
Computer-based Instruction on “Multiple Intelligences Approach to Teaching” Research Studies in Teacher Education

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Abstract: The paper presents a review of a series of researches conducted by the researcher over a span of about 5 years. The central task of these researches was the development of comprehensive Computer Assisted Instructional (CAI) Packages on the concept of Multiple Intelligences (MI) and its application to teaching. The packages were developed to fulfill two objectives: to introduce teacher-educators and student-teachers to the relatively new concept of Multiple Intelligences Approach to teaching, and to expose them to a good model of the use of a slideshow presentation for teaching. The CAI packages were found to produce significantly higher achievement in terms of content when tested on a batch of about 25 teacher-educators. All participants reported that the packages were very well designed and effective in bringing about learning, and also that the introduction to this new approach would help them to think more innovatively about lesson planning. In another study which was a continuation of the first study, the effectiveness of CAI (on MI) used as a visual aid in teaching was compared with traditional lecture method, and use of CAI was found to lead to significantly higher achievement (at 0.01 level of significance) than the traditional lecture method. In a small action research the reactions of M.Ed. students to two modes of CAI on MI, namely, self-study of CAI presentation in pairs, and learning through teacher-mediated CAI presentation were studied. Students reacted more positively to teacher-mediated CAI. In another year-long research study, student-teachers were trained in planning Science lessons using the MI approach. CAI presentations and MI workshops on lesson-planning were used for the training. A pre-test-post-test single group design showed very significant improvement in incorporation of MI-based experiences in lesson-plans. In a M.Ed.-level research, a MI approach-based Science lesson plan was implemented in Grade V. It significantly increased student achievement. The above researches indicate that the introduction and use of MI approach has significantly benefited teacher-educators, student-teachers, and school students.

Keywords: Computer Assisted Instruction, Multiple Intelligences, Teacher Education, Lesson planning

Introduction

The inspiration for research based on the theory of Multiple Intelligences (MI) came from a visit to Harvard University and study of the work of Howard Gardner some 7 years back.

At that time, the MI theory had not reached India in a big way, and was not a part of the Education curricula. The researcher felt that the application of the MI theory to the teaching-learning process could help to shift the paradigm from the predominantly teacher centered teaching methods to a student-centered approach. The theory could serve as an excellent framework for planning and implementing teaching-learning.

With this aim in view, the first step was to introduce the concept of MI to teacher-educators and student-teachers, who would then be able to propagate it through their own teaching. At that time, books on Multiple Intelligences were not available in our libraries, so

the need was felt to prepare teaching-learning material on the use of MI Theory and its application to education.

At around the same time, computers had reached Indian educational institutions; teachers and teacher-educators were obtaining training in their use, but they were hardly, if at all, being used for teaching-learning purposes. The researcher felt that preparation of a good Computer Assisted Instructional (CAI) Presentation on MI would serve two important purposes:

1. To propagate the concept and application of MI theory
2. To enable teacher-educators and student-teachers to experience computer-based instruction first-hand.

The initial researches were undertaken with these objectives in view. After the efficacy of the CAI presentations on MI was established, subsequent researches were planned, firstly to develop a training programme for student-teachers in the use of MI approach in Science lesson planning, and next, to test the efficacy of a MI-based lesson plan on student achievement in Science.

Theoretical Background:

The theoretical background of the above researches covers two areas:

1. MI theory and its application to teaching-learning
2. Use of CAI in teaching-learning

MI Theory and its Application to Teaching-Learning

The Theory of Multiple Intelligences

The theory of MI was developed by Harvard psychologist Dr. Howard Gardner (1983, 1991). 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-Kinesthetic Intelligence**
6. **Interpersonal Intelligence**
7. **Intrapersonal Intelligence**

Later, he added two more intelligences, namely:

8. **Naturalistic Intelligence**
9. **Existential Intelligence**

A review of related literature on Multiple Intelligences (MI) reveals a plethora of books and articles, which emphasize the usefulness of MI perspective in teaching-learning.

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) The MI perspective leads to an increase in the use of innovative strategies by teachers.

Why is a Multiple Intelligences Model Successful?

