



A study of learning outcomes (The mean gain scores in physics) of ninth graders through computer based mastery learning in relation to their academic stress and parental involvement

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Abstract

The present study was conducted to investigate into the effectiveness of Computer based Mastery Learning Strategy in IX grade Physics in relation to Academic Stress and Parental Involvement.

In a classroom having students with diverse backgrounds, a variety of achievement levels and different learning styles which affects all their ability to acquire knowledge, teachers need to move away from traditional methods of teaching and bring into classroom new and innovative approaches to teach the content. In order to meet the National Education Goal for all the students, Mastery Learning is one of the best reform attempts in the current educational reform movement.

A school sample of two hundred and fifty 9th grade students of high and low Parental Involvement and Academic Stress was drawn from the representative Secondary Schools of Chandigarh. The major findings of the study were:

- The mean gain in Physics through Computer Based Mastery Learning was more than the mean gain through Conventional Group Learning.
- The gain means in Physics of the two Parental involvement groups (High & Low) may not be treated as different beyond the contribution of chance factor and the observed mean difference may be ascribed to chance factor alone.
- The gain means in Physics of the two Academic Stress groups (High & Low) may not be treated as different beyond the contribution of chance factor and the observed mean difference may be ascribed to the chance factor alone.
- The two variables, Instructional Strategies and Parental involvement do not interact to yield different gain means in Physics and the two act as independent of each other.
- The two variables, Instructional Strategies and Academic Stress do not interact to yield different gain means in Physics and the two act as independent of each other.
- The two variables, parental Involvement and Academic Stress do not interact to yield differences in gain means in Physics and they act independent of each other.

The three variables, Instructional Strategies (CBML & CGL), parental Involvement (High & Low) and Academic Stress (High & Low) do not interact to yield different gain means in Physics. The three variables act independent of each other.

Keywords: learning outcomes, computer based mastery learning (CBML), conventional group learning (CGL), academic stress, parental involvement

Introduction

Today, expectations for schooling have grown. Schools are expected to meet world-class standards, create model citizens and meet calls for public accountability. Achieving these national goals will require that all schools provide stimulating, substantively rigorous opportunities for all students to learn and achieve higher. It is with quality teaching in mind that we need to review and attempt to consolidate empirical support of effective teaching principles from diverse theories (behavior, cognitive, social learning, etc.). Educational technology can provide the spark for prompting educators to envision new ways to teach and for creating the kinds of schools needed now. Potentially the most effective device for presenting an instructional program is the computer.

For effective teaching and effective student learning Mastery learning has proved to be a powerful strategy in classrooms which may yield higher learning outcomes in all the three domains; cognitive, affective and psycho- motor. Mastery learning is fit for both individual study and group study,

provided that realistic standards be developed, as Bloom suggests. His model, using group instructional techniques, varies both instruction and time to meet individual needs.

Mastery learning rests on "Take your time", that is, take the time you need to learn something well. Time to learn must be adjusted to fit aptitude. No student is to proceed to new material until basic prerequisite material is mastered. Bloom, Block, and Carroll believe that mastery learning can be handled in a normal classroom.

Using his methods, the average student of Bloom's mastery class passed at the 95th percentile of traditionally-taught classes. If this process is repeated every two or three weeks, the differences between those who follow mastery learning versus those who get conventional instruction become striking:

Mastery learning 85% in top 10% vs. 45% in conventional.

Time on task: For mastery learning 85%. For conventional instruction: 45%.

BLOOM believed that not only was the environment

important, but also that it was possible to arrange systematically the ways in which learning could be promoted, (Elliot Eisner). In other words, Educational technology plays an important role in our classrooms.

Educational technology

The concept of educational technology finds a place in the Indian National Policy of Education (1986), by the provision of a separate section entitled media and educational technology. In general, educational technology refers to the application of scientific knowledge about learning and the conditions of learning to improve the effectiveness and efficiency of teaching and training.

