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

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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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Table of Contents

Dedication	ii
Abstract	iii
Acknowledgements	v
Table of Contents	vii
List of Tables.....	xii
List of Figures	xiii
Abbreviations used.....	xv
Chapter One. Introduction and Context	1
1.1. Introduction	1
1.2. The Indian Context.....	6
1.2.1. School education in India.....	8
1.2.2. The quality of education.....	9
1.2.3. Science education in India	12
1.2.4. School science curriculum	14
1.2.5. Methods of Instruction	15
1.3. Rationale of the study	16
1.4. Statement of problem	20
1.5. Objectives of the study	20
1.6. Significance of the study	21
1.7. Structure of the thesis	23
Chapter Two. Literature Review	25
2.1. Learning frameworks	25
2.1.1. Learning defined	25
2.1.2. An operational definition of learning.....	28

2.1.3.	Learning frameworks	29
2.1.4.	A suitable learning framework for the study	34
2.1.5.	Learning and motivation	35
2.2.	Motivation frameworks	37
2.3.	Motivation to learn	51
2.3.1.	Motivation to learn science	56
2.3.2.	An operational definition of motivation to learn science.....	58
2.4.	Meaningful learning	59
2.5.	Strategies for meaningful learning	61
2.5.1.	Concept mapping	66
2.5.2.	Collaborative concept mapping	74
2.5.3.	Computer-based concept mapping.....	78
2.5.4.	Computer-based collaborative concept mapping: The Intervention	80
2.6.	Overview of the Intervention	80
2.6.1.	Purpose.....	80
2.6.2.	Materials.....	81
2.6.3.	Classroom lessons	81
2.7.	Design of the intervention	82
2.7.1.	Theoretical framework.....	82
2.7.2.	Underpinnings.....	83
2.7.3.	Instructional and motivational components	83
2.8.	Conceptual framework	85
2.9.	Research Questions	88
2.10.	Hypotheses of the study	89
Chapter Three. Research Methodology		91
3.1.	Research in education.....	91
3.2.	Research paradigm	92

3.2.1.	Paradigm war and new paradigms	94
3.2.2.	The research approach.....	95
3.2.3.	Pragmatism and mixed methods	96
3.2.4.	Pragmatism as an appropriate paradigm	97
3.3.	Design-based Research methodology	100
3.3.1.	Meaning and definitions of design-based research	102
3.3.2.	Characteristics and process of design-based research.....	104
3.3.3.	Design-based research as a suitable methodology	107
3.4.	Research design	109
3.5.	Participants and sampling.....	114
3.6.	Data gathering instruments.....	115
3.6.1.	Achievement test in science	115
3.6.2.	Concept maps	120
3.6.3.	The Student motivation toward science learning questionnaire	120
3.6.4.	Semi-structured interviews.....	122
3.6.5.	Focus group discussion	123
3.7.	Research procedures	124
3.7.1.	Phase 1: Preparing for the experiment	125
3.7.2.	Phase 2: The Teaching Experiment.....	126
3.7.3.	Phase 3: Evaluation and Reflection	129
3.8.	Data analysis.....	130
3.8.1.	Data analysis from Solomon four-group design	130
3.8.2.	Achievement test data analysis	132
3.8.3.	Concept map data analysis	133
3.8.4.	The SMTSL questionnaire data analyses	133
3.8.5.	Analysis of interview and focus group data.....	133
3.9.	Ethical considerations.....	134

Chapter Four. Results.....	140
4.1. CCCM and science achievement.....	140
4.1.1. Equating the four groups.....	140
4.1.2. The 2x2 factorial ANOVA test	144
4.1.3. Main effects of the intervention	145
4.2. CCCM and conceptual learning	147
4.2.1. Results for questions that assess lower-order cognitive skills	148
4.2.2. Results for questions that assess higher-order cognitive skills	155
4.2.3. Individual and group conceptual learning.....	160
4.3. CCCM and students' motivation towards science learning	167
4.4. Science Teachers' Interview Results.....	174
4.4.1. Teachers' views of CCCM use in science teaching and learning	175
4.4.2. CCCM versus other methods of teaching	177
4.4.3. CCCM and conceptual learning.....	179
4.4.4. Effectiveness of CCCM in addressing misconceptions among students	181
4.4.5. CCCM and the classroom learning environment	183
4.4.6. Overall experience of using CCCM in science learning	187
4.4.7. Factors that support CCCM use in science teaching and learning.....	188
4.4.8. Barriers in using CCCM in science classrooms.....	190
4.5. Students' focussed group discussion results	192
4.5.1. Students' knowledge of concept mapping	193
4.5.2. Students' views about the use of concept mapping	194
4.5.3. CCCM and classroom learning environment.....	198
4.5.4. Factors affecting the CCCM use in science teaching and learning.....	202
4.6. Summary of teachers' and students' views	203
Chapter Five. Discussion	207
5.1. CCCM and science learning.....	207