Conclusions drawn by Campbell (1996) based on his research on MI help us to understand the reasons for the usefulness of MI Approach. He believes that the MI-based programme succeeds for two reasons, firstly, because “every student has the opportunity to specialize and excel in at least one area”, though often in more areas, and secondly because “each student learns the subject matter in a variety of different ways, thereby multiplying chances of successfully understanding and retaining that information”.

He feels that “many student needs are met through this program. Their intellectual needs are met by constantly being challenged and frequently exercising their creativity. At the same time, their emotional needs are met by working closely with others. They develop diverse strengths, and they understand themselves better as individuals”.

Since the emphasis in MI-based programmes is upon *learning* rather than teaching, students’ interests and developmental needs are taken into consideration. His experiences show that MI-based teaching-learning “helps solve many common school problems and optimizes the learning experience for students and teachers alike.”

According to Wilson (1998), “Through creating educational experiences based on natural talents and gifts, teachers are more likely to increase opportunities whereby students can become actively engaged in learning experiences that are pleasurable, heightened or magnified. Such experiences can be highly motivational.”

In view of the usefulness of this approach, it is desirable to have teacher-educators and student teachers know how to use this approach in their lessons.

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 in Teacher Education as far as I know. Hence, the major aim of all these researches was to introduce teacher-educators and/or student-teachers to the MI approach to teaching.

Use of CAI in teaching-learning:

An effective method of teaching-learning, namely, Computer Assisted Instruction (CAI) has now begun to show promise due to availability of computers in Indian schools. Several researches done abroad [Cotton, 2001] to test the efficacy of CAI have mostly revealed positive results in terms of achievement, attitude towards the subject, interest, retention of subject matter, etc. The researcher herself has guided over 25 school-level researches related to effectiveness of CAI in various settings, for different subjects, and under different conditions of comparison. Each of these researches has revealed that CAI is effective in bringing about learning. Although CAI has not always been found to be significantly better than regular classroom teaching, it has never been inferior to it. In addition to it being effective, students have also liked CAI, as shown by their overwhelmingly positive response to it (Ranade, 2006).

In the present researches, the term “CAI” has been used in a narrow sense, to imply tutorial and drill and practice activities related to the teaching unit, presented through the linear slide-show format. The main purpose of the slide-show is to present content in an interesting, easy-to-understand manner, and to help students to test their understanding through self-tests. The slide-show format has its weaknesses in that it is relatively weak at animation, hypertext, interaction, and programmability, but it is a good first step until teachers become comfortable with more complex software.

A definite philosophical position and certain pedagogical principles were adopted in the development of these presentations, as described in [Ranade, 2006].

Drawing from the researcher’s experience with the preparation of CAI presentations in various subjects, a checklist of techniques was prepared to help enhance the quality of learning that could take place through the use of these presentations.

Some of the techniques used in the presentation are:

- Application of various theories of learning, for example, use of advance organizers to provide students with ‘mental hooks’ to attach new learning to, use of memory techniques, and so on
- Application of the theory of multiple intelligences to the preparation of slide-shows.
 - Use of appropriate imagery to complement textual matter
 - Use of concept-maps
 - Colour-coding of information for ease of understanding
 - Use of interactivities such as ‘think-pair-share’ exercises
 - Use of rhetorical questions, puzzles, quizzes, and so on, to stimulate thinking
 - Use of narration, music.
- Use of hyperlinks to provide extra information on a topic and to explain basic concepts (if required)
- Use of formative evaluation, and
- Use of a note-taking format.

Most urban, and even some rural schools have computer labs today. Yet a survey carried out by our B.Ed. students revealed that computers were rarely used for teaching-learning even in urban schools. Teachers still do not have ready access to computers, but the day is not far off when every classroom can sport its own computer and a large-screen display. The question is whether our teachers will be ready to use technology effectively for teaching. We need to be proactive on two counts:

- Developing positive attitudes among teachers for acceptance of computers as a valuable aid in their teaching.
- Developing their skills in preparing high quality CAI material for use in classrooms.

Use of CAI presentations for training teacher-educators and student teachers in the use of MI approach was expected to serve as an exemplar to provide new techniques to teacher-educators and student-teachers and to provide them with a first-hand learning opportunity. This was expected to give them valuable insights regarding the strengths and weaknesses of teaching-learning through CAI.