Computer based instruction

Computer based learning is a method, which uses computers in a learning medium and strengthens students motivation and educational processes. It gives opportunities to both students and teachers to learn and teach more quickly and to combine active learning with computer technology. Collette and Collette (1989)^[5].

The studies show that computer based learning by way of simulation programs makes the concepts and processes more concrete and causes the students to understand more easily the relationship between them and as a result of this, a more permanent learning is achieved.

Mastery learning

Mastery learning as one of the important approaches to enhance student learning, was presented by Bloom (1966) and his associates based on Carroll's (1963) model of school learning. It has been widely researched on and major projects have been carried out.

MLS describe that the learning rate, LR, is a function of the time a learner has to learn to the time he actually needs to learn a given situation of instruction.

$$\text{Degree of learning} = f \frac{[\text{Time actually spent}]}{\text{Time needed}}$$

Mastery Learning Strategy according to Bloom (1968) begins with the assumption that most students can attain a high level of learning capacity; if

- Instruction is approached systematically
- Students are helped when and where they have learning difficulty
- They are given sufficient time to achieve mastery, and
- There is some clear criterion of what constitutes mastery

Learning outcomes

Learning' refers to the acquisition of behaviour being developed by the new Stimulus Response Connections. It is relatively permanent behaviour change tendency and is the result of reinforced practice (Kimble and Garnezy, 1963, Melvin, 1969, 1970)^[8, 15].

According to Encyclopedic Dictionary and Directory of Education (1971) learning outcome is a result of experience in or outside the school stated in terms of pupil behavior. The

outcomes of learning resulting from learning activities may be skills and habits, social competence, abstract and creative thinking.

Achievement is one of the most important goals of education. The outcomes of education are usually characterized as the achievement of those who have been educated. These may be expressed in terms of whether or not the aims of education were fulfilled in relation to those individuals and to that degree. In order to find out what has been achievement, one requires some form of assessment.

Academic stress

Academic Stress is mental distress with respect to some anticipated frustration associated with academic failure or even an awareness of the possibility of such failure, Gupta and Khan (1987). In the context of school, academic stress means a pervasive sense of urgency to learn all those things which are related or prescribed by the school, Shah (1988).

Lazarus (1966) pointed out that stress is a threat, real or implied to the psychological or physiological integrity of an individual. Stress involves a stressor and stress response and stressors are generally psychological. Lazarus (1982) emphasized the role of perception and cognitive appraisal in the stress response process. He argued that unless we perceive a situation threatening, we will not experience stress. Stress has always been a concern of physiologists and psychologists who view the concept in different ways.

Parental involvement

Parental involvement is seen as an important strategy for the advancement of the quality of education. The ultimate objective of this is to expand the social and cognitive capacities of pupils. Grolnick and Slowiaczek (1994)^[6] denotes the extend to which as well as the way in which parents take a keen interest and actively participate in their child's education. Nurturing of children is directly related with home and parents. Parental Involvement implies how the parents involve themselves in developing the overall personality of the child. All parents have certain expectations, likes & dislikes and preferences regarding how children should be handled, brought up and educated.

Types of parental involvement

There can be two kinds of parent involvement.

1. Occurs within the home,
2. Presence of parent(s) in the school.

1. Presence of Parents within the home ideally will include behaviours such as setting high expectations, monitoring homework, limiting television viewing or outside work, knowing a child's friends, discussing school events with children, valuing and talking about education, showing respect for teachers and all school staff.

2. The physical presence of parent's in the school, range from occasional attendance at a parent –teacher conference, regular participation in the school events, ongoing participation in school activities. Teachers and parents are all seen partners with their own but also shared tasks and responsibilities Hall & Sante, (2000)^[7].

