaluation is non-significant and weak and relationship with class control and discipline with PDC was strong. It is concluded that the teacher's teaching can help to achieve effective outcomes in the teaching and learning process.

5.5 Recommendations

The following recommendations are formulated based on the findings of the study and the conclusion so drawn.

1. This study identified that the teachers had considerable PCK but they were less interested in developing students thinking skills; guiding students to define and pronounce different terminologies correctly; preparing and using supplementary materials effectively, and developing instructional material about subject easily. These are an important aspect, but, at the neglected by the teachers. Courses should be designed around requirements and needs expressed by the teacher themselves. Revision of pre-service and in-service curricula, with a focus on improving and enhancing the content knowledge and pedagogical skills of the teacher trainees, is also required.
2. The study also concluded that although the teachers possessed PS, but, they lacked the practical skills like providing feedback to students; connecting teaching and learning producing thinking learners; detecting and tackling with respect the differences of opinions; encouraging discussions in the classroom with respect to the difference of opinion, and maintaining order and discipline in the classroom. Treatment is recommended at three levels: institutional-based (organized need-based programs), Directorate of staff development (DSD) for developing training modules and universities Department of education for revisiting curriculum in pedagogical courses. Teachers' proficiency in these areas may be linked with career-motivated programs. Teachers' performance in the classroom should be regularly assessed by the coordinator to evaluate the quality of their training, their subject knowledge as well as their classroom delivery and management skills. Performance-Based teacher evaluation and compensation systems are required to motivate the teachers to strive towards excellence. Teacher may improve their

instructional planning, presentation skills in class room, content management skills, maintain the classroom climate, conduct healthy discussion during lecture and effective use of ICT for make effective teaching learning process. Additionally, there should be an institutional performance appraisal system to monitor institutional accomplishment against set curricular objectives and goals.

3. The study also concluded that the teachers were lagging in motivating the students; staying on topic objectives and outcome-based learning strategic planning and delivery approach can address these critical areas. It is recommended that teacher educators may updated their knowledge regarding subject matter, different teaching methodologies and used latest teaching learning assistances during lesson presentation. The tested innovations exist in the form of micro-teaching, team teaching, project-based and student learning portfolio approaches. System to improvement at the institutional level with linkages DSD and universities are recommended in this endeavor.
4. Although some positive areas seemed visible in student assessment, monitoring evaluation, yet they seemed at variance integrating research in cognitive development with pedagogical and subject contents, teaching and testing technology and measuring learning form the critical areas for the capacity- building of the teachers. Peer-observation and self-assessment can be used to identify the weak areas of teaching. This equally requires system improvement and powerful interventions to be addressed at university, provincial organizations, and institutional levels.

5. This study makes the distinction that college teachers had more PCK as compared to university teachers. Contrary to this, the university teachers exhibited more PS as compared to the college teachers. This implied that the college teachers had to utilize their PCK into practice. On the other hand, the university teachers were utilizing them well in the classroom environment. This conclusion has a strong implication for college teachers to utilize their PCK into practice. Universities are power-generating institutions and their vision, scholarship research and educational conferences have to address these issues regularly.

5.6 Recommendations for Future Research

The following are some recommendations for future researchers.

1. The study of the development of PCK is a complex endeavor. Several sources contribute to pre-service teachers' initial and emerging development of PCK. Experimental research may be carried out regarding the teacher's PDC.
2. A comparative study may be conducted to examining how college teachers gain higher PCK, but lower PS and the findings integrate with pre-in-service training cycles.
3. This study tried to find out the relationship between teachers' PCK, PS, and PDC. Other aspects like teachers' technological PCK and content knowledge may also be studied by future researchers.
4. The same study may also be replicated using qualitative research methods like case study etc.
5. A comparative study may be conducted in various provinces in context of relationship between teachers' PCK, PS, and PDC.

REFERENCES

Abbitt, J. T. (2011). An Investigation of the Relationship between Self-Efficacy Beliefs about Technology Integration and Technological Pedagogical Content Knowledge (TPACK) among Pre-service Teachers. *Journal of Digital Learning in Teacher Education, 27*(4), 134-143.

Abell, S. K. (2007). Research on science teacher knowledge. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp.1105-1151). New Jersey: Lawrence Erlba- um Associates.

Abell, S. K. (2008). Twenty years later: Does pedagogical content knowledge remain a useful idea? *International Journal of Science Education, 30*, 1405-1416.

Abuseji, F. A. (2007). Student and teacher-related variables as determinants of secondary school students' academic achievement in chemistry. *Journal Pendidikan,32*,3–18.

Adeniyi, T. B. (2009). *Influence of selected teacher variables on secondary school students' performance in social studies in Ado-Ekiti, Nigeria* (Unpublished M. Ed Thesis). University of Ilorin, Ilorin.

Akiri, A. A., & Ugborugbo, N. M. (2009). Teachers' effectiveness a student's academic performance in public schools in Delta State, Nigeria. *Kamla-Raj Stud Home Communication Science, 3*(2), 107-113

Albornoz, F., Anauati, M. V., Furman, M., Luzuriaga, M., Podestá, M. E., & Taylor, I. (2018). "*Training to Teach Science: Experimental Evidence from Argentina.*" Policy Research Working Paper 8594. World Bank.

Alexander, R.J. (2003). *Talk for Learning: the first year*, Northallerton: North Yorkshire County Council.

An, S., Kulm, G. & Wu, Z. (2004). The Pedagogical Content Knowledge of Middle School, Mathematics Teachers in China and the U.S. *Journal of Mathematics Teacher Education, 7*(2), *145-172.*

Angell, C., Ryder, J. & Scott, P. (2005). Becoming an Expert Teacher: Novice Physics Teachers' Development of Conceptual and Pedagogical Knowledge. *Paper presented at European Science Education Research Association,* Barcelona, Spain.

Anthony, G. & Walshaw, M. (2009). Characteristics of Effective Teaching of Mathematics: A View from the West. *Journal of Mathematics Education.2,* 147-164.

Avraamidou, L., & Zembal-Saul, C. (2005). Giving priority to evidence in science teaching: A first-year elementary teacher's specialized practices and knowledge. *Journal of Research in Science Teaching, 42*(9), 965-986.

Balikie, N. (2010). *Designing Social Research: The Logic of Anticipation* (2nd ed.). Cambridge: Polity Press.

