

STRENGTHENING LESSON-PLANNING SKILLS OF PROSPECTIVE SCIENCE TEACHERS THROUGH COMPUTER-ASSISTED TRAINING PROGRAMME BASED ON A MULTIPLE INTELLIGENCES APPROACH.

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The present research was undertaken to improve student-teachers' lesson-planning skills in Science by using the Multiple Intelligences (MI) approach, that is, applying information and insights of MI theory to teaching-learning. A computer-assisted training programme was developed to explain the theory of MI and how to apply it to science teaching so as to trigger the students' multiple intelligences. Next, the effectiveness of the training programme was evaluated.

UNDERLYING THEORETICAL FRAMEWORK

The theory of Multiple Intelligences was developed by Harvard psychologist Dr. Howard Gardner (1983). He proposed the existence of at least 7 different ways of perceiving and understanding the world and of demonstrating intellectual ability and argued that there is both a biological and cultural basis for the multiple intelligences. In our schools, only two kinds of intelligences are stressed, namely, **Mathematical and Verbal intelligence**. He advocated the use of instructional methods such as role playing, musical performance, cooperative learning, reflection, visualization, and story telling that appeal to different intelligences. By addressing each student's unique way of thinking and learning, such instructional methods should reach all students by encouraging the development of the whole range of human potentialities.

Initially, Gardner identified the following seven types of intelligences:

- 1. Mathematical-Logical Intelligence**
- 2. Verbal-Linguistic Intelligence**
- 3. Visual-Spatial Intelligence**
- 4. Musical Intelligence**
- 5. Bodily-Kinaesthetic Intelligence**
- 6. Interpersonal Intelligence**
- 7. Intrapersonal Intelligence**

Later, he added two more intelligences, namely:

- 8. Naturalistic Intelligence**

9. Existential Intelligence

In the West, most teachers who have used this approach to teaching-learning are convinced that this approach leads to positive outcomes for students in terms of attitude towards self, attitude towards school, development of interpersonal skills, motivation to learn, interest in the subject and finally achievement in the subject. (Davis, 2004) Research shows that teaching and learning through the multiple intelligences helps solve many common problems in schools, and also optimizes the learning experience for both students and teachers. This approach provides positive reinforcement in learning to most students. In view of the usefulness of this approach, it is desirable to have student teachers know how to use this approach in their lessons.

SIGNIFICANCE OF THE STUDY

There is tremendous excitement among educationists and researchers abroad regarding the application of the MI theory, and a lot of work is being done, based on this theory.

In India however, the MI approach remains unexplored as far as I know. Hence, the major aim of this research was to introduce student-teachers to the MI approach to teaching.

Although Science is an important subject in the school curriculum, many students find it difficult to master. The researcher feels that the MI approach can help students to develop an interest and understanding in Science.

Use of technology in teaching-learning is a new frontier that prospective teachers need to conquer today. A comprehensive, reusable, self-learning Computer Assisted Instructional (CAI) package on the MI approach was developed in this research with the supplementary objective of exposing student-teachers to an illustrative use of technology for instruction. If they themselves found CAI to be effective in bringing about learning, they could develop positive attitudes towards its use in their own classrooms. At the same time, certain limitations of CAI and methods of compensating for them need to be understood. A first-hand experience in learning through CAI would help student-teachers to use CAI effectively in their own teaching.

REVIEW OF RESEARCH ON USE OF MI IN SCIENCE TEACHING

Many studies have explored the application of MI theory in science teaching, at different levels, primary [Davis, (2004), Lim, (2001)] secondary [Smith, (2000), Cutshall (2003) to college.level (Berkemeier, 2002). Many are action researches. Many lesson-plans have been developed in Science, applying the MI theory (see ED416698). However, there are no researches related to MI-based lesson planning training in Science teaching.

Objectives of the study:

1. To develop CAI packages on Multiple Intelligences Approach.
2. To develop a training programme based on Multiple Intelligences Approach for strengthening lesson-planning skills of Science student teachers.
3. To study the effect of the CAI presentations and the training programme on Science lesson planning by student teachers.