Based on the factor analytic study of involvement indices by Grolnic and Slowiaczek (1994)^[6], the investigator puts forth a multidimensional, representation of Parental Involvement that focus on not one specific activity, but on various dimensions. According to this conceptualization, parents may show their involvement in the Childs schooling in different ways viz:

1. Behaviors Involvement
2. Personal Involvement
3. Cognitive Stimulation & Cognitive Behavior.

1. Behavior Involvement: Parents may manifest their involvement through their *behaviors* i.e. their overt action may serve as indices of their involvement. They would include engaging in activities such as going to the child's school, meeting his teachers, attending parent-teacher meeting and the like. Parents are usually interested in knowing if their child is having any trouble in coping up with studies or not. Many research studies provide evidence for this form of involvement. One of the surveys (Chavkin K. Williams, 1987)^[4] found that the most frequent actions were:

- Open house or special programmes.
- Parent-teacher meeting.
- Parents serving as chaperones.
- Parents assisting with social activities.
- Parents observing classrooms activities.

2. Personal Involvement: While parent's overt behavior is one way in which parents may exhibit their involvement in the child's schooling, the child may also have a more profound affective experience that his parents are providing resources to him and are concerned about him. The role of affective experiences and emotional climate at home has been worked upon by several researches. Studies have indicated the beneficial influence of emotionally supportive home situations on children's outcomes (e.g., Bradley, 1987; Sauer and Gattringer, 1987; Tamir, 1990).

This includes involvement in the academic and social life of the child. This would encompass activities such as: knowing about the child's day-to-day activities:

- His whereabouts, friends, what he usually does at school.
- How well he gets along with others.
- How well is he doing in studies.
- How regular and apt he is in his school work
- How well he performs in examinations, and the like.

3. Cognitive Stimulation and Cognitive Behaviors: Exposing the child to cognitively stimulating activities and materials represents a historically new role for parents in fostering children's cognitive development (Lareau, 1987). Parental stimulation has been defined by Belsky, Goode, and Mosi (1980) as efforts to focus the infant's attention on objects and events within the environment. These attempts can be physical or verbal in nature.

Parents should therefore ensure that their children are brought up in a stimulating, thought provoking surrounding.

Encouraging parents to pursue at home, behaviors that encourage learning and indicate a value for schooling. Conducting at school activities that support the teacher-parent relationship.

Relationship among all Variables i.e., Computer Based Mastery Learning, Learning Outcomes, Parental Involvement and Academic Stress.

The researches have authenticated that computer based instructions or the instructions which are delivered by computer plays a magic role in classes. Mastery of the subject matter is carried out with the help of a scientific computer based instructional plan. As mastery learning is highly planned instructional method to enhance learning based on the principle that learning rate is a function of the time a learner has to learn to the time he actually needs to learn. The students are not advanced to a subsequent learning objective until they demonstrate proficiency with the current one.

Stress makes a significant contribution to the prediction of subsequent school performance and acts as a negative predictor of academic performance in school children.

Learning habits to combat academic stress can bring benefits beyond the classroom. Results showed that there is a consistent positive effect of computer based mastery learning strategy on learning outcomes of students. In the present investigation, computer based mastery learning has resulted into higher achievement in gain scores of physics as against conventional group learning strategy. These results reveal that there is a consistent positive effect of computer based mastery learning strategy on learning outcomes of students.

Use of mastery principles with computers and with the help of parents seems to be an ideal situation for students to enjoy higher strides of success. The outcomes of the study, which are studied in relation to Academic stress and parental involvement, revealed the importance of quality of instruction, time allowed for learning, motive for learning a task and proper use of strategy for accomplishing a task that promotes quality of learning.

In Computer Based Mastery Learning, individualized remediation is the essential part that makes the teaching leaning process filled with fun for each student as it caters to the individual needs of every student and in this way leads to the mastery of the programmed material or the content by every one of them. In this way, the Mastery Learning being the best learning strategy, affects the learning greatly that every student attains much high scores as compared to the conventional method of teaching.