Ball, D. L. (1991). Research on teaching mathematics: Making subject matter part of the equation. In J. Brophy (Ed.), *Advances in research on teaching* (pp. 1-48). Greenwich, CT: JAI Press.

Ball, D.L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L. Darling Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3-32). San Francisco: Jossey-Bass.

Barab, S. A., & Luehmann, A. L. (2003). Building sustainable science curriculum: Acknowledging and accommodating local adaptation. *Science Education, 87,* 454 – 467.

Barnett, J. & Hodson, D. (2001). PCK: Toward a fuller understanding of what good science teachers know. *Science Teacher Education, 85,* 426-453.

Ben-Peretz, M. (1990). *The teacher-curriculum encounter: Freeing teachers from the tyranny of text*. Albany: SUNY Press.

Berliner, D. C. (1986). In pursuit of the expert pedagogue. *Educational Researcher, 15*, 5-13.

Berliner, D. C. (2001). Learning about and learning from expert teachers. *International Journal of Educational Research, 35,* 463-482.

Bernstein, B. (1990). *Class, codes and control, volume 4: The structuring of pedagogic discourse*. London: Routledge.

Bernstein, B. (2000). *Pedagogy, symbolic control and identity: Theory, research and critique (Revised edition)*. Oxford: Rowman & Littlefield.

Black, P. & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education, 5,* 7-73.

Black, T. R. (2002). *Understanding social science research*. London: SAGE Publication Ltd.

Borg, S. (2006). *Teacher cognition and language education.* London: Continuum.

Bossé, M.J., & Bahr, D.L. (2008). The state of balance between procedural knowledge and conceptual understanding in mathematics teacher education. *International Journal of Mathematics Teaching and Learning*,

http://www.cimt.plymouth.ac.uk/journal/default.htm. Retrieved on: 25.11.2017.

Brookhart, S. M. (2011). Educational assessment knowledge and skills for teachers. *Educational Measurement: Issues and Practice, 30*, 3-12. http://dx.doi.org/10.1111/j.1745-3992.2010.00195.x

Brophy, J. (2006). History of Research on Classroom Management. In C. M. Evertson & C. S. Weinstein (Eds.), *Handbook of classroom management. Research, practice, and contemporary issues.* Malwah, NJ: Lawrence Erlbaum Associates.

Brown, E. J., Brailsford, T. J., Fisher, T. & and Moore, A. (2009). Evaluating learning style personalization in adaptive systems: Quantitative methods and approaches. *Learning Technologies, IEEE Transactions on, 2*(1), 10–2.

Brown, M. (2002). *Teaching by Design: Understanding the Intersection between Teacher Practice and the Design of Curricular Innovations* (Doctoral Dissertation). Northwestern University, Evanston, Illinois.

Brown, M. (2009). The teacher-tool relationship: Theorizing the design and use of curriculum materials. In J. T. Remillard, B. Herbel-Eisenmann, & G. Lloyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (pp. 17-36). New York: Routledge.

Brown, M., & Edelson, D. (2003). *Teaching as design: can we better understand the ways in which teachers use materials so we can better design materials to support their changes in practice?* Chicago: Northwestern University.

Brown, S. & McIntyre, D. (1993). *Making sense of teaching.* Buckingham and Philadelphia: Open University Press.

Bruner, J. (1999). The Process of Concept Attainment. In Eric Margolis & Stephen Laurence (eds.), *Concepts: Core Readings* (p. 101). MIT Press.

Bukova-Güzel, E. (2010). An investigation of pre-service mathematics teachers' pedagogical content knowledge, using solid objects. *Scientific Research Essays, 5*(14), 1872-1880.

Bullough, J. R. V. (2001). Pedagogical content knowledge circa 1907 and 1987: A study in the history of an idea. *Teaching and Teacher Education, 17*, 655-666. doi:10.1016/S0742-051X(01)00022-1.

Chick, H.L., Pham, T. & Baker, M.K. (2006). Probing teachers' pedagogical content knowledge: lessons from the case of subtraction algorithm. In P. Grootenboer, R. Zevenbergen, & M. Chinnappan (Eds). *Identities, Cultures and learning spaces* (Proceedings of the 29th annual conference of the *Mathematics Education Research Group of Australia*), (pp. 139-146). Sydney: Merga.

Chou, Y. C. (2008). Exploring the reflection of teachers' beliefs about reading theories and strategies on their classroom practices. *Feng Chia Journal of Humanities and Social Sciences, 16*, 183-216.

Clark, C. M., & Peterson, P. L. (1986). Teachers' thought process. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (pp. 255-296). New York: Macmillan.

Clark, J.C., & Walsh, J. (2002). *Elements of a model of effective teachers*. Paper presented at AARE Conference, Brisbane, 1-5 December.

Clutterbuck, D. & Hirst, S. (2002). Leadership communication: A status report. *Journal of Communication Management, 6*(4), 351-354.

Cochran, K. F., DeRuiter, J. A., & King, R. A. (1993). Pedagogical content knowing: An integrative model for teacher preparation. *Journal of Teacher Education, 44*, 263-272.

Cockburn, A.D. (2008). How can research be used to inform and improve mathematics teaching practice? *Journal of Mathematics Teacher Education, 11*, 343-347.

Cohen, D. K. (1988). *Educational technology and school organization. Technology in education: Looking toward 2020.* Hillsdale, NJ, Erlbaum: P. P. Zodhiates.

Collins, K. T. (2010). Advanced sampling design in mixed research: Current practices and emerging trends in the social and behavioral sciences. In A. Tashakkori & C. Teddlie (Eds.), *Sage Handbook of Mixed Methods in Social Sciences & Behavioral Research (2nd ed.)*. Thousand Oaks California: SAGE.

Cothran, D. J., & Ennis, C. D. (2000). Building Bridges to Student Engagement: Communicating Respect and Care for Students in Urban High Schools. *Journal of Research and Development in Education, 33*, 106-117.

Cowie, B. (2005). Pupil commentary on assessment for learning. *Curriculum Journal, 16*(2), 137-151. doi: 10.1080/09585170500135921

Davis, E. A., & Krajcik, J. S. (2005). Designing Educative Curriculum Materials to Promote Teacher Learning. *Educational Researcher, 34*, 3-14. doi.org/10.3102/0013189X034003003

Davis, E. A., Beyer, C., Forbes, C. T., & Stevens, S. (2007). *Promoting pedagogical design capacity through teachers' narratives*. Paper presented at the National Association for Research in Science Teaching, New Orleans.

