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A Study On "The Effectiveness Of Instructional Module On The Achievement Of M.Ed. Students In Introductory Statistics Of Education"

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Abstract:

This paper presents the overview of the final study on "The Effectiveness of Instructional Module on the Achievement of M.Ed. students in Introductory Statistics of Education" by disclosing its purpose, procedure & findings. The purpose of this paper is to present the results of the experiment which includes the two different approaches of teaching i.e. modular approach & conventional approach, to compare the achievement of M.Ed students in introductory statistics. In this study, 20 students of M.Ed. course were involved for formulating two parallel groups i.e. one experimental group & other conventional group. For the present study, the 11 modules were developed on the introductory statistics of M.Ed. course using CAI .The findings of the study explores that the achievement of the students was higher, attitude of the students improved towards statistics, anxiety reduced, conceptual clarity increased and computational ability improved in introductory statistics when taught through modular approach rather than conventional one.

Key words: Instructional modules, introductory statistics, effect of instructional module on statistics

Introduction:

Although we are living in 21st century, yet in India, in almost all the colleges, universities and schools, teachers have adopted the traditional method of teaching. With this narrow method of teaching we can't achieve the objectives for 21st century learners. For modern education system the teachers have to change their methods of teaching. We need such methods with which we can make teaching and learning process more interesting, innovative and meaningful. The methods today which are taking place of

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traditional teaching are: use of multi-media, programmed learning material, personalized system of instruction, brain-storming, use of ICT and modular approach. Although these methods can be used successfully yet these may not be applied at a time for all the subjects. In, the present study, a venture has been made to test the effectiveness of modular approach in introductory statistics for the students of M.Ed. course. Introductory statistics requires teaching strategies that could help the teacher perform his task more efficiently, and provide each student sufficient time to maximize learning at the same time. One such technique is to individualize instruction where individual differences of students in their capacities to learn are taken into account. Individualized instruction develops critical thinking. Students are encouraged to question, criticize and argue their point of view. It also develops one's self-concept by recognizing the desirability of individual differences. The basis for this approach is the fact that every student is unique with his own potentials, abilities, interests, and needs. Thus, no two students can learn statistical concepts at the same rate in the same manner.

A module is a new teaching strategy for arranging learning experiences in education and it has been receiving much attention. The strategy of learning modules has become a part of all level of teaching. A learning module is a self-learning package dealing with one specific subject matter unit. It can be used in any setting convenient to the learner and may be completed at the learner's own pace. It may be used individually or in small groups. It is structured in such a way that learner can identify the objectives he/she wants to achieve, select the appropriate material, follow a learning sequence by selecting from a variety of methods of presentation, and evaluate his/her own achievements. In module learning teachers becomes a facilitator of learning rather than the traditional dispenser of knowledge. Sufficient theory and practice are available for the application of modular teaching in our classrooms

The Philippine Education Quarterly (1985, as cited in Figuerres, 1994) reported that modules can take the place of a teacher. These self-learning devices help pupils to learn or acquire skills, knowledge and information in the absence of a teacher. These materials provide sufficient reinforcement, enrichment and source materials. They allow

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also the learner to work at a rate style and level situated to his capacity. Among the forms of individualized instruction, modules effective and economical in developing specific knowledge and skills. Modules induce learning with minimum teacher direction and supervision. Furthermore, these develop learning and grading strategies, improve classroom management techniques, and encourage achievement for greater use of existing educational resources through the establishment of realistic obtainable learning goals within an individualized program of studies (Rillo,1995).

Method & Procedure:

a. **Design**-The present study was undertaken to investigate the effect of two approaches of teaching (modular & conventional) on the achievement of M.Ed. students in introductory statistics. The pre-test, post-test, parallel group design having one experimental & one control group design was followed. The experimental group was taught through instructional modules using CAI i.e. through modular approach. The control group was taught through conventional approach. The criterion test was administered to the students of each group as pre test before starting the experiment & as post test at the completion of instructional period.

b. **Sample**-24 students of M.Ed institute from Kurukshetra were taken as sample in the beginning of the experiment. But because of the sample death due to absence or irregularity of the students, in the end the data were analyzed for 20 students only.

c. **Tools Used** -For providing instructions to experimental group 11 modules covering all concepts of introductory statistics of M.Ed students were developed by the researchers using CAI. Control group was given instruction by using conventional approach of teaching.