As far as the variable Parental Involvement is concerned, when parents take interest in the school as well as at home in the studies of their child, this variable, independently, positively affects the students' overall achievement in the academics. In this study, Computer Based Mastery Learning has been proved to be such a powerful Strategy that in the presence of it gain means (Mean Gain Scores in Physics) even due to High and Low Parental Involvement may not be treated as different beyond the contribution of chance factor.

Similarly, individual effect of Academic Stress leads to various behavioural, physiological and psychological health hazards but when Computer Based Mastery Learning Strategy is applied for instruction in the classroom, the gain means (Mean Gain Scores in Physics) of the two groups due to academic stress (High & Low) may not be treated as different beyond the contribution of chance factor. There occurs no significant interaction effect of Academic Stress and

Instructional Strategy. For Computer Based Mastery Learning individually engross students so much in the teaching – learning process that the effect of Academic Stress is almost nullified.

Again, there is no significant interaction effect of Instructional Strategy, Parental Involvement and Academic Stress, for, both Parental Involvement (High & Low) and Academic Stress (High & Low) almost loses their effect in the presence of highly effective Computer Based Mastery Learning Strategy.

Review of the related literature

The results of the present investigation were supported by research findings of. Chen-Lin C. Kulik and James A. Kulik (1987) suggested that a meta-analysis of forty-nine comparative studies showed that mastery testing generally has positive effects on student learning, but the size of effect in any single study depends on both the stringency of the mastery criterion used with the mastery group and the degree of experimental control employed in the study. Mastery effects were also more pronounced on the less able students in a classroom and were less noticeable in more able students. Finally, the analysis showed that mastery testing increased the amount of time needed for instruction. Robert L. Bangert-Drowns Kulik, James A. Kulik (1990) who showed that mastery learning programs have positive effects on the examination performance of students in colleges, high schools, and the upper grades in elementary schools. Laney, James D. et al (1995) ^[12] explored the effects of cooperative and Mastery Learning methods, alone and in combination, on first and second grade student's learning and retention of basic economic facts. The study suggests that the cooperative-Mastery Learning method is in line with current early childhood practices and has the capacity for simultaneously boosting the conceptual development and language development of young children. Kuchler, J.M. (1999) ^[9] suggested that CAI has only an overall small positive effect on mathematics achievement. The most effective CAI mode appears to be 'drill and practice' CAI appears to be equally effective across gender and grade level but has a greater positive impact on students from low socio-economic backgrounds. Preciado, Christina (2005) Conducted a study on CAI field test, the results of which were encouraging and suggest that the proposed methodology can be effective in performing its task. Patricia W. Wambugu and Johnson M. Changeiywo (2008) ^[16] who found evidences of the effects of Mastery Learning Approach (MLA) on students' achievement in Physics. The study was Quasi-experimental and Solomon Four Non-equivalent Control Group Design was used. The target population comprised of secondary school students in Kieni East Division of Nyeri District. The results of the study showed that MLA teaching method resulted in higher achievement but gender had no significant influence on their achievement. The researchers concludes that MLA is an effective teaching method, which physics teachers should be encouraged to use and should be implemented in all teacher education programmes in Kenya. Piia Maria Björn^{a*} & Paavo H.T. Leppänen (2013) ^[1] examined the results of Fast ForWord® training on English decoding-related skills. The students' English skills were examined in pre-test, post-test and follow-up measurements. The TRG (Training Group)