De Jong, O., van Driel, J., & Verloop, N. (2005). Pre-service teachers' pedagogical content knowledge of using particle models in teaching chemistry. *Journal of Research in Science Teaching, 42,* 947-964.

De Miranda, M.A. (2008). Pedagogical Content Knowledge and Engineering and Technology Teacher Education: Issues for Thought. *Journal of the Japanese Society of Technology Education, 50* (1), 17-26.

DeBoer, G. (2000). Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching, 37*(6), 582-601.

Denscombe, M. (2007). *The good research guide for small-scale social research projects.* Berkshire: Open University Press.

Dixon, H & Haigh, M. (2009). Changing mathematics teachers' conceptions of assessment and feedback. *Teacher Development: An international journal of teachers' professional development, 13*(2), 173-186.

Doyle, W. (1985). Recent research on classroom management. *Journal of Teacher Education, 36,* 31-35.

Doyle, W. (1986). *Classroom organization and management* (3rd ed.). New York: Macmillan.

Doyle, W. (2011). *Classroom organization and management* (4th Edition). MacMillan publishing, New York, USA.

Drageset, O. G. (2009). Exploring mathematical knowledge for teaching. In M. Tzekaki, M. Kaldrimidou, & C. Sakonidis (Eds.), *Proceedings of the 33rd Conference of the*

International Group for the Psychology of Mathematical Education (Vol. 2, pp. 473-480). Thessaloniki, Greece: PME.

Drake, C., & Sherin, M. G. (2006). Practicing change: Curriculum adaptation and teacher narrative in the context of mathematics education reform. *Curriculum Inquiry, 36*(2), 153 187. doi.org/10.1111/j.1467-873X.2006.00351.x

Dugguh, S.I. (2007). *Human Resource Management.* Makurdi, Nigeria: Oracle Business Ltd.

Emmanuel, S. (2010). *The influence of teachers' characteristics and senior secondary students' performance in economics in Ilorin West L. G. A* (Unpublished B. Sc. (Ed) Research Project). University of Ilorin, Ilorin.

Emmer, E. T., & Gerwels, M. (2006). *Classroom management in middle and high school classrooms*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Enem, F. O. (2005). The importance of instructional materials to the successful implementation of the social studies curriculum at the junior secondary school level. *Journal of Curriculum and Media Technology Research, 1*(11), 48 – 56.

Falk, A. (2012). Teachers learning from professional development in elementary science: Reciprocal relations between formative assessment and pedagogical content knowledge. *Science Education, 96*(2), 265-290. doi: 10.1002/sce.20473

Faqir, K., Ayaz, M., & Shah, R. (2015). Perceptions of Teachers about Communicative Role of Teaching Department Heads in Universities. *Pakistan Annual Research Journal, 51,* 111.

Feiman-Nemser, S. (2001). Helping novices learn to teach: Lessons from an exemplary support teacher. *Journal of Teacher Education, 52,* 17-30.

Fernández-Balboa, J., & Stiehl, J. (1995). The generic nature of pedagogical content knowledge among college professors. *Teaching and Teacher Education, 11*(3), 293-306. doi:10.1016/0742-051x(94)00030-a

Forbes, C. T. & Davis, E. A. (2009). Beginning Elementary Teachers' Beliefs about the Use of Anchoring Questions in Science: A Longitudinal Study. *Science Education, 94,* 365 – 387.

Friedrichsen, P. M., (2008). A conversation with Sandra Abell: Science teacher learning. *Eurasia Journal of Mathematics, Science and Technology Education, 4*(1), 71-79.

Froyen, L.A. & Iverson, A.M. (1999). *School-wide and Classroom Management: The Reflective Educator- Leader.* Upper Saddle River: Prentice-Hall.

Furman, M., Luzuriaga, M., Taylor, I., Anauati, M. V., & Podestá, M. E. (2018). *Opening the "Black Box" of the Science Classroom: A Study on the Relationship between Teaching Practices and Thinking Skills that are Promoted in Students].* Enseñanza de las Ciencias. 36 (2): 81 - 103

Garrett, T. (2014). *Classroom Management: The Essentials.* New York, NY: Teachers College Press.

Gay, L. R. (2009). *Educational Research Competencies for Analysis and Application.* Islamabad: National Book Foundation.

Gayson, P.A. (2000). *Concept of Productivity.* London: Macmillan

Geddis, A. N., Onslow, B., Beynon, C., & Oesch, J. (1993). Transforming content knowledge: Learning to teach about isotopes. *Science Education, 77*(6), 575-591.

Gess-Newsome, J. (1999). Pedagogical content knowledge: An introduction and orientation. In J. Gess-Newsome & N. G. Lederman (Eds.), *PCK and science education* (pp. 3–17). Dordrecht, the Netherlands: Kluwer Academic.

Gipps, C. (1994). *Beyond testing: Towards a theory of educational assessment.* London: Falmer Press.

Goldston, M. (2004). The Highly Qualified Teacher and Pedagogical Content Knowledge. *Focus Group Background Papers*. Arlington, Va.: The National Congress on Science Education.

Gopang, I. (2016). Teacher Education and Professional Development Programs in Pakistan. *International journal of research in teacher education, 7, 1*-14.

Gorard, S. (2001). *Quantitative methods in educational research: The role of numbers made easy*. London: Continuum.

Grossman, P. & Thompson, C. (2004). *Curriculum Materials: Scaffolds for New Teacher Learning? A Research Report.* Center for the Study of Teaching and Policy University of Washington.

Grossman, P. L. (1990). *The making of a teacher: Teacher knowledge and teacher education*. New York, NY: Teachers College Press.

Halim, L., & Meerah, S. M. (2002). Science trainee teachers' pedagogical content knowledge and its influence on physics teaching. *Research in Science & Technological Education, 20* (2), 215-225.

Harris, J., Mishra P. & Koehler, M. (2009). Teachers' Technological Pedagogical Content Knowledge and Learning Activity Types. *Journal of Research on Technology in Education, 41*(4), 393-416.

Hashweh, M. (1987). Effects of subject-matter knowledge in the teaching of biology and physics. *Teaching and Teacher Education, 3*, 109-120.

