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**Computer-based Collaborative Concept Mapping:
Motivating Indian Secondary Students
to Learn Science**

A thesis presented in partial fulfilment of the requirements for the degree of

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in

Education

at

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Dedication

Dedicated to my Dad

who,

Lit the fire of learning in me;

Provided this opportunity to gain ‘some knowledge’;

and

Endlessly inspired me to

Excel personally and professionally.

Koti-koti dhanyawaad Pitaji!

and

Mum’s blessings are *beyond words*.

Abstract

This is a study of the design, development, implementation and evaluation of a teaching and learning intervention. The overarching aim of the study was to investigate the effectiveness of the intervention ‘Computer-based Collaborative Concept Mapping’ (CCCM) on Indian secondary students’ conceptual learning and motivation towards science learning. CCCM was designed based on constructivist and cognitive theories of learning and reinforced by recent motivation theories. The study followed a Design-based research (DBR) methodology. CCCM was implemented in two selected Indian secondary grade 9 classrooms. A quasi-experimental *Solomon Four-Group* research design was adopted to carry out the teaching experiment and mixed methods of data collection were used to generate and collect data from 241 secondary students and the two science teachers. The intervention was designed and piloted to check the feasibility for further implementation. The actual implementation of CCCM followed the pilot testing for 10 weeks. Students studied science concepts in small groups using the computer software *Inspiration*. Students constructed concept maps on various topics after discussing the concepts in their groups. The achievement test ATS9 was designed and administered as a pre-post-test to examine the conceptual learning and science achievement. Students’ responses were analysed to examine their individual conceptual learning whereas group concept maps were analysed to assess group learning. The motivation questionnaire *SMTSL* was also administered as a pre-post-test to investigate students’ initial and final motivation to learn science. At the end of the teaching experiment, the science teachers and two groups of students were interviewed. Analyses of the quantitative data suggested a statistically significant enhancement of science achievement, conceptual learning and motivation towards science learning. The

qualitative data findings revealed positive attitudes of students and teachers towards the CCCM use. Students and teachers believed that CCCM use could promote conceptual learning and motivate students to learn science. Both students and teachers preferred CCCM over on-going traditional didactic methods of teaching-learning. Some enablers and barriers identified by teachers and students in the Indian science classroom context are also explored and discussed. A framework for enhancing secondary school students' motivation towards science learning and conceptual learning is proposed based on the findings. The findings of the study also contribute to addressing the prevailing *learning crisis* in Indian secondary school science classrooms by offering CCCM an active and participatory instructional strategy as envisioned by the Indian National Curriculum Framework 2005.

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Undertaking research is usually not an easy endeavour. I believe that the doctoral research is the most difficult because this is the stage most doctoral students are confronted with the nature, structure, process and experience for the first time. Generally, a doctoral student enters the world of research inexperienced, with an excitement and a vision in mind to improve the situation. For me, the completion of this study involved a good amount of blood, sweats and tears, although all of them were not mine. I am indebted to those who shared this portion and acknowledge the care, support and help which I received from those ‘significant others’.

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Abbreviations used

ATS9	:	Achievement Test in Science, Grade 9
ASER	:	Annual Status of Education Report
CCM	:	Collaborative Concept Mapping
CCCM	:	Computer-based Collaborative Concept Mapping
DSEL	:	Department of School Education and literacy
GoI	:	Government of India
HOCS	:	Higher-order cognitive skills
IISER	:	Indian Institute of Science Education and Research
IISc	:	Indian Institute of Science
IIT	:	Indian Institute of Technology
INCF:	:	Indian National Curriculum Framwork
INSA	:	Indian National Science Academy
LOCS	:	Lowe-order cognitive skills
MHRD	:	Ministry of Human Resource Development
NAS	:	National Achievement Survey
NCERT	:	National Council of Educational Research and Training
NCFTE	:	National Curriculum Framework for Teacher Education
NCTE	:	National Council for Teacher Education
RAA	:	Rashtriya Avishkar Abhiyan (National Invention Campaign)

RMSA : Rashtriya Madhyamik Shiksha Abhiyan (National Secondary Education Campaign)

SSA : Sarv Shiksha Abhiyan (Education for All Campaign)