students saw an acceleration in decoding-related skills. Lin, Chun-Hung; Liu, Eric Zhi-Feng; Chen, Yu-Liang; Liou, Pey-Yan; Chang, Maiga; Wu, Cheng-Hong; Yuan, Shyan-Ming (2013) ^[19] in their study sought to compare the effectiveness of game-based and video-based remedial instruction incorporated with elements of mastery learning. The results demonstrate that (a) both instructional videos and the proposed Monopoly game enhance the learning of mathematical concepts; and (b) the Monopoly game is more effective than instructional videos at leveraging the benefits of mastery learning. The goal of the research was to integrate games and mastery learning into after-school remedial instruction and design a game to practice the steps of mastery learning. Peter K. Ronoh, Monicah Ndonga (2014) ^[17] found that students taught using CBML(Computer Based Mastery Learning) approach had significantly higher scores in SMQ (Students' Motivation Questionnaire) than those taught using conventional approaches and found that there is no gender difference in motivation when CBML is used. They recommended that CBML teaching strategy be incorporated in teacher education programs. Cindy De Smet^{ab*}, Tammy Schellens^a, Bram De Wever^a, Pascale Brandt-Pomares^c & Martin Valcke (2014) conducted a quasi-experimental study in the context of a biology course involving 360 secondary school students. A 2x2 factorial research design was adopted. The study provides empirical evidence that both the design and the group setting (collaborative versus individual) have an impact on learning outcomes. Although there was no main effect, several significant interaction effects with gender were found. The results are helpful to direct research about the design and implementation of learning paths in a secondary school setting and underpin the relevance of representation modes in science learning.

Objectives

1. To develop and validate computer based mastery learning (CBML) instructional package in Physics, for IX graders.
2. To study the impact of computer based mastery learning instructional packages on learning outcomes viz. achievement in Physics of IX graders.
3. To study the effect of Academic stress on the learning outcomes viz. achievement in Physics of IX graders.
4. To study the effect of Parental involvement on learning outcomes viz. achievement in Physics of IX graders.
5. To study the interaction effect of Instructional Strategies and Academic stress on the learning outcome viz. achievement in Physics of IX graders.
6. To study the interaction effect of Instructional Strategies and Parental involvement on learning outcomes viz. achievement in Physics, of IX graders.
7. To study the interaction effect of Academic stress and Parental involvement on learning outcomes viz. achievement in Physics of IX graders.
8. To study the interaction effect of Instructional Strategies, Academic stress and Parental involvement on learning outcomes viz. achievement in Physics of IX graders.

Hypotheses

The following hypotheses were formulated and tested:

Ho.1: There is no difference in gain means in Physics of IX

graders when taught by Computer Based Mastery Learning as against Conventional Group Learning.

Ho.2: There is no difference between mean gain scores in Physics of IX graders with high Parental involvement and low Parental involvement.

Ho.3: There is no significant difference in the gain means in Physics of IX graders of high Academic stress and low Academic stress.

Ho.4: There is no interaction between Instructional Strategies and Parental involvement in respect of mean gains in Physics of IX graders.

Ho.5: There is no interaction between Instructional Strategies and Academic stress in respect of mean gain scores in Physics of IX graders.

Ho.6: There is no significant interaction between Academic stress and Parental involvement in respect of mean gains in Physics of IX grader.

Ho.7: There is no interaction among, Instructional Strategies, Academic stress and Parental involvement in respect of mean gain scores in Physics of IX grader.

Sample

The research investigation was carried out on the students of IX th grade. The students ranged between 13 – 15 years of age. The sample was selected from the representative

coeducational English medium senior secondary schools located in Chandigarh. The names of schools selected for the experiment have been listed below:

1. Shivalik Public School, 41-B, Chandigarh
2. DAV Senior Secondary School, Sec.8 Chandigarh

These two schools were assessed for matching of general background of the students and their entry behaviour knowledge (through Entry Behaviour Test). Both of these schools were found to be matched.

Shivalik Public School, 41-B, Chandigarh was selected randomly for Experimental Group and DAV Senior Secondary School, Sec.8 Chandigarh was selected as control group. The control group was taught through Conventional method of teaching by their own teacher.

Because of administrative constraints of the school, the experimental treatment was given to all the 150 students in three sections. During the process of experimentation that lasted for approximately 3 months, some students dropped out at one stage or the other. These students therefore were not considered at the time of analysis. The classification of students on the basis of Academic stress (high and Low) and parental involvement (high and Low) was done at the time of analysis. The final sample for analysis thus comprised of N= 92 Students.