Along with the instructional tools the following measuring tools were employed to measure the change in students' behavior viz. achievement,

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conceptual understanding, computational ability, anxiety & attitudes towards introductory statistics developed by the researcher.

d. **Statistical tools used-** Keeping in view the design and objectives of the study, the following statistical techniques were employed to analyze the collected data. The rationale for using the particular techniques has been given in the paragraph as:

- Appropriate descriptive statistics such as mean, median, standard deviation, skewness and kurtosis were worked out and to ascertain the nature of the distribution of scores on dependent variable of achievement in introductory statistics (pre-test & post-test) and independent variables of attitude towards statistics, statistical anxiety, conceptual understanding towards statistics and computational ability in introductory statistics.

- Test was employed to see the individual effectiveness of methods of teaching on achievement in introductory statistics.

- Three-way ANOVA having two variables each i.e. 2x2x2 ANOVA was employed to study the main effects and interactional effects of the variables under study.

- In the case of teaching strategies, where F-ratio was found to be significant, t-ratio was calculated.

Findings of the Study:

a. Main Effect of Factor A (Teaching Approaches)

For the main effect of teaching approach on the achievement on introductory statistics, F-ratio was 73.06, which is found to be significant at 0.01 level of significance.

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This implies that both the groups differ in the mean scores of achievement in introductory statistics. In order to interpret the results, we found the value of t-ratio as given in the next table

SR. NO.	*GROUPS*	*MEAN*	*SED*	*t-RATIO*	*SIG*
1	A1 (Experimental Group)	35.8	3.7	2	0.05 LEVEL
2	A2 (Control Group)	28.4			

Table 1: Means and t-ratios of Introductory Statistics Scores for treatments

Table 1 depicts that the t-ratios between groups A1 and A2 (t-ratio=2) is significant at 0.05 level. The difference in means can not be attributed to sample error or chance factor. The data rejects the hypothesis that there is no difference in the achievement of students when taught through modular approach.

Thus the accepted hypothesis is that there will be significant difference in the performance of the students in achievement in introductory statistics between the groups with regard to teaching approaches.

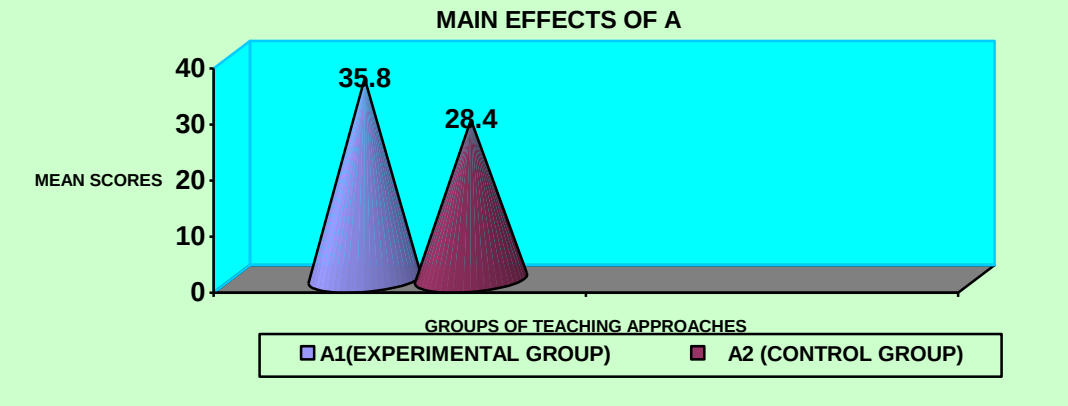


Fig 1: Pictorial form of mean scores achieved by students when taught through particular approach.

The higher mean score of experimental group in figure shows that group 1 i.e. experimental group scored higher than group11 i.e. control group.

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Thus we can say that learning introductory statistics through modular approach is more effective as compared to conventional approach of teaching.

Main Effect of Factor B (Testing Occasions):

F-ratio is (145.92) for the main effect of testing occasions on the achievement on introductory statistics, which was found to be significant at 0.01 level of significance.

This implies that the difference exists in the mean achievement scores on the two different occasions. In order to see the direction of the difference between the occasions, t-ratio has been calculated between the two different occasions (pre-test and post-test) in the following table.

SR. NO.	***TESTING OCCASSIONS***	***MEAN***	***SED***	***t-RATIO***	***SIG***
1	B1 (Pre-testing OCCASION)	28.6	4.35	2.27	0.05 LEVEL
2	B2 (Post-testing OCCASION)	35.6			

TABLE 2: Means and t-ratios of Introductory Statistics Scores for testing OCCASSION

Table 2 shows that the t-ratios between groups B1 and B2 (t-ratio=2.27) is significant at 0.05 level. The t-ratio between the mean scores of pre-test (B1) and post-test (B2) are significant at 0.05level. This shows that achievement scores of the students were higher on occasion II (post-test) than the occasion I (pre-test).

