8

An Investigation into the Conceptual Understanding of Students in the Light of Thinking Skills Approach

S.V. Sharma, S. Yadav, K.B. Rath, Ram Niwas, A. Horo, Rana Pratap*

Abstract

A study entitled 'An Investigation into the Conceptual Understanding of Students about the Subject Content in the Light of Thinking Skills Approach at Primary Level' has been conducted on students of schools of experimental and control groups. Analysis of the data through both qualitative and quantitative approaches shows performance of students of experimental group is better as compared to control group in Hindi, English, EVS and Mathematics subjects. It is envisaged that teaching-thinking skills by infusing it across curricular areas may be made an integral part of teaching-learning process in today's scenario to help students in becoming innovative problem-solvers, constructors of knowledge, thoughtful decision makers, independent thinkers and life-long learners. Present practices of designing lesson planning can be modified so as to integrate various components of thinking skills leading to create thinking classrooms.

Introduction

In recent years, there has been growing interest and much research into the ways of developing children's thinking and learning skills. Most of the educators now agree that learning to think is among the most desirable goals of formal schooling. They agree that it is, in fact, possible to increase students' creativity and innovation, critical thinking, problem-solving, communication and collaboration capability through instruction and practice. Several promising approaches have been developed to foster thinking skills in students. These approaches fall mainly into three categories viz., independent or separate programmes, subject or domain-specific programmes and infused programmes (across-the-curriculum approach). However, several documents in the literature of thinking skills offer support for

* Regional Institute of Education, NCERT, Ajmer

infusion of thinking skill activities into subjects in the regular curriculum. In a recent analysis, Bernard *et al.* found that mixed instructional approach that combine both content and critical thinking instruction significantly outperformed all other types of instruction. It has also been found that while developing critical thinking skills among the students, pedagogy matters and collaborative learning conditions have some advantages. Newton and Newton has measured the impact of thinking skills approach in terms of those aspects of classroom interaction known to support conceptual understanding in learners such as the quantity and quality of people talk, pupil to pupil mediation and types of teacher question etc. So in this context each school system must determine what makes the most sense given their unique circumstances. Whatever approach is adopted, the methodology must ensure that the 21st century skills are meaningful to all types of learner and learning transfers beyond the context in which it occurs. Educators are not alone in their concern about the urgency of teaching and learning of different thinking skills. Various organisations and government all over the world are now more concerned than ever to promote life skills needed in fast changing world. It is now realised that 'higher order thinking skills' are required, in addition to basic skills, because individuals cannot 'store' sufficient knowledge in their memories for future use. In England the revised National Curriculum included thinking skills in its rationale, stating that thinking skills are essential in 'learning how to learn'. In the United States, "a national survey of employers, policy makers, and educators found consensus that the dispositional as well as the skills dimension of critical thinking should be considered an essential outcome of a college education". The Conference Board of Canada expressed the need for Canadians to improve critical thinking skills to strengthen Canada's innovation profile and competitive advantage in the knowledge-based global economy. In recent years, a number of articles, books, reports, seminars have highlighted the importance of 'Higher Order Thinking (HOT) skills' and hence appear in the support of teaching thinking. In India, the *National Curriculum Framework* has strongly advocated the development of life skills such as critical thinking skills, interpersonal communication skills, decision-making/problem-solving skills, and coping and self-engagement skills is very critical for dealing with demands and challenges of everyday life. Many teachers now admit this fact that 'teaching for thinking' and 'quality learning' is desirable. If we accept that we need to prepare our students to a greatly different future than we have known, then our understanding of the focus of education also needs to shift. This includes shift in the role of learner and teachers and changes in their teaching practices and corresponding shifts in assessment.

To become a thinking school, a whole school approach will be necessary whereby all stakeholders are fully committed to the school's aims and how they can best be achieved. Staff will need to be specially trained and methods will need to be introduced into the curriculum for teaching the skills of thinking, and associated cognitive and meta-cognitive strategies. In the 'knowledge society' of 21st century, the idea of thinking children, thinking classrooms, and thinking schools is essential to achieve the mission of education. Keeping above in view, the present study entitled 'An Investigation into the Conceptual Understanding of Students about the Subject Content in the Light of Thinking Skills Approach at Primary Level' has been conducted in two CBSE-affiliated schools of Ajmer district of Rajasthan. The state aims to promote the thinking skills such as critical thinking, analytical thinking, reflective thinking, integrative thinking and creative thinking of students at primary level.