Hattie, J. (2009). *Visible Learning: a synthesis of over 800 Meta-Analyses Relating to Achievement*. London: Routledge

Herbel-Eisenmann, B. A. (2007). From the intended curriculum to written curriculum: Examining the "voice" of a mathematics textbook. *Journal for Research in Mathematics Education,* 344-369.

Heritage, M. (2007). Formative assessment: What do teachers need to know and do? *Phi Delta Kappan, 89*, 140-145.

Heritage, M. (2010). *Formative Assessment: Making it happen in the classroom*. Thousand Oaks, CA: Corwin Press.

Ibe, B. O., & Maduabum, M. A. (2001). Teacher qualification and experience as correlates of secondary school students' achievement in biology. *Educational Thought, 1*(2), 176-183.

Imogie, A. I. (2001). Optimization of instructional media. In O. Nnoli, & I. Sulaiman (Eds.), *Reassessing the Future of Education in Nigeria* (pp. 91-101). Abuja: Education Tax Fund.

Ingvarson L., Beavis A., Bishop A., Peck R. & Elsworth G. (2004). *Investigation of effective mathematics teaching and learning in Australian secondary schools*. Commonwealth: Australia.

Ireson, J., Hallam, S., Hack, S., Clark, H. & Plewis, I. (2002). Ability grouping in English secondary schools: effects on attainment in English, mathematics, and science. *Educational Research and Evaluation, 8*, 299-318.

Iyengar, R., Witenstein, M. & Byker, E. (2014). *Comparative Perspectives on Teacher Education in South Asia.* doi:10.1108/S1479-3679_2014_0000025010.

Iyewarun, S. A. (1989). *The Teaching of social studies.* Ilorin: Owoye Press & Book Industries (Nig) Ltd.

Jagtap, H. N. (1999). Content cum Methodology- An Innovation in Teacher Education, in A. N. Joshi (Ed.), *Content com Methodology.* Nashik: YCMOU.

Käpylä, M., Heikkinen, J. P. & Asunta, T. (2009). Influence of Content Knowledge on Pedagogical Content Knowledge: The case of teaching photosynthesis and plant growth. *International Journal of Science Education, 31*(10), 1395-1415. doi: 10.1080/09500690802082168.

Kilić, H. (2011). Pre-service secondary Mathematics Teachers' knowledge of students. *Turkish Online Journal of Qualitative Inquiry, 2*(2), 17-35.

Killen, R. (2003). *Effective Teaching Strategies, Lesson from Research and Practice.* Australia: Ligare Book Printers.

Koballa, T. R. Jr., & Crawley, F. E. (1985). The influence of attitude on science teaching and learning. *School Science and Mathematics, 85*, 222–232.

Koster, B., Korthagen, F. A. J., & Wubbels, T. (2005).Quality requirements for teacher educators. *Teaching and Teacher Education, 21(2)*, 157- 176.

Lampert, M. (2001). *Teaching problems and the problems of teaching.* New Haven: Yale University Press.

Land, T. J. (2011). *Pedagogical design capacity for teaching elementary mathematics: A cross-case analysis of four teachers.* Retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi

Leach, J. & Scott, P. (2003). Individual and sociocultural views of learning in science education. *Science and Education, 12,* 91-113.

Leach, S. (2006). *How to be a Successful Secondary Teacher.* London: Continuum International Publishing Group.

Lee, E., & Luft, J.A. (2008). Experienced secondary science teachers' representation of pedagogical content knowledge. *International Journal of Science Education, 30*(10), 1343-1363.

Lee, E., Brown, M. N., Luft, J. A., & Roehrig, G. H. (2007). Assessing beginning secondary science teachers' PCK: Pilot year results. *School Science and Mathematics, 107,* 52-68.

Lim, C.S. (2007). Characteristics of mathematics teaching in Shanghai, China: through the lens of a Malaysian. *Mathematics Education Research Journal, 19* (1), 77-89.

Lortie, D. (1975). *Schoolteacher: A Sociological Study.* London: University of Chicago Press.

Loughran, J., Berry, A., & Mulhall, P. (2006). *Understanding and developing science teachers'pedagogical content knowledge.* Rotterdam, Netherlands: Sense.

Loughran, J., Milroy, P.,, Berry, A., Gunstone, R. & Mulhall, P. (2001). Documenting Science Teachers' Pedagogical Content Knowledge Through PaP-eRs. *Research in Science Education, 31*(2), 289.

Loughran, J., Mulhall, P., & Berry, A. (2008). Exploring pedagogical content knowledge in science teacher education. *International Journal of Science Education, 30*(10), 1301–1320.

Loveless, A.M. (2002). Literature review in creativity, new technologies, and learning. *Future lab Archive*. Available online http://www.nestafuturelab.org/research/reviews/cr01.htm

Luft, J. A., Roehrig, G. H., & Patterson, N. C. (2003). Contrasting landscapes: A comparison of the impact of different induction programs on beginning secondary science teachers' practices, beliefs, and experiences. *Journal of Research in Science Teaching, 40,* 77-97.

Madeira, M. C. (2010). *The Development of Pedagogical Content Knowledge in Science Teachers: New Opportunities through Technology-Mediated Reflection and Peer-Exchange* (Doctoral Dissertation). University of Toronto

Magnusson, S., Krajacik, J., & Borko, H. (1999). Nature, sources, and development of PCK for science teaching (pp. 95-120). In J. Gess-Newsome & N.G. Lederman (eds.) *Examining PCK: The construct and its implications for science education.* Boston: Kluwer Academic Press.

Mansor, A.N., Eng, W.K., Rasul, M.S., Hamzah, M.I., & Hamid, A.H. (2012). Effective classroom management. *International Education Studies.*

Mark, R. (1990). Pedagogical Content Knowledge: From a Mathematical Case to a Modified Conception. *Journal of Teacher Education*, *41*(3), 3-11.

Maryani, I., Martaningsih, S. T., & Bhakti, C. P. (2017). Module Based on Pedagogical Content Knowledge to Increase the Engagement and Skills of the Future Teachers in Designing a Lesson Plan. *Journal of Education and Learning* (EduLearn), *11* (1), 92-102

Masters, G. (2010). Teaching and Learning School Improvement Framework. *Australian Council for Educational Research* (ACER).

McClain, K., Zhao, Q., Visnovska, J., & Bowen, E. (2009). Understanding the role of the institutional context in the relationship between teachers and text. In J. T. Remillard, B. A. Herbel-Eisenmann, & G. M. Lloyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (pp. 56–69). New York: Routledge.