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The difference in means can not be attributed to sample error or chance factor. The data rejects the null hypothesis that there is no difference in the achievement of students on two different occasions. Thus the accepted hypothesis is that there will be significant difference in the performance of the students in achievement in introductory statistics between the groups on the different testing occasions.

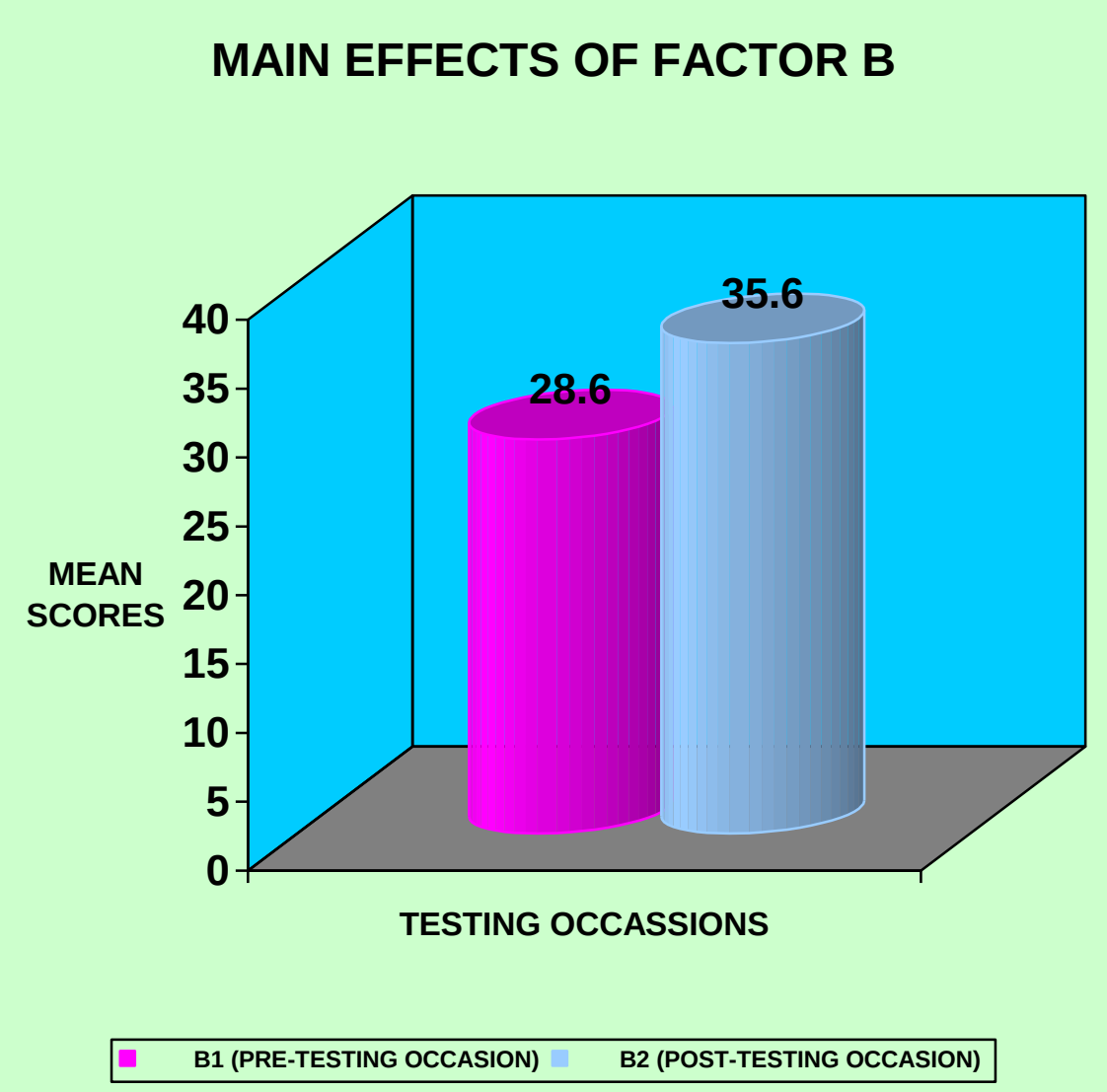


Fig. 2: Pictorial form of mean scores achieved by students at different testing occasions.

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The higher mean score of B2 in figure shows that students achieved higher in post-testing occasion than B1 i.e. in pre-testing occasion.

Thus we can say that achievement of the students differ in different occasions i.e. there performance differs before starting the instructional stage and just after completing the instructional stage/ experiment.