Objectives

- To develop instructional materials, strategies and activities (i.e., thinking lessons, thinking tools); to use and to integrate it into the classroom to teach different thinking skills viz., critical thinking, analytical thinking, reflective thinking, integrative thinking and creative thinking by the primary teachers.
- To examine the feasibility of instructional materials, strategies and activities in enhancing different thinking skills in present time-frame of primary school.
- To train and equip primary school teachers with innovative instructional strategies and assessment techniques to promote and assess students' learning growth at primary level.
- To see the effect of thinking skills approach on students' conceptual understanding about the content of Hindi, English, EVS and Mathematics subjects.

Research Questions

- What types of methods, strategies, activities (in school both inside or outside the classroom), interactions, communications and assessment techniques did the teacher practice and integrate into everyday teaching to create thinking classrooms and ultimately thinking schools?
- To what extent such practices affect various thinking, meta-cognitive and social skills?
- To what extent these skills affect the performance of students during continuous and comprehensive evaluation process?
- To what extent this approach is feasible for teachers in infusing current curriculum transaction process?

Methodology, Design, Sample and Research Tools

The quasi-experimental pre-test, post-tests control group design was chosen to coduct the present study on

the students of Class V of schools of experimental and control groups. The study purports to find out the effect of innovative instructional material, strategies and activities on different thinking skills of students of primary schools. The sample was collected from the two primary CBSE-affiliated schools of Ajmer district of Rajasthan. One of them was Demontration Multipurpose (DM) School, Ajmer and other one was Kendriya Vidyalaya (KV)-I, Ajmer. DM School, Ajmer was taken as experimental group and KV-I, Ajmer was taken as control group. Primary school teachers of experimental group were oriented regarding the innovative instructional strategies and approaches and assessment techniques with a view to promote and monitor thinking skills of the students, whereas the teachers of control group were not oriented regarding aforesaid. In order to stimulate students' thinking and develop their social skills during both inside and outside the classroom, different activities like poster making on different themes of Hindi, English, EVS and Mathematics subjects for Class V (outside the classroom) and worksheets on different themes of Hindi, English, EVS and Mathematics subjects (inside the classroom) were placed for the students so that they could work individually or in group in the school whenever they get time. Finally, before the conduction of the experiment, students of Class V of experimental group and control group were oriented regarding the use of different graphic organisers. After this, thinking based test items in the form of research tools for pre-tests and post-tests were developed and administerd on the students of Class V in respect of Hindi, English, EVS and Mathematics subjects of schools of both the groups. After collection of the data, a minute analysis was carried out through both qualitative and quantitative approaches. Size of the sample was 34 and 35 in experimental group and control group, respectively.

Instructional Materials

Innovative instructional materials in respect of Hindi, English, EVS and Mathematics subjects were developed by the experts and practicing teachers in workshop mode. They developed subject-wise instructional materials and strategies (i.e., thinking lessons and thinking tools) to teach different thinking skills viz., critical thinking, analytical thinking, reflective thinking, integrative thinking and creative thinking in the classroom situation with existing curriculum time-frame. Details of instructional materials, strategies, tools and classrooms activities (inside and outside) are given in reference. Teachers of experimental group have used these materials, strategies, tools and activities in their teaching-learning process. Students' involvement in one of the activities conducted by a teacher of experimental group during teaching-learning process is delineated as follows:

Data Analysis

Innovative instructional materials, strategies, tools and activities (for inside and outside classroom activities) in respect of Hindi, English, EVS and Mathematics subjects were used during teaching-learning process by the teachers in the school of Experimental Group (EG). Teachers of primary school of experimental group were oriented regarding the instructional strategies and assessment techniques with a view to promote and monitor thinking skills of the students of Class V. Finally, before the conduction of the experiment, the students of Class V of experimental group and control group were oriented regarding the use of different graphic organisers. After this, thinking based test items for different test levels (pre-test to post-tests) research tools were administered on students of both the groups in respect of Hindi, English, EVS and Mathematics subjects for Class V. It is, worthwhile to mention over here that the teachers of school of control group did not use innovative instructional materials developed by us for the classroom transaction. Afterward, quantitative and qualitative analysis of the data was carried out. Responses of the students of both the groups were categorised into three categories, viz., Acceptable Responses (AR), Unacceptable Responses (UAR) and Not Responded Responses (NR). Analysis of the data in terms of percentage of average accepted responses of students of experimental group and control group for Hindi, English, EVS and Mathematics subjects has been carried out and percentages of average accepted responses of students of both groups were calculated and their respective graphical representations are shown in Figures 1-4 for Hindi, English, EVS and Mathematics subjects. Primarily attention was focused to accepted responses of students of both the groups.