Sample

Incidental sample comprised of 23 female student-teachers, having Science Education as one of their subjects, studying in the SNTD College of Education for Women, Pune, in the academic year 2005-2006.

Research Design and Procedure

Single-group pre-test post-test experimental design was used for the research.

The independent variable was “CAI and workshop-based training programme on Multiple Intelligences”, while the dependent variable was “incorporation of MI-based activities in Science lesson plans”.

The research comprised of the following steps:

1. *Preparation of CAI presentations on the MI Approach:*

The instructional material had following three parts:

Part 1-The concept of MI (In English and Marathi)

Part 2- Application of MI concept in Education (English and Marathi)

Part 3- Science Teaching and MI (In English)

A specific philosophical position and pedagogical principles were adopted in the development of these presentations (Ranade, 2006)

2. *Preparation of an MI evaluation tool (MI checklist) for scoring lesson-plans*

As the training programme focused on eight types of multiple intelligences (Existential intelligence was excluded), the evaluation tool also used these eight types as the major sub-divisions in the checklist. Possible categories of learning experiences were listed under each sub-division. Each relevant learning experience was given one point under that sub-division. If a single learning experience could be classified under two or more intelligence types, points were given under each category.

As an example, the MI checklist on Linguistic Intelligence is given in Table 1.

	Intelligence Type	Tally marks	Total
A	Linguistic Intelligence		
1	Lectures, debates		
2	Large- and small-group discussions		
3	Books, worksheets, manuals		
4	Brainstorming		
5	Writing activities		
6	Word games		
7	Storytelling, speeches, reading to class		
8	Use of talking books and cassettes		
9	Extemporaneous speaking		
10	Journal keeping		
11	Reading in chorus		
12	Individualized reading		
13	Memorizing linguistic facts		
14	Tape recording one's words		
15	Using word processors		
16	Publishing (e.g., creating class newspapers)		
17	Any other		

Table 1: MI checklist on Linguistic Intelligence

3. Administration of pre-test on lesson planning on a selected unit in school Science.
4. *Administration of the training programme:*

Initially, formal training in the MI approach to lesson-planning was provided through CAI presentations, discussions and a workshop. However, training continued throughout the academic year.

Demonstration lessons, a specially compiled MI-Ideas workbook and special assignments were also included in the training. In the workshop, Student-teachers

worked in small groups to analyze the content in school Science textbooks from the MI viewpoint, and to record suggestions for inclusion of various MI-based activities.

5. Administration of post-test (Lesson planning on the same unit chosen for the pre-test)
6. Analysis of quantitative data using t test and percentages and analysis of qualitative data.

Analysis of data

The t-test indicated that the post-test scores in lesson planning were significantly higher than pretest scores at 0.01 level of significance.

Scores of student–teachers were categorized according to the type of intelligence tapped through lesson plans. These scores and their percentages are given below.

Type of Intelligence		Group Pre-test Score	%	Group post- test score	%
1	Mathematical/Logical	3	3.80	80	20.15
2	Verbal/ Linguistic	47	59.49	87	21.91
3	Visual/ Spatial	21	26.58	89	22.42
4	Musical/Rhythmic	0	0.0	11	2.77
5	Bodily/ Kinesthetic	5	6.33	56	14.11
6	Interpersonal	2	2.53	31	7.81
7	Intrapersonal	0	0.0	21	5.29
8	Naturalistic	1	1.27	22	5.54
Total		79	100	397	100

Table 2: Group scores on the MI checklist on use of 8 types of Intelligences in pre test and post-test

The table shows, first of all, a five fold increase in total scores in the post-test. Detailed analysis showed that richer and varied experiences were provided in the post-test lesson plans as compared to pre-test plans.

Secondly, student-teachers mostly used learning experiences related to verbal/linguistic and visual/ spatial intelligence in their initial lesson plans (about 85%), while learning experiences related to musical and intrapersonal intelligences were not used at all.

After training, the use of learning experiences related to all intelligences increased.

However, maximum learning experiences pertained to mathematical/logical, verbal/linguistic and visual/spatial intelligences (perhaps Science as a subject lends itself better to the use of these intelligences in teaching). Experiences related to Bodily/Kinesthetic intelligence were also used considerably.