McKenzie, P. J. (2003). A model of information practices in accounts of everyday-life information seeking. *Journal of Documentation, 59*(1), 19-40.

Ming-tak, H. & Wai-Shing, L. (2008). *Classroom Management: Creating a Positive Learning Environment.* Hong Kong: Hong Kong University Press.

Mishra R. C. (2007). *Classroom Management*. New Delhi: A P H Publishing Corporation.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A new framework for teacher knowledge. *Teachers College Record 108* (6), 1017-1054.

Mkpa, A. M. (2001). Optimization of available teaching and learning materials/facilities. In O. Nnoli, & I. Sulaiman, (Eds.), *Reassessing the Future of Education in Nigeria* (pp 79-89). Abuja: Education Trust Fund.

Morgan, C., & Watson, A. (2002). The interpretative nature of teacher's assessment of students' mathematics; Issues for equity. *Journal for research in mathematics education.*

Mudzimiri, R. (2012). *A Study of the Development of Technological Pedagogical Content Knowledge (TPACK) in Pre-Service Secondary Mathematics Teachers* (Doctoral Dissertation). Montana State University Bozeman, Montana.

Mulholland, J., & Wallace, J. (2001). Teacher induction and elementary science teaching: enhancing self-efficacy. *Teaching and Teacher Education, 17*, 243–261.

Murnane, R. J., & Ganimian, A.J. (2014). *Improving Educational Outcomes in Developing Countries: Lessons from Rigorous Evaluations*. NBER Working. Paper No. 20284 JEL No. I21, I24, I25, I32.

National Research Council (1997). *Science teaching reconsidered.* Washington, D.C.: National Academy Press.

Nkuuhe J. (1995). Instructional Media. In: Matiru, Anna & Ruth (ed.). *Teach Your Best: A Handbook for University Lecturers* (pp. 223-260). German Foundation for International Development.

Northouse, P. G. (2010). *Leadership: Theory and practice* (5th ed.). Thousand Oaks, CA: Sage.

Obidah, J. E. & Teel, M. K. (2001). *Because of the Kids Facing Racial and Cultural Differences in Schools.* New York: Teachers College Press.

Offorma, G.C. (2005). Increasing professionalism in teaching and learning. *International Journal of Arts and Technology Education, 4*, 85-93.

Oladele, O. T. (2010). *Teacher quality and students' academic performance in C. R. S. in secondary schools, Ilorin – South L. G. A., Nigeria* (Unpublished B. A. (Ed) Research Project). University of Ilorin, Ilorin.

Oliver, P. (2010). *Understanding the research process*. London: SAGE Publication Ltd.

Onyejemezi, D. A. (2001). Quality, quantity, production and distribution of teaching resources/facilities. In O. Nnoli, & I. Sulaiman, (Eds.), *Reassessing the Future of Education in Nigeria* (pp 41-61). Abuja: Education Tax Fund.

Opasola, A. J. (2009). *Influence of school variables on junior secondary school students' performance in social studies in Afijio, Oyo State, Nigeria* (Unpublished M. Ed. Thesis). University of Ilorin, Ilorin.

Özdemir, M. (2016). An Examination of the Techno-pedagogical Education Competencies (TPACK) of Pre-service Elementary School and Preschool Teachers. *Journal of Education and Training Studies.*

Pace, D. & Middendorf, J. (Eds.) (2004). *Decoding the disciplines: Helping students learn disciplinary ways of thinking. New Directions for Teaching and Learning.* San Francisco: Jossey-Bass.

Padilla, K., Ponce-de-León, A. M., Rembado F. M., & Garritz, A. (2008). Undergraduate Professors' Pedagogical Content Knowledge: The case of 'amount of substance'. *International Journal of Science Education, 30*(10), 1389-1404.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*, 307 – 322.

Park, S & Oliver, J. (2008). Revisiting the Conceptualisation of Pedagogical Content Knowledge (PCK): PCK as a Conceptual Tool to Understand Teachers as Professionals. *Research in Science Education. 38.* 261-284. doi:10.1007/s11165-007-9049-6.

Pea, R. D. (1993). Practices of distributed intelligence and design for education. In G. Solomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 47-87). Cambridge, UK: Cambridge University Press.

Pintó, R, Couso, D., & Gutierrez, R. (2005). Using research on teachers' transformations of innovations to inform teacher education. The case of energy degradation. *Science Education, 89*(1), 38–55.

Popova, A., Evans, D. K., Breeding, M. E. & Arancibia, V. (2019). "*Teacher Professional Development around the World: The Gap between Evidence and Practice.*" CGD Working Paper 517. Washington, DC: Center for Global Development. https://www.cgdev.org/publication

Preston, J. A. & Shackelford, R. (2005). *A System for Improving Distance and Large Scale Classes.* Georgia: Institute of Technology.

Prosser, M. & Trigwell, K. (1999). *Understanding learning and teaching: The experience in higher education*. Buckingham: SRHE and Open University Press.

Raheem, M. J. (2010). *Relationship between teachers' characteristics and senior secondary school economics students' performance in Ilorin, Nigeria* (Unpublished B. Sc. (Ed) Research Project). University of Ilorin, Ilorin.

Remillard, J. T. (2005). Examining key concepts in research on teachers' use of mathematics curricula. *Review of Educational Research, 75*, 211-246.

Remillard, J., & Bryans, M. (2004). Teachers' orientations towards mathematics curriculum materials: implications for teacher learning. *Journal for research in mathematics education, 35*(5), 352-388.

Richards, J. C. (1996). Teachers' maxims in language teaching. *TESOL Quarterly, 30*(2), 281-296. doi.org/10.2307/3588144

Richardson, V. & Fallonan, C. (2001). *Classroom management as a method and manner.* Singapore: Longman Singapore Publishers.

Rollnick, S. et al. (2008). *Motivational Interviewing in Health Care: Helping Patients Change Behavior.* London: The Guildford Press.

Roskos, K., & Neuman, S. B. (2012). *Classroom management for achieving readers*. Addis Ababa: Addis Ababa University Press.

Ruiz-Primo, M. A. (2011) Informal Formative Assessment: The Role of Instructional Dialogues in Assessing Students' Learning. *Special Issue in Assessment for Learning Studies of Educational Evaluation, 37*(1), 15-24.