Main Effect of Factor C (Levels of Intelligence)

F-ratio is (26.88) for the levels of intelligence on the achievement in introductory statistics were found to be significant at 0.01 level of significance.

This indicates that the students belonging to different levels of intelligence differ significantly on the achievement scores. In order to interpret these results, the value of t-ratio has been given in the following table.

SR. NO.	***Levels of Intelligence***	***MEAN***	***SED***	***t-RATIO***	***SIG***
1	C1 (High Level of Intelligence)	37.35	3.32	3.16	0.01 LEVEL
2	C2 (Low Level of Intelligence)	26.85			

TABLE 3: Means and t-ratios of Introductory Statistics Scores for Levels of Intelligence

Table 3 shows that the t-ratios between groups C1 and C2 (t-ratio=3.16) is significant at 0.01 level. The t-ratio between the mean scores of high level of intelligence (C1) and low level of intelligence (C2) are significant at 0.01level. This shows that achievement scores of the students were higher on high intelligence level (post-test) than the occasion I (pre-test).

The difference in means can not be attributed to sample error or chance factor. The data rejects the null hypothesis that there is no difference in the achievement of students on two different occasions. Thus the accepted hypothesis is that there will be significant

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difference in the performance of the students in achievement in introductory statistics between the groups on the different levels of intelligence.

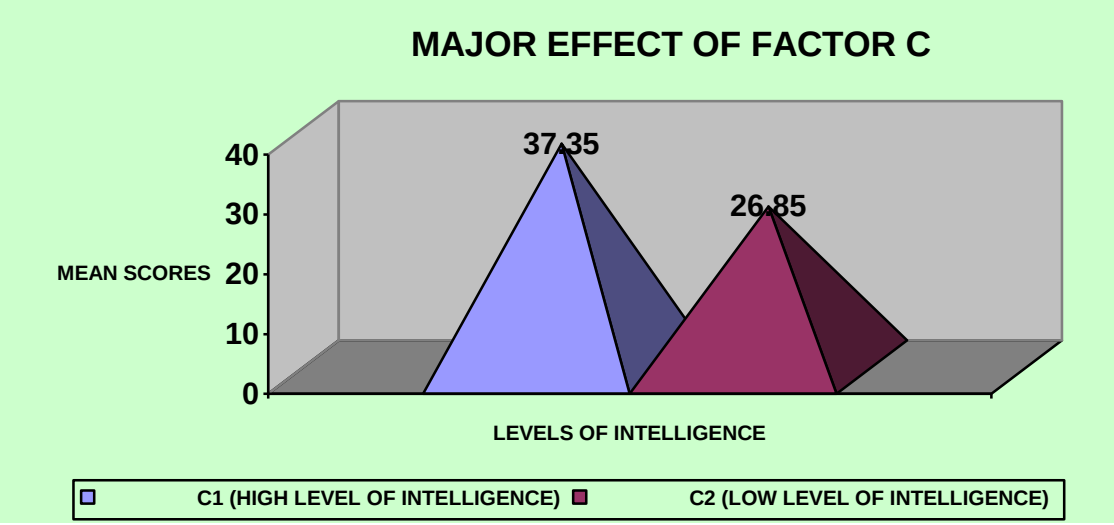


Fig 3: Pictorial form of mean scores achieved by the students of particular level of intelligence.

The higher mean score of C2 in figure shows that students of high intelligence level achieved higher than C1 i.e. low intelligence level students. Thus we can say that achievement of the students differ on different levels of intelligence i.e. high level intelligence students score more than in achievement test than low level intelligence students.

Interactional Effects (First Order Interaction):

a) Interaction between teaching approaches and testing occasion (AXB)

F-ratio is (8.79) for the levels of intelligence on the achievement in introductory statistics were found to be significant at 0.05 level of significance. This indicates that all the four groups A1B1, A1B2, A2B1 and A2B2 differ significantly on the mean scores of achievement in introductory statistics. Thus there is particular approach of teaching and particular testing occasion where the mean achievement scores are highest. Therefore, the hypothesis namely, there is no difference in the achievement of the students on particular testing occasion when taught through a particular

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approach of teaching. The alternative hypothesis that there will be a significant interaction between different approaches of teaching and testing occasion is accepted.

TABLE 4: Means and t-ratios of Introductory Statistics Scores for Levels of Intelligence

In order to interpret the results of interaction between approaches of teaching and testing occasion, t-test was found out for different combinations of groups. The results for the same are given in the table as

The table 4 shows that there remains a significant difference among the students taught through two approaches of teaching on two different testing occasions. The groups have been arranged in ascending order on the basis of their mean scores as given in the table 4.

