

**THE EFFECTS OF TEACHER'S PEDAGOGICAL CONTENT KNOWLEDGE  
ON STUDENTS' ACHIEVEMENT IN MATHEMATICS**

**A**

**THESIS**

**BY**

**SACHI KUMAR CHAUDHARY**

**FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF MASTER'S DEGREE IN MATHEMATICS EDUCATION**

**SUBMITTED TO**

**DEPARTMENT OF MATHEMATICS EDUCATION**

**CENTRAL DEPARTMENT OF EDUCATION**

**UNIVERSITY CAMPUS, KIRTIPUR**

**KATHMANDU, NEPAL**

**2018**

**EFFECTS OF PEDAGOGICAL CONTENT KNOWLEDGE ON  
STUDENTS' ACHIEVEMENT**

**A**

**THESIS**

**BY:**

**SACHI KUMAR CHAUDHARY**

**FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF MASTER OF EDUCATION**

**SUBMITTED TO:**

**DEPARTMENT OF MATHEMATICS EDUCATION**

**CENTRAL DEPARTMENT OF EDUCATION**

**UNIVERSITY CAMPUS**

**TRIBHUVAN UNIVERSITY**

**KIRTIPUR, KATHMANDU**

**2018**

## LETTER OF CERTIFICATE

This is certify that Mr. Sachi Kumar Chaudhary a student of academic year 2070/71 with Campus Roll No: 626, Thesis number 1292, Exam Roll No: 280513 and T.U. registration number 9-2-447-68-2008 has completed this thesis under my supervision and guidance during the period prescribed by the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. This thesis entitled on **“The Effects of Teacher's Pedagogical Content Knowledge on Students' Achievement in Mathematics”** has been prepared based on the results of his investigation conducted during the prescribed period under the Department of Mathematics Education, Central Department of Education, University Campus, Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward that his thesis be submitted for the evaluation as the partial requirements to award the degree of Master of Education.

.....  
(Assoc. Prof. Laxmi Naryan Yadav)

Head

Date: .....

## RECOMMENDATION FOR ACCEPTANCE

This is to certify that Mr. Sachi Kumar Chaudhary has completed his M. Ed. thesis entitled **The Effects of Teacher's Pedagogical Content Knowledge on Students' Achievement in Mathematics at Grade IX** under my supervision during the period prescribed the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize final viva-voce.

.....

(Ms Sarala Luitel)

Supervisor

Date: .....

**LETTER OF APPROVAL**

This thesis entitled "**The Effects of Teacher's Pedagogical Content Knowledge on Students' Achievement in Mathematics**" submitted by Mr. Sachi Kumar Chaudhary in partial fulfillment of the requirements for the Master's Degree in Education has been approved.

Viva Voce Committee

Signature

Assoc. Prof. Laxmi Narayan Yadav

.....

(Chairman)

Prof. Dr. Bishnu Prasad Dhungana

.....

(External)

Ms Sarala Luitel

.....

(Supervisor)

Date: .....

## ACKNOWLEDGEMENTS

My first obligation is to the Department of Mathematics Education T.U., Kirtipur for providing me an opportunity to do a thesis on the topic of “The Effects of Teacher's Pedagogical Content Knowledge on Students Achievement in Mathematics”.

I would like to express my sincere thanks, gratitude and gratefulness to my thesis supervisor Ms Sarala Luitel who provided me ideas, guidance, advice, mentoring, encouragement and feedback throughout my research study. Without her encouragement, advice, motivation, and support, this research study would not have been possible.

Similarly, I would like to express my sincere gratitude to Assoc. Prof. Laxmi Narayan Yadav, Head of the Department of Mathematics Education, Prof. Dr. Hari Prasad Upadhyay, Prof. Dr. Min Bahadur Shrestha, Mr. Abatar Subedi, Mr. Bed Prasad Dhakal, Mr. Krishna Adhikari, Mr. Deepak Mainali and all the respected Professors, Readers and Lecturers of Department of Mathematics Education, FOE TU for academic inspiration, encouragement, supports and suggestions as well as to complete this thesis.