Sajjad, S. (2007). Teacher as a Classroom Manager. *Annual journal of Humanities and Social Sciences, 4.*

Schneider, M. C. & Gowan, P. (2013). Investigating Teachers' Skills in Interpreting Evidence of Student Learning. *Applied Measurement in Education, 26*(3), 191-204, doi: 10.1080/08957347.2013.793185

Schwartz, S., & Pollishuke, M. (2013). *Creating the dynamic classroom: A handbook for teachers* (2nd ed.). Toronto, ON: Pearson Canada Inc.

Sergiovanni, T. J. & Starratt, R. J. (2006). *Supervision: A Redefinition* (eighth edition). New York: McGraw-Hill.

Shaheen, M. N. K. S. (2011). *Problems of Management of the Crowded Classrooms and their Solutions at Secondary Level in Pakistan* (Unpublished Master's thesis). International Islamic University Islamabad Pakistan.

Shaheen, M. N. K. S., Khan, G. M., Tariq, M. A., Mahmood, T., & Hamid, S. (2013). Application of Management Techniques by Teachers to Control the Disruptive Behavior in Over-Crowded Classrooms. *Global Journal of Human Social Science Linguistics & Education, 13*(5), 64-72.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(1), 4–14.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Shulman, L. S. (2005). Signature pedagogies in the professions. *Daedalus, 134*(3), 52-59.

Sibuyi, C. D. (2012). *Effective Teachers' Pedagogical Content Knowledge in Teaching Quadratic Functions in Mathematics* (Master's Thesis). University Of Pretoria.

Singh, R. P. & Rana, G. (2004). *Teaching Strategies*. New Dehli: APH Publishing Corporation.

Smith, C. L., Wiser, M., Anderson, C. W. A., & Krajcik, J. (2006). Implications of research on children's learning for standards and assessment: A proposed learning progression for matter and the atomic-molecular theory. *Measurement: Interdisciplinary Research & Perspective, 14* (1&2), 1–98.

Son, J. W. (2013). How pre-service teachers interpret and respond to student errors: ratio and proportion in similar rectangles. *Educational Studies in Mathematics, 84*(1), 49-70.

Sotoyinbo, A. O. (2009). *Influence of teachers variables performance in social studies in Abeokuta metropolis, Nigeria* (Unpublished M. Ed. Thesis) University of Ilorin, Ilorin.

Spillane, J. P. (1999). External reform initiatives and teachers' efforts to reconstruct their practice: The mediating role of teachers' zones of enactment. *Journal of Curriculum Studies, 31*, 143-175.

Star, J. R. (2005). Reconceptualising Conceptual Knowledge. *Journal for Research in Mathematics Education. 36* (5), 404-411.

Sternberg, R. J. & Horvath, J. A. (1995). A prototype view of expert teaching. *Educational Researcher, 24,* 9-17.

Stevens, K., & Stewart, D. (2005). Cyber cells: Learning in actual and virtual groups. Melbourne: Thomson Dunmore Press.

Stigler, J. W. & Hiebert, J. (1998). Teaching is a cultural activity. *American Educator, 4*, 4–11.

Stodolsky, S. S. & Grossman, P. L. (2000). Changing students, changing teaching. *Teachers College Record, 102* (1), 125–172.

Tabak, I., & Baumgartner, E. (2004). The teacher as a partner: Exploring participant structures, symmetry, and identity work in scaffolding. *Cognition and Instruction, 22,* 393–429.

Tamir, P. (1988). Subject matter and related pedagogical knowledge in teacher education. *Teaching and Teacher Education, 4,* 99–110.

Tanner, B. M., Bottoms, G., Feagin, C., & Bearman, A. (2003). *Instructional Strategies: How Teachers Teach Matters*. Southern Regional Education Board, Atlanta, GA.

Taylor, C., Appiah, K. A., Habermas, J., Rockefeller, S. C., Walzer, M., & Wolf, S. (1994). *Multiculturalism: Examining the politics of recognition*. Princeton, NJ: Princeton University Press.

Treagust, D. F. (1987). Exemplary practice in high school biology classes. In K. Tobin and B.J. Fraser (eds.) *Exemplary practice in science and mathematics education.* (29-43). Perth, Western Australia: Science and Mathematics Education Centre.

Turnuklu, E.B. & Yesildere, S. (2007). The pedagogical content knowledge in mathematics: pre-service primary teachers' perspectives. *IUMPST: The Journal, 1*, 1 - 13.

Valencia, S., Place, N., Martin, S., & Grossman, P. (2006). Curriculum materials for elementary reading: shackles and scaffolds for four beginning teachers. *The Elementary School Journal, 107*, 93–120.

Van Dijk E.M. & Kattmann U. (2007). A research model for the study of science teachers' PCK and improving teacher education. *Teaching and Teacher Education, 23*(6), 885-897.

Van Driel, J. H., de Jong, O., & Verloop, N. (2002). The development of preservice chemistry teachers' pedagogical content knowledge. *Science Education, 86,* 572-590.

Van Driel, J. H., Verloop, N., & de Vos, W. (1998). Developing science teachers' pedagogical content knowledge. *Journal of Research in Science Teaching, 35,* 673–695.

Van Zee, E. & Minstrell, J. (1997). Using Questioning to Guide Student Thinking. Journal of the Learning Sciences, 6(2), 227-269, doi: 10.1207/s15327809jls0602_3

Veal, W.R. & MaKinster, J. G. (2001). PCK taxonomies. *Electronic Journal of Science Education, 3* (4).

Verloop, N., Van Driel, J., & Meijer, P. (2001). Teacher knowledge and the knowledge base for teaching. *International Journal of Educational Research, 35,* 441-461.

Verma, P. & Chabra, S. (1996). Application of Pedagogical Knowledge & Skills Acquired in teacher Training to School Teachers of Mathematics. In NCERT (Ed.), *Studies on Classroom Processes and School Effectiveness at Primary Stage.* New Delhi: NCERT, 406-425.

Watkins, D., Dahlin, B., & Ekholm, M. (2005). Awareness of the backwash effect of assessment: A phenomenon graphic study of the views of Hong Kong and Swedish lecturers. *Instructional Science, 33*, 283-309.

Watson, A. (2006). Some difficulties in informal assessment in mathematics. *Assessment in Education: Principles, Policy & Practice, 13*(3), 289-303, doi: 10.1080/09695940601035445

Weinstein, C. (2006). *Secondary classroom management lessons from research and practice*. Boston, USA: McGraw Hill.