Fig 4: Pictorial interaction between approaches of teaching and testing occasions. (AXB)

GROUPS	*MEAN*	*SED*	*t-RATIO*	*SIG*
A1B1 ***(Pre-test was applied to experimental group)***	**31.6**			
A1B2 ***(Post-test was applied to experimental group)***	**40**	**3.3**	**2.54**	**0.05 LEVEL**
A2B1 ***(Post-test was applied to experimental group)***	**25.6**			
A2B2 ***(Post-test was applied to control group)***	**31.2**	**2.4**	**2.33**	**0.05 LEVEL**

b. Group wise arrangement according to the trend of Achievement in Introductory Statistics Scores for Treatment X Testing Occasion (AXB)

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It is clear from the Figure 4 that scores on the achievement test were highest in case of modular approach on post test. In other words, it may be said that students achieved the highest scores when taught through modular approach and the lowest when taught through conventional approach.

SR. NO.	***GROUPS***	***MEAN***
1	A1B2	40
2	A1B1	31.6
3	A2B2	31.2
4	A2B1	25.6

Table 5

c. Interaction between Testing Occasion and Levels of Intelligence (BXC)

F-ratio is (0.19) for the interaction b/w testing occasion and levels of intelligence on the achievement of students in introductory statistics was found to be insignificant.

This indicates that there exists no difference in the mean achievement scores in introductory statistics among high and low intelligence students when tested at two testing occasion. Thus there is no interaction between the testing occasion and levels of intelligence.

Therefore, the null hypothesis that, there exists no difference in the achievement of students tested at different occasions and of different levels of intelligence is accepted. Table 6 shows the mean scores of all the four groups, whereas figure no. 5 shows the pictorials form of the different combinations of interaction BXC

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SR. NO.	*GROUPS*	*MEAN*
1	B1C1 (PRE-TEST WAS APPLIED TO HIGH INTELLIGENCE LEVEL)	34.1
2	B1C2 (PRE-TEST WAS APPLIED TO LOW INTELLIGENCE LEVEL)	23.1
3	B2C1 (POST-TEST WAS APPLIED TO HIGH INTELLIGENCE LEVEL)	40.6
4	B2C2 (POST-TEST WAS APPLIED TO LOW INTELLIGENCE LEVEL)	30.6

TABLE 6

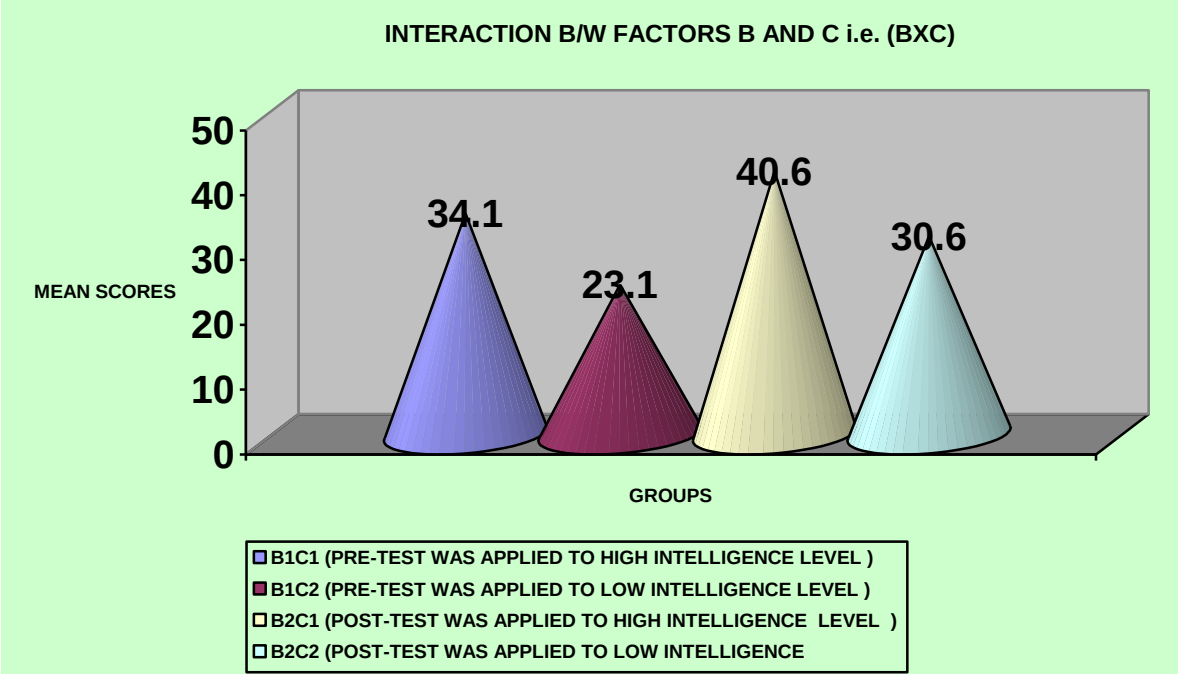


Fig 5: Interaction between approaches testing occasion and levels of intelligence (BXC)

d. Interaction between Testing Occasion and Levels of Intelligence (AXC)

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F-ratio is 0.90 for the interaction b/w testing occasion and levels of intelligence on the achievement of students in introductory statistics were found to be insignificant.