Implications

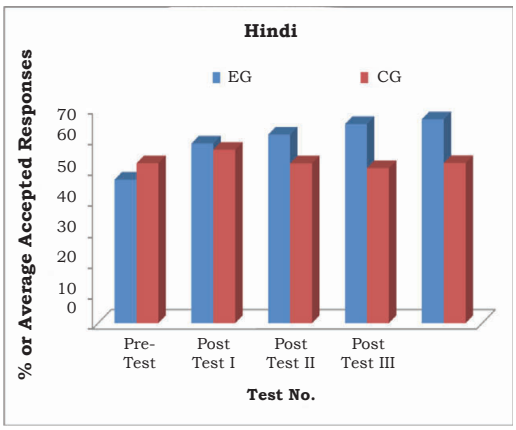

Fig. 1 Percentage of average accepted responses of students of Class V: Hindi

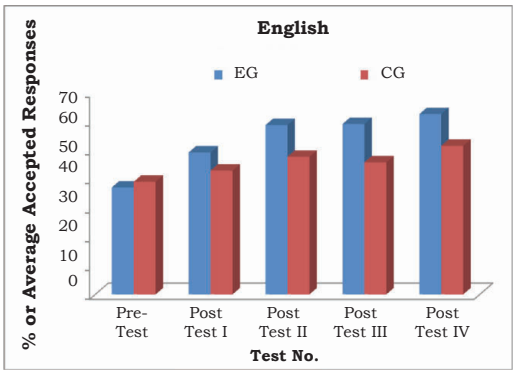

Fig.2 Percentage of average accepted responses of students of Class V: English

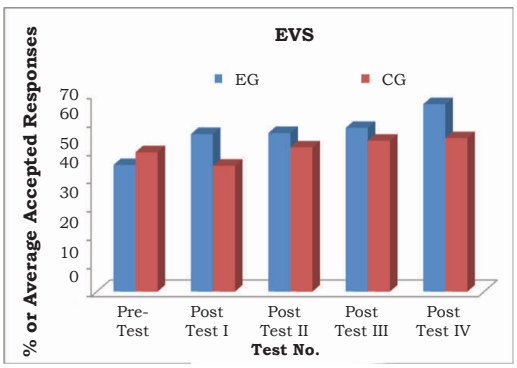

Fig. 3 Percentage of average accepted responses of students of Class V: EVS

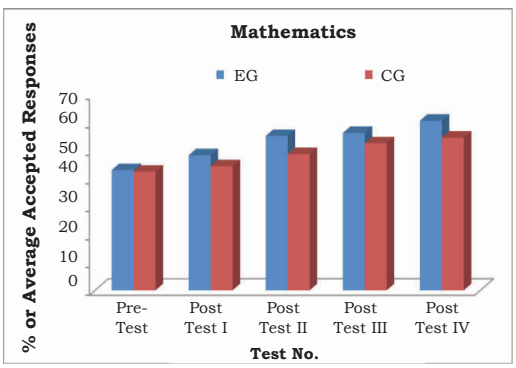

Fig. 4 Percentage of average accepted responses of students of Class V: Mathematics

It is evident from the Figures 1-4 that performance of the students of control group is better in all the pre-tests administered on the students of Class V, whereas the performance of students of experimental group is better in all the post-tests administered on the students of Class V (Figures1-4). Quantitative and qualitative analysis of the data of experimental and contol groups shows that threre exists a difference in performance of students of two groups in all the subjects (Hindi, English, EVS and Mathematics, Class V) at primary level. Students of contol group performed better in all the pre-tests administered on them. Performance of students of experimental group is found to be better in all the post-tests administered on them. There is an increase in the average percentage of accepted responses of the students. However, it is in larger proportion to the students of experimental group. It was noticed that most of the questions based on higher order thinking were remain unresponded in case of contol group whereas experimental goup attempted these questions and responded most of them correctly. This forms a strong background to make use of the innovative instructional materials and strategies, and inside and outside classroom activities during the teaching-learning process. It is, worthwhile, to mention here that in school of experimental group teachers have used innovative instructional materials developed on subjects Hindi, English, EVS and