Westerman, D. A. (1991). Expert and novice decision making. *Journal of Teacher Education, 42,* 292-305.

Westwood, P. (2004). *Effective teaching to reduce educational failure* (PhD Dissertation). University of Hong- Kong.

William, D. (2006). Formative Assessment: Getting the Focus Right. *Educational Assessment, 11*(3), 283-289.

Wilson, S., & Cameron, R. (1996). Student Teacher Perceptions of Effective Teaching: A Developmental Perspective. *Journal of Education for Teaching, 22,* 181-195. doi:10.1080/02607479620340

Yadav, S. K. (2012). *SSA Inset Packages in States: An Assessment*. National Council of Educational Research and Training. Retrieved from http://www.ncert.nic.in/departments/nie/dtee/publication/print_material/SSA%20INSET.pdf

Yara, P. O., & Wanjohi, W. C. (2011). Performance determinants of Kenya certificate of secondary education (KCSE) in the mathematics of secondary schools in Nyamaiya division, Kenya. *Asian Social Science, 7*(2), 107 – 112.

Yusof, Y. M. & Zakaria, E. (2010). Investigating secondary mathematics teachers' pedagogical content knowledge: a case study. *Journal of Education and Sociology*, 32 -39.

Zembal-Saul, C., Starr, M., & Krajcik, J.S. (1999). *Constructing a framework for elementary science teaching using pedagogical content knowledge.* In N. Lederman and J. Guess-Newsome (Eds.) Examining Pedagogical Content Knowledge. The Netherlands: Kluwer Academic Publishers, 237-256.

Zwozdiak-Myers, P. (2009). *An analysis of the concept of reflective practice and an investigation into the development of student teachers' reflective practice within the context of action research* (Doctoral dissertation). Brunel University.

Appendix I

Questionnaire for Teachers

"Relationship of Teacher Educators' Pedagogical Content Knowledge and Pedagogical Skills with Pedagogical Design Capacity"

The researcher of the above title solicits your cooperation and time in the completion of the questionnaire. All the information and data provided by you will be confidential and shall be only used for educational research purposes. No reference shall be made to any individual either in the analysis or inferences drawn from the survey.

Note: The following statements concern your perception of yourself in a variety of situations. Mark only one option according to your opinion.

Section A. Demographic Variables

1. Name of teacher: (Optional) _____

2. College/ University Name:

_____

3. Qualification:

(a) Academic: B.A/ B.Sc/ M.A/ M.Sc. Any other: _____

(b) Professional: B.Ed / M.Ed. Any other: _____

4. Pay scale: _____ 4. Total pay: _____ 5. Age: _____ years

5. Service experience:

0----5 years ☐ 6----10 years ☐ 11---15 years ☐

16----20 years ☐ 21years and above. ☐

6. Job status: Permanent ☐ Contract ☐

7. In service training: Yes / No

8. Gender: Male ☐ Female ☐

Key:

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

S. No.	Statements	1	2	3	4	5
Section B	**Pedagogical Content Knowledge** **1. Knowledge of subject-matter**					
	As a teacher I					
1.	Understand the central concepts of the subjects I am teaching.					
2.	Create detailed, sequential lesson plans.					
3.	Am confident about my command in the subject matter.					
4.	Can deliver my subject matter confidently					
5.	Have updated subject matter knowledge.					
6.	Have a command to explain concepts meaningfully.					
7.	Am able to relate concepts with everyday life experiences.					
8.	Can correlate examples with the subject matter.					
9.	Am able to give details of procedures accurately in subjects.					
10.	Am able to guide students to draw conclusions based on scientific procedures.					
11.	Am able to instill positive scientific attitudes in my teaching.					
12.	Am able to develop students thinking skills.					
13.	Am able to guide students to define and pronounce different terminologies correctly.					
14.	Am able to draw relationships between the subject matter and daily life examples (making connection between concepts).					
15.	Am able to use various resources that are available in University/ College.					
16.	Am able to use various resources that are available in and around University/ college efficiently.					
	2. Knowledge of Pedagogy					
	As a teacher I					
17.	Can deliver my lesson in a variety of ways for my students					
18.	Am able to develop instructional material about subject easily.					
19.	Can adapt my teaching style for different learners.					
20.	Can prepare and use supplementary materials effectively.					

21.	Can design effective lesson introductions, transitions, pacing and closing					
22.	Am familiar with common student understandings and misconceptions.					
23.	Know how to organize, maintain and management classroom.					
24.	Know how to lead the child.					
25.	Know how to use teaching methods effectively					
Section C	**Pedagogical Skills** **1. Assessment and Evaluation**					
	As a teacher I					
26.	Have command on different types of assessments.					
27.	Monitor students effectively while taking their exams.					
28.	Provide feedback to students accordingly.					
29.	Assign appropriate learning tasks related to subject demand.					
30.	Assess students' understanding in subject matter.					
31.	Use various measuring techniques for assessment.					
32.	Use content management skills.					
33.	Use effective teaching approaches to guide student thinking and learning in the subject.					
34.	Am ready to adapt teaching resources which are based on students' learning needs.					
	2. Control and Discipline					
	As a teacher I					
35.	Maintain order and discipline in the classroom.					
36.	Detect and tackle with respect the differences of opinions among students					
37.	Treat all students with respect and concern					
38.	Encourage discussions in the classroom with respect to the difference of opinion.					
39.	Make students partners in setting the classroom rules and regulations					
40.	Sympathize with students and meet their needs when asked for help.					
41.	Try my level best to exhibit a role model to the students					
42.	Can use ICT for making my lectures effective.					