This indicates that all the four groups A1B1, A1B2, A2B1 and A2B2 differ insignificantly on the mean scores of achievement in introductory statistics. Thus there is no interaction between the testing occasion and levels of intelligence. Therefore, the null hypothesis, there is no difference in the achievement of the students of particular level of intelligence at different testing occasions.

SR. NO.	***GROUPS***	***MEAN***
1	A1C1 EXPERIMENTAL GROUP SCORES OF HIGH INTELLIGENCE STUDENTS)	42.4
2	A2C1 (CONTROL GROUP SCORES OF HIGH INTELLIGENCE STUDENTS)	32.3
3	A1C2 (EXPERIMENTAL GROUP SCORES OF LOW INTELLIGENCE LEVEL STUDENTS)	29.2
4	A2C2 (CONTROL GROUP SCORES OF LOW INTELLIGENCE LEVEL STUDENTS)	25.4

TABLE 7

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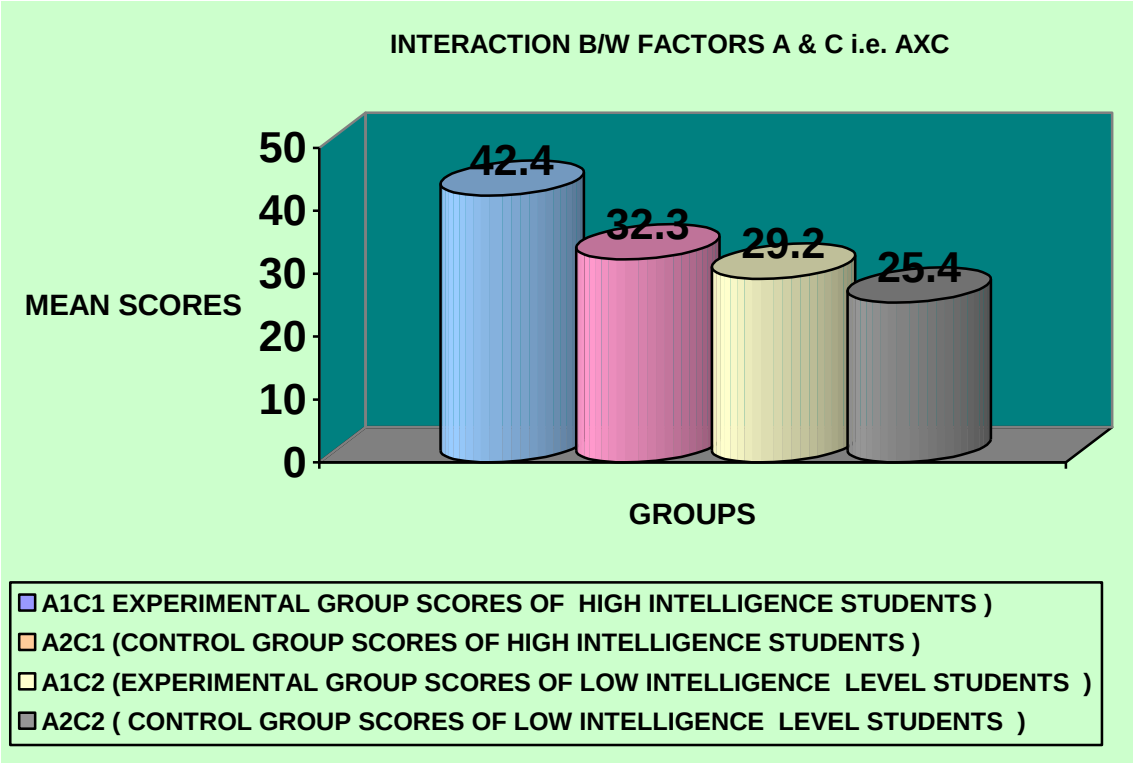


Fig 6: Interaction between approaches of teaching and levels of intelligence (AXC)

e. Second Order Interaction among Factors Interaction among Approaches of Teaching, Testing Occasion and Levels of Intelligence (AXBXC)

F-ratio is 0.01 for the interaction among approaches of teaching, testing occasion and levels of intelligence on the achievement of students in introductory statistics was found to be insignificant.