I would also like to thanks the principal, mathematics teachers and students of sampled school family for their help during the data collection period and participated throughout my study. Without their participation and support my research study would not have been possible.

Finally, I would like to thank to my family who always their being for me and my deepest appreciation to my all friends especially Mr Janardan Chaudhary, Dhirendra Chaudhary, Yogesh Chaudhary and Jitbahadur Chaudhary for their collaborative supports and encouragements.

.....  
Sachi Kumar Chaudhary

© 2018

Copyright by Sachi Kumar Chaudhary

This document is copyright material. Under law, no parts of  
this document may be reproduced without the expressed  
permission of the researcher.

Defense Date: 26/02/2017

All Right Reserved

## **DEDICATION**

This study is affectionately dedicated to my parents



## DECLARATION

This thesis contains no material which has been accepted for the award of other degree in any institutions. To the best of knowledge and belief this thesis contains no material previously published by any authors except due acknowledgement has been made.

.....

(Sachi Kumar Chaudhary)

Date: .....

## ABSTRACT

This study focused on the effect of teacher's pedagogical content knowledge on students' achievement in mathematics of grade IX students of Rautahat district. The objectives of this study were to compare the achievement of students taught by teacher having PCK and teacher without having PCK and to explore classroom behavior of teacher having PCK and teacher without having PCK. This study is based on mixed research design. For quantitative data, 30/30 students taught by teacher having PCK and teacher without having PCK were taken from the annual results of each year 2070, 2071 and 2072. In this way, 90/90 students of both teachers having Roll No. 1-30 were selected for the study. For qualitative data, the researcher selected two teachers, one having PCK and another without having PCK. The qualitative data was collected from interview and class observation of the sample teachers. Mean, standard deviation and z-test were used for the analysis of quantitative data and the qualitative data analyzed by thematic approach method.

In comparison, teacher having PCK has more knowledge about the organization of lesson, management of classroom environment, understanding of student psychology, skill to use teaching materials, skill to use teaching methods and use of student evaluation than the teacher without having PCK. Also its implementation side of teacher having PCK is better than the teacher without having PCK. It means that the pedagogical content knowledge and its implementation side of teacher having PCK is better than the teacher without having PCK. Also according to the annual result of combined three years 2070, 2071 and 2072, the mean of the achievement scores of the students taught by teacher having PCK and teacher without having PCK are 66.56 and 51.56 respectively and the calculated z-value is 6.56 which

is greater than the critical value  $z_{0.05} = 1.645$ . That means the achievement of students taught by teacher having PCK is higher than the achievement of students taught by teacher without having PCK and there is significance difference between the achievement of students taught by teacher having PCK and teacher without having PCK. From this, it was declared that the achievement of students taught by teacher having PCK became higher than the achievement of students taught by teacher without having PCK due to the pedagogical content knowledge. Hence the researcher concluded that teacher's pedagogical content knowledge affects on the achievement of students and play a vital role to deliver PCK in their teaching.

## TABLE OF CONTENTS

	<b>Page No</b>
<i>Letter of Certificate</i>	<i>i</i>
<i>Letter of Approval</i>	<i>ii</i>
<i>Recommendation for Acceptance</i>	<i>iii</i>
<i>Acknowledgement</i>	<i>iv</i>
<i>Copy Rights</i>	<i>v</i>
<i>Abstract</i>	<i>vi</i>
<i>Dedication</i>	<i>viii</i>
<i>Declaration</i>	<i>ix</i>
<i>Table of Contents</i>	<i>x</i>
<i>List of Tables</i>	<i>xiii</i>
<i>List of Figures</i>	<i>xiv</i>
<i>Abbreviations</i>	<i>xv</i>
<b>Chapters</b>	
<b>I. INTRODUCTION</b>	<b>1-9</b>
Background of the Study	1
Pedagogical content knowledge	3
Mathematical content Knowledge	4
Teachers Influences on Teaching	5
Statement of the Problem	5
Objectives of the Study	6
Research Questions	6
Significance of the Study	6
Research Hypothesis	7