Table 1: Final Sample according to Instructional Treatment

S. No.	Instructional Treatment	No. of Students	
		Initial ungrouped sample	Final sample
I	Experimental Group	50+50+50	46
II	Conventional Group	30+36+34	46
	Total	250	92

Tools used

The following tools were used for collecting data:

- Parental involvement Scale: Developed and validated by Ahuja, M. and Sharma, N. (2002).
- Academic stress: Developed and validated by Bisht, A. (1987).
- Entry Behaviour Test –Developed and validated by Malhan, A.
- Formative Tests Developed and validated by the investigator separately for each unit.
- Enrichment - material for early masters (Identified by the investigator from the related literature on the content).
- Remedial instruction (provided with the help of Power Point Presentations used by the students according to their requirements including peer- tutoring developed and validated by the investigator).
- Summative Tests for a group of 4 units of Physics (developed and validated by the investigator).
- Computer based Mastery learning Instructional package: (developed and validated by investigator). The instructional package is based on Bloom’s Mastery learning Strategy.

The programmed instructional package was developed by the investigator. The content to be delivered through CD have been taken and modified from CD developed and validated by

S. Chand Company, with add on by the investigator. The total package consisted of:

- Content sequence
- Enduring Understanding
- Formulation of Objectives
- Orientation session
- Warm up session
- Formative Test after every unit
- Remediation (1 & 2)
- Enrichment
- Summative test

Computer Based Mastery Learning Instructional Package

Computer Based Mastery Learning Instructional Package was developed meticulously by following each step carefully.

The CBML package consisted of 4 units of Physics developed by investigator based on the cognitive skills, different objectives and content matter and information taken from the syllabi of the IX class syllabus prescribed by (NCERT) National Council of Educational Research and Training, New Delhi.

- The topics selected were discussed with science teachers to scrutinize which content has to be taught.

Instructional Objectives were written in behavioral terms and Sensitivity Indices were calculated for each item. Reliability

coefficient for each Unit Formative Test was also calculated. Sensitivity indices & Reliability coefficient for Summative Tests of Physics were also calculated. Unit Formative Test & Summative Tests were found reliable as well as valid.

Analyses on gain scores in physics

As the performance tests yielded the scores out of 50 for

Physics. The subject scores were transferred on to the base of 100.

i) Descriptive Analyses on Gain Scores in Physics

The means, SD's of Experimental and Control groups across parental Involvement and Academic Stress have been recorded in table no. 1

Table 1: Table for Means and SD's of Physics Gain scores

	CBML (Experimental group)		CGL (Control group)		Total
	HPI	LPI	HPI	LPI	
HAS	M =39.27 N =11 SD =8.31	M =41.33 N =12 SD =9.12	M =28.67 N =12 SD =5.07	M =28.73 N =11 SD =8.21	M=34.52 N=46
LAS	M =39.2 N =10 SD =13.44	M =47.69 N =13 SD =12.54	M =26.83 N =12 SD =9.89	M =24 N =11 SD =7.04	M=34.74 N=46
Total	M=39.24 N=21	M=44.64 N=25	M=27.75 N=24	M=26.37 N=22	M=34.63 N=92
Total	M=42.17 N= 46		M= 27.09 N=46		

As it is shown in the table no.1.1, the details of the Physics Gain scores for Experimental Group and Control Group across PI (high& Low) and AS (high & Low) levels have been given separately in two halves. The means and SD's have also been presented for each sub-group. Their means have been depicted on the bar diagrams given below:

ii) Bar diagrams for Gain Scores in Physics

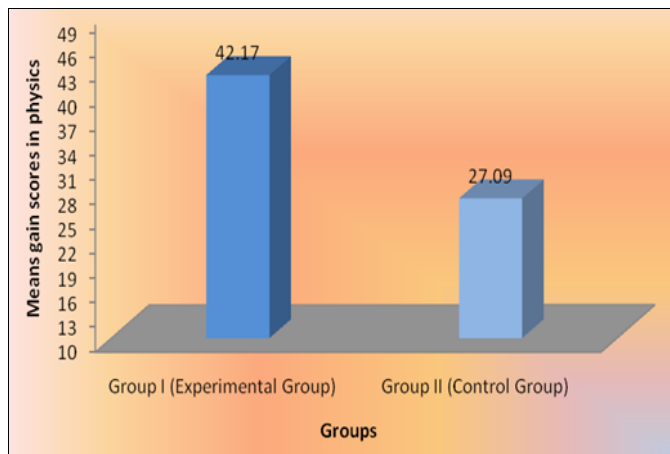


Fig 1: Bar Graph Showing the Means of Two Selected Groups on Gain Scores in Physics

The sample data as depicted in the table 1 and Bar diagram, showed variation in means on Physics Gain scores. To study whether the difference in means was significant or not, 2x2x2 analysis of Variance was applied on Physics Gain scores.

iii) 2x2x2 Analyses of Variance on Gain Scores in Physics in relation to Instructional Strategies, Parental Involvement and Academic Stress

A similar 2x2x2 ANOVA was employed to analyse Gain Scores in Physics.

This analysis was done to test the following hypotheses:

- Ho.1:** There is no difference in gain means in Physics of IX graders when taught by Computer Based Mastery Learning as against Conventional Group Learning.
- Ho.2:** There is no difference between mean gain scores in Physics of IX graders with high Parental involvement and low Parental involvement.
- Ho.3:** There is no significant difference in the gain means in Physics of IX graders of high Academic stress and low Academic stress.
- Ho.4:** There is no interaction between Instructional Strategies and Parental involvement in respect of mean gains in Physics of IX graders.
- Ho.5:** There is no interaction between Instructional Strategies and Academic stress in respect of mean gain scores in Physics of IX graders.
- Ho.6:** There is no significant interaction between Academic stress and Parental involvement in respect of mean gains in Physics of IX graders.
- Ho.7:** There is no interaction among Instructional Strategies, Academic stress and Parental involvement in respect of mean gain scores in Physics of IX graders.

The sum of squares and F-ratios for main effects, interaction effects of instructional strategy, parental Involvement and Academic Stress have been recorded in the following table no. 2.

Table 2: Summary of Analysis of Variance for the Gain Scores of Physics.

Source of Variation	SS	df	MSS	F-Value
Main Effects; A: Instructional Strategies; CBML vs CGL	5234.5	1	5234.5	60.7**
B: Parental Involvement	203.3	1	203.3	2.36
C:Academic Stress	1.1	1	1.1	0.01
Two Order Interactions: A x B, Instructional Strategies x Parental Involvement	152.9	1	152.9	1.77
Two Order Interactions: A x C, Instructional Strategies x Academic Stress	271.6	1	271.6	3.15
Two Order Interactions: B x C, Parental Involvement x Academic Stress	45	1	45	0.52
Three Order Interaction:, (A x B x C)	77.7	1	77.7	0.90
Within Group (Error)	7245.9	84	86.26	
Total	13232	91		

**Significant at 0.01 Level, *Significant at 0.05 Level

It may be observed from the table no. 1.2 that the F-ratio for instructional strategies was 60.7 has been found highly significant at the .01 level of confidence. It indicates that the null hypothesis for equality of the means i.e., *Ho.1: There is no difference in gain means in Physics of IX graders when taught by Computer Based Mastery Learning as against Conventional Group Learning*, was rejected at the .01 level of confidence. The mean gains through the two strategies were found different. The observation of their respective means (table 1) indicates that the mean gain in Physics through computer based mastery learning (M= 42) was more than the mean gain through conventional group learning (M= 27).