This implies the acceptance of null hypothesis, that, there is no difference in the achievement of the students of particular level of intelligence in introductory statistics when taught through a particular approach of teaching and tested at different occasions. Thus there is no interaction among the factors approaches of teaching, testing occasions and levels of intelligence.

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GROUPS	*MEAN SCORES*
A1B1C1	38.6
A1B1C2	24.6
A1B2C1	46.2
A1B2C2	33.8
A2B1C1	29.6
A2B1C2	21.2
A2B2C1	35
A2B2C2	27.4

TABLE 8

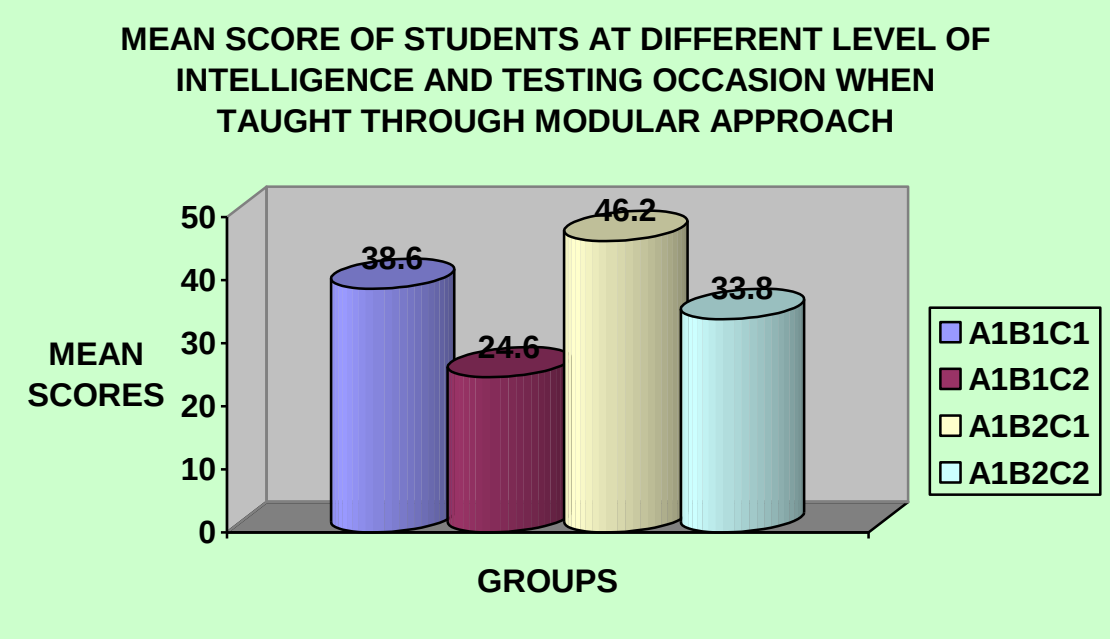


FIG 7: Interaction among modular approach, testing occasion and levels of intelligence. (A1XBXC)

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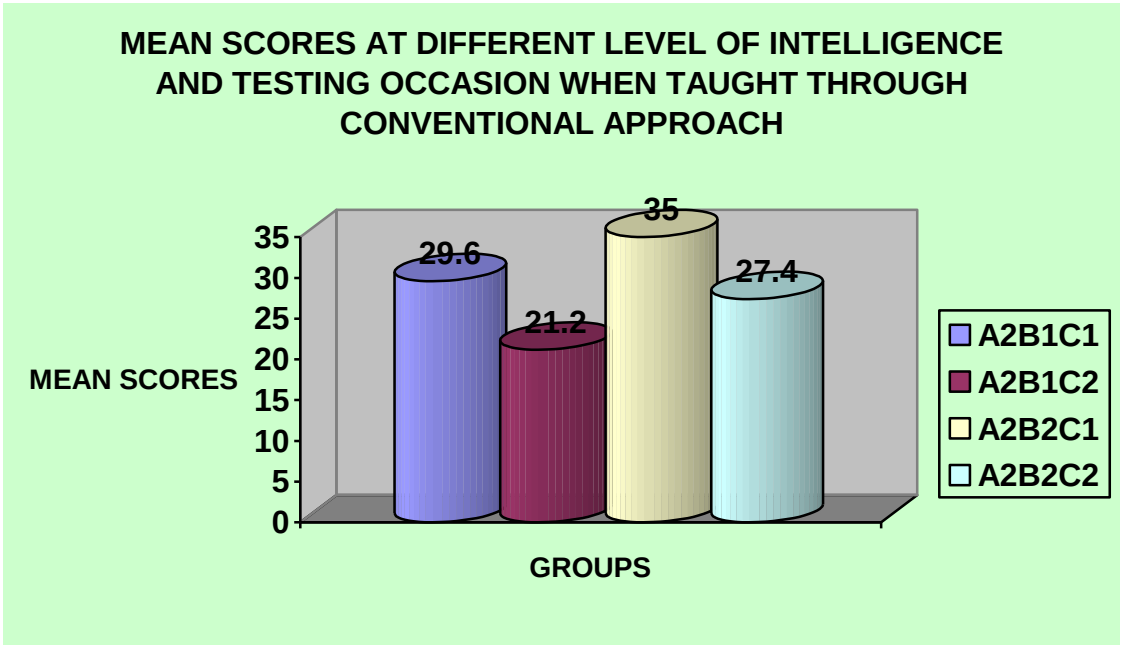