Study 1: “Effectiveness Study and Critical Evaluation of a Computer Assisted Instructional Package Developed for Teacher Educators”

The CAI package was on MI theory and its implications in teaching-learning. [A part of the CAI presentation can be downloaded from the researcher’s home page (Ranade, 2001)]

This study had the following objectives:

1. To prepare a Computer Assisted Instructional (CAI) package on “Multiple Intelligences”
2. To study the effectiveness of the package in terms of achievement.
3. To analyse critical comments obtained from participants viewing the presentation.
4. To study the reactions of participants towards future use of CAI by them.

The incidental sample consisted of 25 teacher-educators from both rural and urban regions of 3 states in India (Maharashtra, Goa, and Tamilnadu), attending a refresher course.

The CAI package on MI contained 93 slides, of which 84 were based on content. Nine slides contained a short test for generating a Multiple Intelligence profile of the learner. The viewing time was about one and a half hours. This presentation was in English.

A pre-test post-test single group experimental design was used. The test was an achievement test on the concept and implications of Multiple Intelligences Theory. The Pre-test was administered a day before the presentation. The CAI package, comprising of a PowerPoint™ Presentation, was projected on a large screen, and the researcher provided minimal commentary as required.

To enable the participants to provide critical comments on the presentation (Objective No.3), another presentation regarding preparation of PowerPoint for teaching-learning, prepared by the researcher, was shown to the participants a day before the Multiple Intelligences presentation. This provided information regarding the criteria on the basis of which a presentation could be evaluated.

The participants were then asked to view the presentation on Multiple Intelligence from two angles:

- For learning the content
- For evaluating the presentation

Next, participants were asked to give their evaluative comments.

Finally, they were asked to give an introspective report regarding their reactions to the package in terms of their readiness to use CAI in their own teaching (Objective No.4).

Analysis of data related to pre and post-test on achievement is summarized below.

Table 1. ‘t’-test for significance of difference between pre and post-test means

Sample size	Pre-test Mean	Post-test Mean	Degrees of Freedom	Probability of Error	Significant at
	Marks out of 30				
25	0.24	21.8	24	4.8 E-18	0.01 Level

The 't' Test, as shown in Table 1, indicates that there is a significant increase in achievement in the post-test than in the pre-test. The pre-test scores indicate that the topic was entirely new for most participants. The post-test scores of over 75% participants were above 65%.

Participants gave very positive comments regarding the presentation. They also gave some suggestions for improvement, which were later incorporated in the presentation.

This study was extended later to include a control group.

Study 2: “A comparative study of the effectiveness of CAI used as visual aid in teaching and traditional lecture method for teaching the topic “Multiple Intelligences”

The sample for the control group comprised of a batch of 31 teacher-educators from a similar background attending a refresher course in another city (Kolhapur) in Maharashtra, India. Since the researcher herself taught the same content to both the classes, the teacher and content variable were held constant.

Table 2. *'t'-test for significance of difference between mean-gain scores of 2 groups*

Mean-gain score of Group1 (CAI as visual aid)	Sample size	Mean-gain scores of Group2 (Lecture Method)	Sample size	Probability of Error
21.56	25	16.42	31	0.000383

Table 2 shows that use of CAI as visual aid in teaching is significantly better (at .01 level of significance) than traditional lecture method in increasing achievement.

Study 3: “A Study of the Reactions of M.Ed. Students to Two Modes of CAI on Multiple Intelligences”

A small action research was conducted on M.Ed. students of SNDT, Pune, in which all 20 students in the sample were exposed to two modes of learning, namely, self-study of CAI presentation in pairs, and learning through teacher-mediated CAI presentation.

The effectiveness of the use of two modes of CAI presentation on Multiple Intelligences was studied in terms of students' reactions towards the two modes. Their reactions towards computer assisted study and towards their readiness to use CAI and MI approach in their own teaching were also studied.

Of the 20 students, 16 preferred the teacher-mediated CAI mode due to the extra information and relevant examples given by the teacher and also because of the possibility of immediate clarification of doubts. They felt that it would be easier to recall material learnt through this mode than through self-learning with CAI. 19 students said they felt much more positive about using CAI in their own teaching. Of these, 6 students reported that they would definitely use CAI in their own teaching. All students reported that they found the MI approach to teaching very useful and they would be able to use the same in their own teaching.