Mathematics for Class V and inside and outside classroom activities and strategies during the teaching-learning process. Also primary school teachers of experimental group were oriented regarding the use of instructional materials and strategies and assessment techniques using graphical tools with a view to promote and monitor thinking skills of the students. As a result of the orientation, all the teachers of primary section of school of experimental group designed thinking based test items in the respective subjects that (Hindi, English, EVS and Mathematics) that they teach for the summative assessment i.e., first term, second term and final term of students of Class V). In order to stimulate students' thinking and develop their social skills during both inside and outside the classroom, different activities like poster making on different themes of Hindi, English, EVS and Mathematics for Class V (outside the classroom) and worksheets on different themes of Hindi, English, EVS and Mathematics (inside the classroom) were placed for the students so that they could work individually or in group in the school whenever they get time. In addition to this, audio-video recording of the teachers transacting subject content using innovative approaches in the classroom (in primary section of school of experimental group and video recording of students of Class V working outside the classroom has been done. Also feedback from the students and teachers has been collected. Accordingly additional input to the teachers was given.Whereas in the school of Control Group (CG) neither teacher used exemplar instructional materials for transaction of content of Hindi, English, EVS and Mathematics subjects nor they were oriented regarding aforesaid. Keeping aforesaid in view, the following recommendations are made:

- The school is one of the places where children are supposed to learn, to think and get various platforms which enable them to make full use of their potential. In today's fast changing world, where progress and advancement is going on at a rapid pace, one can-not, therefore, afford to be lagged behind. Hence, they look for a school which boasts of innovative ways of teaching, where learners at the end of the school days feel that they are ready to face the challenges of the 21st century. It is, therefore, recommended that learners must be equipped with thinking skills such as critical thinking, analytical thinking, reflective thinking, integrative thinking and creative thinking, innovation, problem solving, communication and collaboration which can help them to become innovative problem-solver, constructors of knowledge, thoughtful decision-maker, independent thinker and life-long learner.
- As teachers/ teacher educators,the challenge is to match the needs of the learners to a world that is

changing with rapid pace. To meet this challenge, there is a need to become strategic learners. It is, therefore, suggested that teachers should act as strategic learners by deliberately expanding perspectives and updating their approaches.

- Most of the teachers and teacher educators now agree that learning to think is among the most desirable goal of formal schooling and it is, in fact, possible to increase learners' creativity and innovation, critical thinking and problem-solving, communication and collaboration capability through instruction and practice. It is, therefore, recommended that innovative approaches/models/ infused programmes (across the curriculum approach) have to be developed to foster thinking skills in the students.
- It is now realised that 'higher-order thinking skills' are required, in addition to basic skills, because individuals cannot 'store' sufficient knowledge in their memories for future use. Information is expanding at such a rate that individuals require transferable skills to enable them to address different problems in different context, at different times throughout their lives. It is, therefore, recommended that the curriculum for school education should emphasise on 'higher-order thinking (HOT) skills' in its rationale, stating that thinking skills are essential in 'learning how to learn'.
- It is recommended that there is a need of well organised teaching-learning strategies for classrooms that invites and supports 'teaching for thinking' and 'quality learning'. To become a thinking school, a whole school approach is exercised necessarily wherein all stakeholders are fully committed to the school's aims and how they can be achieved superbly. Acoordingly, taches need to be specially trained and methods need to be introduced into the curriculum for teaching the skills of thinking and associated cognitive and meta-cognitive strategies. Also innovative instructional materials and strategies (i.e., thinking lessons, thinking tools, resource materials i.e., print, video and audio) for primary teachers to teach different thinking skills such as critical thinking, analytical thinking, reflective thinking, integrative thinking and creative thinking are suggested in present time-frame of primary school to achieve the mission of education in the 'knowledge society' of 21st century and to exercise the idea of thinking children, thinking classrooms and thinking schools.
- Many teachers and teacher educators now admit the fact that 'teaching for thinking' and 'quality learning' is desirable to a great extent. If we accept that we need to prepare our students to a greatly different future than we have known, then our understanding of the focus of education also needs to

shift in the role of learner, teachers and changes in their teaching practices and corresponding shifts in assessment. It is, therefore, recommended that the focus on holistic assessment of students through school-based continuous and comprehensive evaluation is very much expected to be practiced.

- It is recommended that primary school teachers must be oriented/trained and equiped with innovative instructional materials, strategies, activities and continuous comperenssive evaluation /assessment techniques to promote and monitor thinking skills of students at primary level to create thinking classrooms and ultimately leading to thinking schools. Teachers must try to infuse continuous comperenssive evaluation /assessment techniques in the current curriculum transaction process to assess learners' learning growth.
- Use of graphical tools for designing assessment items of different subjects such as Hindi, English, EVS and Mathematics and assessing students' learning growth in terms of learning indicators is recommended and it can be accomplished in terms of learning indicators. For example, basis of learning indicators for assessment of learning at primary stage may be taken as –

Indicators	Needs improvement	Satisfactory	Outstanding
Active participation of students in the activities related within and outside the classroom situations.			
Demonstration of students in learning beyond the classroom.			
Engagement of the students in new strategies without prompting them by the teacher.			
Students' response to the teacher's questions. Elobarate and explain their learning concepts.			
Involvement of students in planning, self-monitoring and evaluating their learning.			
Demonstration of the ability to initiate, locate and evaluate information from multiple sources by the students and motivation within and outside the classroom/school.			