Experiences related to Inter-personal and Naturalistic Intelligence were not as frequently used as is possible in Science teaching, and need to be stressed in further training.

Analysis of learning experiences used in the lesson-plans: an analysis of the type and extent of learning experiences actually used by the student teachers under the eight categories in their post-training lesson plans follows.

Type of Intelligence	Learning experiences		
	Most commonly used	Less used	Not used of at all
Logical/Mathematical	Inductive/deductive reasoning, working with symbols, recognizing patterns, generalizing, predicting, finding relationships, guessing reasons and consequences.	Generating formulae	Problem solving
Visual/Spatial	Opportunity to draw, assemble things, handle models, use of visual aids	Paper folding activities, preparation of graphics by students	Opportunity to paint, preparing models
Verbal/Linguistic	Story telling, fun with words, phrases related to content, etymology of terms, use of idiomatic expressions, poems, explanations, Answering questions.	Writing story or poem Asking questions (by the students).	Humorous anecdotes
Musical/Rhythmic	Use of songs and poems related to content		Recognition of tones, sounds, Games based on music.
Interpersonal	Recalling experiences related to events, things, Reflection on likes.	Internal reflection about personal needs Reflection on dislikes	Metacognition Activities based on self knowledge
Bodily/Kinesthetic	Participation in play, games related to subject, activities involving movements, role play, drama	Visits	Dance, miming
Naturalistic	Observation of nature, suggesting remedies about environmental problems	Sensitivity to the environment, operating effectively with plants,	Action on environmental problems.

		animals, rocks, etc.	
Intrapersonal	Discussion, Group activities, Role play in groups, Pair and share activities	Group problem solving, interpretation of other's gestures, group participation in scientific experiments.	Predict what some body will do next

Table 3: Analysis of type and extent of learning experiences used in the post-training lesson plans.

The above table shows that some learning experiences important in Science teaching such as problem solving, preparation of models, action on environmental problems, etc. have not been used in the lesson plans. These need to be stressed in future training.

Conclusion

Introduction to the MI approach has shown very positive results, leading to inclusion of a variety of MI-based activities in the lesson plans. Student teachers felt that this approach provided them with a “framework” or “structure” in thinking about various experiences in teaching.

It can be argued that the efficacy of lesson-plans can only be tested after they are implemented in the classroom, but that can be a topic of further research.

Having student teachers plan a variety of experiences for the students without imposing practical constraints of classroom implementation has been useful in coming up with really good teaching ideas. We feel that even if a few of these ideas are eventually implemented in the classroom, our efforts would have been worthwhile.

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References

- Davis, L. (2004) *Using the Theory of Multiple Intelligences to Increase Fourth-Grade Students' Academic Achievement in Science*, Dissertation, online submission (ED491477).
- Ranade, M.D. (2006) Development of CAI Presentations for Science Teaching and Overview of Research Findings. *International Journal of Science & Math Education, Online First*, Springer Netherlands. <http://www.springerlink.com/content/m714216p73774834/fulltext.pdf>.
- Berkemeier, G.Y. *Exploring Multiple Intelligences Theory at a Community College Level*, Dissertation, ED469466.
- ED416698 (Authors not mentioned), (1997) *A Collection of Mathematics and Science Lessons for General and Special Education Students (Grades 4-8)*.

- Smith, W; Odhiambo, E.; El Khateeb, H. (2000) *The Typologies of Successful and Unsuccessful Students in the Core Subjects of Language Arts, Mathematics, Science, and Social Studies Using the Theory of Multiple Intelligences in a High School Environment in Tennessee*. Research Report, ED448190.
- Cutshall, L.C; (2003) *The Effects of Student Multiple Intelligence Preference on Integration of Earth Science Concepts and Knowledge within a Middle Grades Science Classroom*. Dissertation, ED479329.
- Lim, C. & Wang, K. (2001) Effects of Project Activities Based on Multiple Intelligences to Elementary School Children's Science Achievement. *Journal of the Korean Association for Research in Science Education*, 21 (1), 13-21.