It may be observed from the table 1.2 that F-ratio for the difference in mean gains of the two parental Involvement groups was 2.36 which is less than the table value of F at the .05 level of confidence. Hence the null hypothesis; *Ho.2: There is no difference between mean gain scores in Physics of IX graders with high Parental involvement and low Parental involvement*, could not be rejected even at .05 level of confidence. It suggests that the gain means in Physics of the two Parental involvement groups (High & Low) may not be treated as different beyond the contribution of chance factors and the observed mean difference may be ascribed to chance factor alone.

It may be observed from the table 2 that the F-ratio for the difference in mean gains in Physics of the two Academic Stress groups (High & Low) was 0.01 which is less than the table value of F at the .05 level of confidence. Hence, the null hypothesis; *Ho.3: There is no significant difference in the gain means in Physics of IX graders of high Academic stress and low Academic stress*, could not be rejected even at the .05 level of confidence. It suggests, that the gain means in Physics of the two Academic Stress groups (High & Low) may not be treated as different beyond the contribution of chance factor and the observed mean difference may be ascribed to the chance factor alone.

It may be observed from the table 2 that the F-ratio for the interaction between Instructional Strategies and Parental Involvement in respect of mean gains in Physics was 1.77 which is less than the table value of F even at the .05 level of confidence. Hence the null hypothesis; *Ho.4: There is no interaction between Instructional Strategies and Parental involvement in respect of mean gains in Physics of IX graders*, could not be rejected even at the .05 level of confidence. It suggests that the two variables Instructional Strategies and Parental involvement do not interact to yield different gain

means in Physics and the two act as independent of each other.

It may be observed from the table 1.2 that the F-ratio for the interaction between Instructional Strategies and Academic Stress was 3.15 which is less than the table value of F at the .05 level of confidence. Hence the null hypothesis; *Ho.5: There is no interaction between Instructional Strategies and Academic stress in respect of mean gain scores in Physics of IX graders*, could not be rejected even at the .05 level of confidence. It suggests that the two variables Instructional Strategies and Academic Stress do not interact to yield different gain means in Physics and the two act as independent of each other.

It can be observed from the table 1.2 that the F-ratio for the interaction between parental Involvement and Academic Stress was 0.52 which is less than the table value of F at the .05 level of confidence. Hence the null hypothesis of no interaction, i.e., *Ho.6: There is no significant interaction between Academic stress and Parental involvement in respect of mean gains in Physics of IX grader*, could not be rejected even at the .05 level of confidence. It suggests that the two variables parental Involvement (High & Low) and Academic Stress (High & Low) do not interact to yield differences in gain means in Physics and they act independent of each other.

It may be observed from the table 1.2 that the F-ratio for the three order interaction among Instructional Strategies, parental Involvement and Academic Stress in respect of mean gains in Physics was 0.90 which is less than the table value of F at the .05 level of confidence. Hence the null hypothesis *Ho.7: There is no interaction among, Instructional Strategies, Academic stress sand Parental involvement in respect of mean gain scores in Physics of IX grader*, could not be rejected even at the .05 level of confidence. It suggests that the three variables Instructional Strategies (CBML & CGL), parental Involvement (High & Low) and Academic Stress (High & Low) do not interact to yield different gain means in Physics. The three variables act independent of each other.

Based on the findings of 't'- ratio there exists a significant difference between Computer Based Mastery Learning as against Conventional Group Learning. It appears that in Computer Based Mastery Learning students achievement is higher as they get remediation according to their own need through the programmed instruction that suits to their individuality, whereas, on the other hand, in Conventional Group Learning students are taught through similar traditional method of instructions for all, which is mostly difficult to

understand to the weak students and boring for the students with high IQ level. In other words, it is not according to the individual interest and need. In Conventional Learning they are unable to find instructions that fulfill their individual needs, separately. They lose their interest in their studies as compared to the students who are taught through Computer Based Mastery Learning. The researcher draws probable reasons that because of all these factors the students when taught through Computer Based Mastery Learning, show much better performance as compared to when they are taught through the Conventional Group Learning.

Reference

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