Appendix II

Observational Checklist for Teachers

(For Pedagogical Design Capacity)

Section A- Demographic Variables

1. **Name of Teacher: -**

   _____

2. **Name of college/ University:**

   _____

3. **Date of Observation:** _____
4. **Subject Name:** _____
5. **Class:** _____
6. **Starting Time:** _____
7. **Ending Time:** _____
8. **Observation session:** _____

Key: 1 = Seldom, 2 = Often, 3 = frequently, 4 = Always

S. No.	Statement	1	2	3	4
	Section B **1. Domain Representations**				
1	Dresses appropriately				
2	Greets the students warmly.				
3	Uses a voice loud and clear enough to hear easily.				
4	Pronounces words clearly				
5	Varies voice pitch and tone				
6	Feels shame, hyperactivity				
7	Faces class while speaking				
8	Exhibits facial gestures or expressions (smiles)				
9	Performs movement in class				
	1. Delivery of Lesson				
10	Begins lesson with a review of previous knowledge.				
11	Explains clearly the content and the objectives of the material at the beginning of the class				
12	Covers all the area needed				
13	Starts and ends the lesson at the right time				
14	It provides a consistently well-planned sequence of appropriate instructional strategies.				
15	Attending lessons in a timely manner				

16	Makes sure that all students understand the subject matter				
17	Prepares lessons very effectively.				
18	Guides students to resource learning				
19	Uses a variety of nontraditional instructional methods				
20	Uses a variety of appropriate strategies to facilitate higher-order thinking skills				
21	Motivates through instruction and presentation				
	3. Strategies and Skills				
22	Carefully directs and explains expectations				
23	Uses effective questioning				
24	Summarizes lesson				
25	Use of audiovisual aids.				
26	Makes sure materials could be read easily from where the student is sitting.				
27	Has a concluding activity				
28	Correlates lesson with other subjects				
29	Meets objectives				
30	Stays on topic				
	4. Student Engagement				
31	Creates interest in students.				
32	Encourages class participation				
33	Respects students				
34	Listens to students				
35	It gives students opportunities to choose appropriate activities.				
36	Helps students when needed				
37	Does not embarrass				
38	Does not argue with students				
39	Does not tolerate or dwell on inappropriate behavior				
	5. Goals and Beliefs				
40	Exhibits modesty in knowledge				
41	Accepts objective critique				
42	Teacher's words and actions match				
43	It does not discuss personal life or personal matters with students.				
44	Enthusiastic about his/her teaching				
45	Maintains the respect of the students				
46	Is approachable to students at any time and willing to help				

Appendix III

Questionnaire about Pedagogical content knowledge and pedagogical skills (for students)

A study about teacher educators' pedagogical knowledge and skills with pedagogical design capacity

The researcher of the above title solicits your cooperation and time in the completion of the questionnaire. All the information and data provided by you will be confidential and shall be only used for educational research purposes. No reference shall be made to any individual either in the analysis or inferences drawn from the survey.

Section A

Note: Mark only one option according to your opinion.

Name: _____

Program: _____

College / University Name:

_____

Key:

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

S. No.	Statements	1	2	3	4	5
Section B	**Pedagogical Content Knowledge** **1. Knowledge of subject-matter**					
	My teachers					
1.	Understand the central concepts of the subjects they teach.					
2.	Create detailed, sequential lesson plans.					
3.	Are confident about their command in the subject matter.					
4.	Can deliver their subject matter confidently					
5.	Have updated subject matter knowledge.					
6.	Have a command to explain concepts meaningfully.					
7.	Are able to relate concepts with everyday life experiences.					
8.	Can correlate examples with the subject matter.					
9.	Are able to give details of procedures accurately in subjects.					
10.	Are able to guide students to draw conclusions based on scientific procedures.					
11.	Are able to instill positive scientific attitudes through their teaching.					
12.	Are able to develop students thinking skills.					

13.	Are able to guide students to define and pronounce different terminologies correctly.					
14.	Are able to draw relationships between the subject matter and daily life examples (making the connection between concepts).					
15.	Are able to use various resources that are available in University/ College.					
16.	Are able to use various resources that are available around the University/College efficiently.					
	2. Knowledge of Pedagogy					
	My teachers					
17.	Can deliver the lesson in a variety of ways					
18.	Are able to develop instructional material about the subject easily.					
19.	Can adapt their teaching style for different learners.					
20.	Can prepare and use supplementary materials effectively.					
21.	Can design effective lesson introductions, transitions, pacing and closing					
22.	Are familiar with common student understandings and misconceptions.					
23.	Know how to organize, maintain and manage the classroom.					
24.	Know how to lead the child.					
25.	Know how to use teaching methods effectively					
Section C	**Pedagogical Skills** **1. Assessment and Evaluation**					
	My teachers					
26.	Have command on different types of assessments.					
27.	Monitor students effectively while taking their exams.					
28.	Provide feedback to students accordingly.					
29.	Assign appropriate learning tasks related to subject demand.					
30.	Assess students' understanding in subject matter.					
31.	Use various measuring techniques for assessment.					
32.	Use content management skills.					
33.	Use effective teaching approaches to guide student thinking and learning in the subject.					
34.	Are ready to adapt to teaching resources that are based on students' learning needs.					
	2. Control and Discipline					
	My teachers					
35.	Maintain order and discipline in the classroom.					
36.	Detect and tackle with respect the differences of opinions among students					
37.	Treat all students with respect and concern					
38.	Encourage discussions in the classroom with respect to the difference of opinion.					

39.	Make students partners in setting the classroom rules and regulations					
40.	Sympathize with students and meet their needs when asked for help.					
41.	Try their level best to exhibit a role model to the students					
42.	Can use ICT for making their lectures effective.					

Appendix IV

List of all Public Universities of Punjab

- **Population of students and teachers of Universities (2015-16)**

S.No	Name of Universities	Teachers	Students in Department of Education	Class wise (M.A/B.Ed)
1.	Bahauddin Zakariya University (BZU), Multan	13	1426	65
2.	Fatima Jinnah Women University (FJWU), Rawalpindi	12	674	57
3.	Government College University (GCU), Faisalabad	09	1553	73
4.	Government College University (GCU), Lahore	11	962	87
5.	Islamia University, Bahawalpur	12	1289	53
6.	University of Arid Agriculture, Murree Road, Rawalpindi	10	678	58
7.	University of Education, Lahore	07	1536	60
8.	University of Gujrat , Gujrat	10	948	65
9.	University of Sargodha, Sargodha	09	745	54
10.	University of the Punjab	07	1354	85
11.	Government College Women University, Faisalabad	07	638	85

Appendix V

- **Population of students and teachers of GCET Punjab (2015-16)**

S.NO	Cities	Teachers	Students (B.Ed.)
1	Faisalabad	16	112
2	Gujranwala	13	87
3	Jhang	7	38
4	Khushab	12	121
5	Lahore	25	173
6	Pasroor	10	72
7	Chiniot	9	45
8	Shaikhupura	13	64
9	Sargodha	7	54