Fig 8: Interaction among conventional approach, testing occasion and levels of intelligence.

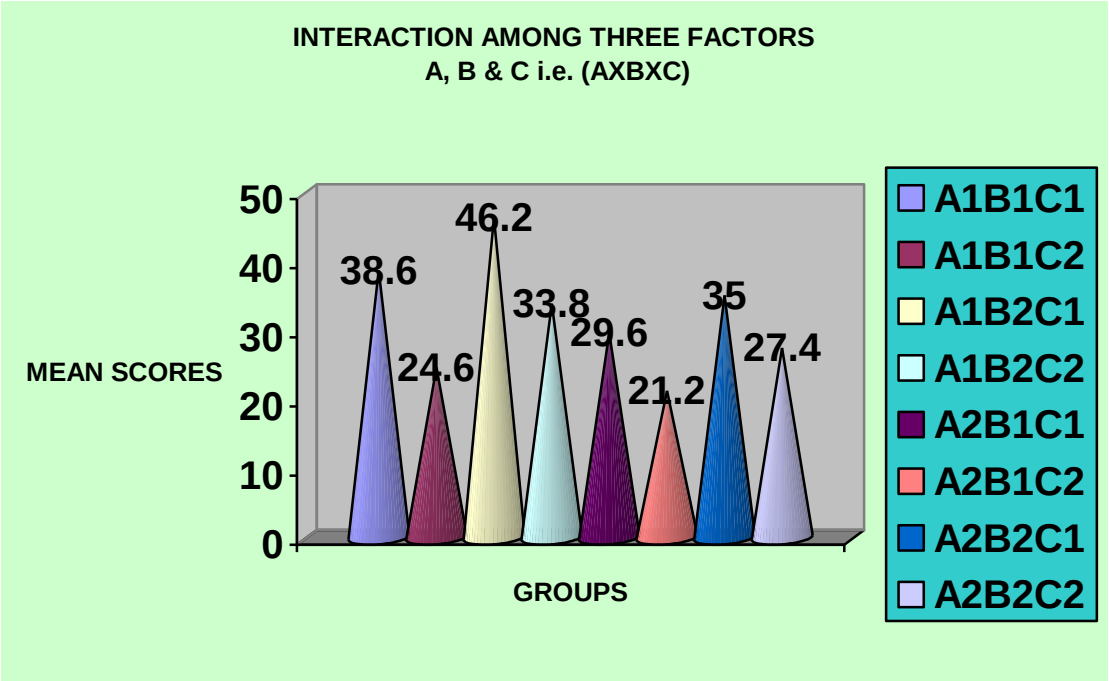


FIG 9: Interaction among teaching approaches, Testing occasions and Levels of intelligence (AXBXC)

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Conclusion:

The students achieved the highest achievement scores in introductory statistics when taught through modular approach. High intelligence students secured the highest scores when they were taught through modular approach & conventional approach. Keeping intelligence being constant, the students maintained the higher achievement scores in introductory statistics when taught through modular approach in comparison to the conventional approach. The M.Ed. students of experimental group and control group when taught through particular approach of teaching differ significantly in their attitude towards statistics on different testing occasions. The t-value were found respectively which are significant at 0.05 level.

This shows that attitude of the students taught through modular approach differs significantly on particular testing occasions in comparison to control group. Anxiety of the students for introductory statistics reduces after the treatment the most when they were taught through modular approach than conventional approach of teaching. The M.Ed. students of experimental group when taught through modular approach differ significantly on conceptual understanding in statistics at different testing occasions. The t-value was found which is significant at 0.05 level. Computational ability of the students in introductory statistics increased after the treatment the most when they were taught through modular approach than conventional approach of teaching.

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