Study 4: “Strengthening Lesson-planning Skills of Prospective Science Teachers through Computer-assisted Training Programme based on a Multiple Intelligences Approach”

Following were the 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.

An incidental sample comprising of 23 female student-teachers, having Science Education as one of their subjects, studying in the SNDT College of Education for Women, Pune, in the academic year 2005-2006 was used for the study.

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

The effect of CAI and workshop-based training programme on Multiple Intelligences was explored in terms of incorporation of MI-based activities in Science lesson plans.

Initially, rigorous formal training in the MI approach to lesson-planning was provided through CAI presentations, discussions and a workshop. The students were reminded of the MI concepts during lesson guidance 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.

An MI evaluation tool (MI checklist) was prepared for scoring lesson-plans

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

There was a five fold increase in total scores in the post-test. 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. The type and extent of learning experiences actually used by the student teachers under the eight categories in their post-training lesson plans were also analyzed and showed a wide variety. However, learning experiences important in Science teaching such as problem solving, preparation of models, action on environmental problems, etc. were not used in the lesson plans and need to be stressed in future training.

Study 5: “A study of the effectiveness of Use of MI-Approach in teaching a unit in Science for Std. V”

This was a M.Ed.-level research conducted under the researcher’s guidance (Tapkeer, 2006). A Science lesson plan for Grade V on the unit “Air” was developed using the MI approach. It included a CAI presentation in addition to a variety of activities based on MI theory. A non-standardized MI test was used to identify students’ strengths with respect to various intelligences, and effort was made to use these strengths during the teaching. It was observed that Kinesthetic intelligence was the most predominantly occurring intelligence, followed by Visual intelligence. The least occurring predominant intelligences were Musical, Inter-personal, Intra-personal and Naturalistic. This distribution can be seen in Table 3.

Table 3: *Distribution of Predominant Intelligence in Class V students*

Type of Intelligence	No. of Students Indicating Predominance (out of 45)
Mathematical	6
Verbal	5
Visual	12
Musical	2
Kinesthetic	14
Inter-personal	2
Intra-personal	2
Naturalistic	2

Students were asked their preferences regarding the various MI-based activities used in teaching. When matched with their reported predominant intelligence, it was seen that 22 out of 45 students’ preferences perfectly matched their predominant intelligence. 15 students selected the activity matching their second predominant intelligence. Observations made during the lesson regarding participation in various activities also corroborated these findings. A pre-test-post-test single group design was used and the ‘t’ test of significance of difference between pre and post-test means revealed significant increase in achievement (at 0.01 level) in the post-test as seen in Table 3

Table 4: *‘t’-test for significance of difference between pre and post-achievement test means.*

No. of Students	Pre-test Mean	Post-test Mean	Probability of Error
	Marks out of 20		
45	0.622	14.8	9.7 E-42

It was also seen that 100% students scored above 50% marks, of which 51% scored above 75% marks. In the researcher’s experience, this level is higher than marks normally scored by students, indicating the success of the MI approach in increasing achievement. Students’ opinions regarding the lesson were also sought. 95.6% students found the teaching of the lesson to be quite different from any lesson other lesson they had experienced. 76% responded that most of the techniques used in this lesson are never used in regular teaching, while 24% felt that only a few methods are sometimes used by the teachers in regular teaching. 100% students said they understood the lesson better and felt they could answer the examination questions on the unit better too. 100% students wanted to study other lessons in a similar way (MI-based teaching/learning).

To sum up, students reacted very positively to the learning experience and scored better too.

Concluding Remarks on Researches on MI

In the past 5 years, there has been enormous technological progress and dissemination of information through the Internet. Far more interactivity is possible today, and expected in CAI. Hence, by today's standards, the CAI package on MI may not seem to have much relevance. However, even today, Internet facilities are not easily available in our educational institutions, and so the presentation is still a useful means of obtaining information and insights on the MI approach.

The researches on MI approach indicate that the introduction and use of MI approach has significantly benefited teacher-educators, student-teachers, and school students in terms of achievement in MI-related content, attitude towards CAI, readiness to use MI approach in teaching, in Science lesson planning and in learning Science through this approach. Thus the MI approach holds promise in teaching-learning, and needs further application and exploration in Indian schools.

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