5.1.1.	CCCM and science achievement	208
5.1.2.	CCCM and conceptual learning	211
5.1.3.	Possible explanations regarding the findings	212
5.2.	CCCM and motivation towards science learning	214
5.3.	Students' and teachers' views of CCCM use	217
5.3.1.	CCCM as a teaching, learning and assessment strategy	218
5.3.2.	CCCM and conceptual learning	221
5.3.3.	CCCM and classroom learning environments	223
5.3.4.	CCCM and teacher change.....	224
5.4.	Enablers and barriers to CCCM use in Indian classrooms	225
5.4.1.	Enablers to the CCCM use	225
5.4.2.	Barriers to CCCM use	227
Chapter Six. Conclusions and Implications		230
6.1.	Conclusions from the study	230
6.2.	Significance of the research.....	232
6.3.	Implications for practice	235
6.4.	Contribution to knowledge	236
6.4.1.	A framework for conceptual learning in science	238
6.5.	Methodological constraints and limitations	240
6.6.	Recommendations for further research	242
6.7.	Final thoughts	244
References		246
Appendices		288

List of Tables

Table 1-1 <i>Learning achievement at Elementary level</i>	18
Table 3-1 <i>ATS9 Blue Print: Chapter wise distribution of items according to cognitive process dimensions</i>	118
Table 3-2 <i>Taxonomy table for ATS9: Knowledge and cognitive process dimensions</i> ..	119
Table 3-3 <i>Description of SMTSL questionnaire items and scales with respect to the possible low, moderate and high motivation scores</i>	122
Table 4-1 <i>Descriptive statistics for the one-way ANOVA</i>	141
Table 4-2 <i>Results for multiple comparisons table (Tukey post hoc test)</i>	142
Table 4-3 <i>Descriptive statistics for the independent samples t-test</i>	143
Table 4-4 <i>Results for the independent samples t-test</i>	143
Table 4-5 <i>Results for the 2x2 ANOVA test</i>	144
Table 4-6 <i>Descriptive statistics for the independent samples t-test</i>	146
Table 4-7 <i>Results for the main effects of intervention test</i>	146
Table 4-8 <i>Descriptive statistics for the independent samples t-test for LOCS</i>	149
Table 4-9 <i>Results for the independent samples t-test for LOCS</i>	150
Table 4-10 <i>Percentages of responses for questions those assess LOCS</i>	151
Table 4-11 <i>Descriptive statistics for the independent samples t-test for HOCS</i>	155
Table 4-12 <i>Results for the independent samples t-test for HOCS</i>	156
Table 4-13 <i>Percentages of responses for questions that assess HOCS</i>	157
Table 4-14 <i>Descriptive statistics for the intervention and comparison groups</i>	168
Table 4-15 <i>Independent samples t-test results on SMTSL gain scores</i>	169
Table 4-16 <i>Descriptive statistics for the SMTSL component scores (pretest)</i>	170
Table 4-17 <i>Independent samples t-test results for the SMTSL components (pretest)</i> ...	171
Table 4-18 <i>Descriptive statistics for the SMTSL component scores (posttest)</i>	172
Table 4-19 <i>Independent samples t-test results for the SMTSL components (posttest)</i> ..	173

List of Figures

<i>Figure 2.1</i> A concept map that describes a concept map.....	67
<i>Figure 2.2</i> Conceptual framework of the study	87
<i>Figure 3.1</i> Crotty's theoretical grounding	94
<i>Figure 3.2</i> Generic model for conducting design-based research in education	105
<i>Figure 3.3</i> Dewey's Five-Step Model of Inquiry	108
<i>Figure 3.4</i> The generic intervention mixed methods design.....	111
<i>Figure 3.5</i> The Solomon four-group research design	112
<i>Figure 3.6</i> Quasi-experimental Solomon four-group research design of the study	113
<i>Figure 3.7</i> Focus of the Achievement test based on the revised Bloom's Taxonomy ..	117
<i>Figure 3.8</i> Students practicing and studying science content using CCCM in intervention schools	129
<i>Figure 3.9</i> Statistical analyses for Solomon four-group design	131
<i>Figure 4.1</i> A sample answer for the <i>proficient</i> category for item 11.....	152
<i>Figure 4.2</i> A sample answer for the <i>intermediate</i> category for item 11	152
<i>Figure 4.3</i> Some novice category sample answers for item 11	153
<i>Figure 4.4</i> A sample answer for the <i>proficient</i> category for item 19.....	153
<i>Figure 4.5</i> Some sample answers for the <i>intermediate</i> category for item 19	154
<i>Figure 4.6</i> Some sample answers for the <i>novice</i> category for item 19	154
<i>Figure 4.7</i> A sample answer for the <i>advanced</i> category for item 22.....	158
<i>Figure 4.8</i> A sample answer for the <i>proficient</i> category for item 22.....	159
<i>Figure 4.9</i> A sample answer for the <i>intermediate</i> category for item 22	159
<i>Figure 4.10</i> A sample answer for the <i>novice</i> category for item 22.....	160
<i>Figure 4.11</i> Concept map of Atoms and Molecules by group N students (<i>Intermediate</i> category).....	162
<i>Figure 4.12</i> Concept map of the Mole Concept by group T students (<i>Proficient</i> category)	164
<i>Figure 4.13</i> Concept map of Models of Atom by group N students (<i>Proficient</i> category)	165

<i>Figure 4.14</i> Concept map of Classification of Organisms by group T students (<i>Proficient</i> category)	166
<i>Figure 5.1</i> Teachers' and students' views of CCCM use in secondary science	218
<i>Figure 6.1</i> A Framework for Conceptual Learning at Secondary Stage of Science.....	239

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)