Students seek/explore information from different sources and apply in new situation.			
Active involvement of students in learning tasks.			
Students ask higher order questions during the teaching- learning process.			
Students reflect supporting information from valid and reliable sources.			
Students demonstrate learning beyond classroom by discussing with colleague and teacher.			
Final work includes clearly stated main ideas logically and coherently connected to supporting information and to analyse and synthesise it.			

The innovative instructional strategies/practices are considered to be helpful to facilitate learners' conceptual change, improve their thinking skills and develop quality learning among students.These strategies are helpful to make existing teaching-learning process more effective. It is, therefore, recommended that workshops can be organised for in-service teachers to develop insight about innovative instructional materials, strategies, practices and assessment techniques and how to make them work in their school with an existing curriculum and time-frame.

Conclusion

It may be concluded from the findings of the present study that there is a need of well organised teaching-learning strategies that support 'teaching for thinking' and 'quality learning' to make thinking classrooms. Teaching thinking skills by infusing it across curricular areas assist the students to become life-long learners and independent thinkers. Present practices of designing lesson planning, instructional materials and strategies need to be modified in the light of thinking skills approach to achieve the mission of education in the 'knowledge society' of 21st century and to put into effect the idea of thinking students, thinking classrooms and thinking schools.

Acknowledgements

Authors gratefully acknowledge the financial support provided by the authorities of the NCERT for conducting present research study. Authors also sincerely acknowledge the support of Head Master, DM

School, Ajmer and I/c Primary Section, DM School, Ajmer and Principal, KV-I, Ajmer and teachers of the sample schools in administering pre-and post- tests to the students. Authors would like to express sincere gratitude to the experts (Professor. H. C. Jain and Dr D.S. Mishra) and the teachers (Dr Renupama Mahapatra, Mr Abhishek Bhardwaj, Mr Seeta Ram Meena and Mr Amer Singh Meena) for their active participation in workshop for developing research tools and instructionl materials.

References

Adey, P. and M. Shayer. 2002. Learning Intelligence, Open University Press. Buckingham.

Bernard, R. M., et al. 2008. Thinking Skills and Creativity, 3, 15-22 doi:10.1016/j.tsc.2007.11.001.

Cederblom, J. and D.W. Paulsen. 2006. Critical Reasoning: Understanding and criticizing arguments and theories, 6th edn. Thomson Wadsworth. Belmont, CA.

Craft, A. 2005. Creativity in Schools: Tensions and Dilemmas. Paperback, Published by R Routledge, New York.

Dfee and QCA. 1999. The National Curriculum Handbook for Primary Teachers in England, London: www.standards.dfes.gov.uk/schemes3.

Dictionary.com. 2013. "critical thinking," in Dictionary.com's 21st Century Lexicon. http://dictionary.reference.com/browse/critical thinking.

Ennis, Robert. 2002. "A Super-Streamlined Conception of Critical Thinking" http://faculty.education.illinois.edu/rhennis/SSConcCTApr3.html.

Fisher, Alec and Scriven Michael. 1997. Critical Thinking: Its Definition and Assessment, Centre for Research in Critical Thinking (UK) / Edgepress (US). ISBN 0-9531796-0-5.

Fisher, R. 2005. Teaching Children to Think, (2nd Ed) Stanley Thornes. Cheltenham.

Gammil, D. 2006. "Learning the Write Way". *The Reading Teacher.* 59 (8): 754.

Higgins, S. V. Baumfield and D. Leat. 2001. Thinking Through Primary Teaching. Chris Kington. Cambridge.

McGuinness, C. 1999. From Thinking Skills to thinking classrooms: a review and evaluation of approaches for developing pupils' thinking. London: DfEE, (Research Report RR115).

Mulnix, J. W. 2010. Thinking critically about critical thinking. *Educational Philosophy and Theory.* doi: 10.1111/j.1469-5812.2010.00673.x.

NCERT Textbooks (English and Hindi version) of Hindi, English, EVS and Mathematics for Class V.

Newton, L.D. et al. 2000. Thinking Skills and Creativity 7(3): 165-176.

Sharma, S.V., Saryug Yadav, K.B. Rath, R. Niwas, A. Horo and R. Pratap. 2014. Project Report 'Thinking School: An Experiment'. Regional Institute of Education. NCERT, Ajmer.

Twardy, R. Charles. (2003). Argument Maps Improve Critical Thinking. *Teaching Philosophy* 27, 2.