Statistical Hypothesis	7
Delimitation of the Study	7
Definition of Related Terms	8
<b>II. LITERATURE REVIEW</b>	<b>10-23</b>
Empirical Literature	10
Current Conceptualization of Teachers' Pedagogical Content Knowledge in Mathematics	16
Conceptual Framework	19
Organization of Lesson	21
Management of Classroom Environment	21
Understanding of Students' Psychology	21
Skill to Use Teaching Materials	21
Skill to Use Teaching Method	22
Use of Student Evaluation	22
<b>III. METHODS AND PROCEDURES</b>	<b>23-26</b>
Research Design	23
Population of the Study	24
Sample of the Study	24
Data Collection Tools	24
Class Observation Form	24
Interview Schedule	24
Data Collection Procedure	25
Data Analysis Procedure	26
<b>IV. ANALYSIS AND INTERPRETATION</b>	<b>27-51</b>
Comparison of Achievement Scores of Students Taught by Teacher having PCK and Teacher without having PCK, Obtained from the Annual Result of the Year 2070	28

Comparison of Achievement Scores of Students Taught by Teacher having PCK and Teacher without having PCK, Obtained from the Annual Result of the Year 2071	30
Comparison of Achievement Scores of Students Taught by Teacher having PCK and Teacher without having PCK, Obtained from the Annual Result of the Year 2072	33
Comparison of Achievement Scores of Students taught by Teacher having PCK and Teacher without having PCK, Obtained from the Annual Result of the Three Years 2070, 2071, 2072	36
Analysis and Interpretation of Qualitative Data	38
Management of Classroom Environment	41
Understanding of Students' Psychology	43
Use of Teaching Materials	45
Use of Teaching Method	47
Use of Student Evaluation	49
<b>V. SUMMARY, FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS</b>	<b>52-56</b>
Summary of the Study	52
Findings	53
Conclusion	54
Recommendations	55
Implications	56
<b>References</b>	
<b>Appendices</b>	

## LIST OF TABLES

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
4.1	Achievement of students taught by teacher having PCK and teacher without having PCK	28
4.2	Achievement of students taught by teacher having PCK and teacher without having PCK	31
4.3	Achievement of students taught by teacher having PCK and teacher without having PCK	33
4.4	Achievement of students taught by teacher having PCK and teacher without having PCK	36
4.5	Condition of organization of lesson	39
4.6	Condition of management of classroom environment	41
4.7	Condition of student understanding	43
4.8	Condition of use of teaching materials	45
4.9	Condition of use of teaching methods	48
4.10	Condition of the use of evaluation	50

## LIST OF FIGURES

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
4.1	Mean, SD and coeff of variance of achievement scores of students taught by teacher having PCK and teacher without having PCK.	29
4.2	Mean, SD and coeff of variance of achievement scores of students taught by teacher having PCK and teacher without having PCK.	32
4.3	Mean, SD and coeff of variance of achievement scores of students taught by teacher having PCK and teacher without having PCK	35
4.4	Mean, SD and coeff of variance of achievement scores of students taught by teacher having PCK and teacher without having PCK	37



## ABBREVIATIONS

B. A.	: Bachelor of Arts
B. Ed.	: Bachelor of Education
B. Sc.	: Bachelor of Science
CCK	: Common Content Knowledge
CERID	: Research Centre for Educational Innovation and Development
FGD	: Focus Group Discussion
FOE	: Faculty of Education
HCK	: Horizon Content Knowledge
ICS	: Institute of Community Service
KCS	: Knowledge of Content and Students
KCT	: Knowledge of Content and Teaching
KCC	: Knowledge of Content and Curriculum
MCK	: Mathematical Content Knowledge
MKT	: Mathematical Knowledge for Teaching
MOE	: Ministry of Education
NCED	: National Center for Educational Development
NELS	: National Education Longitudinal Study
PCK	: Pedagogical Content Knowledge
SCK	: Specialized Content Knowledge
SMK	: Subject Matter Knowledge
T. U.	: Tribhuvan University