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A COMPARATIVE STUDY FOR TEACHING CHEMISTRY THROUGH INDUCTIVE THINKING MODEL AND ADVANCED ORGANIZER MODEL

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ABSTRACT

The objective of the study is to compare the relative effectiveness of Inductive Thinking Model (ITM) and Advance Organizer Model (AOM) in teaching chemistry under two different boards/councils in relation to level of cognitive achievement of the students on the criteria of immediate learning and retention. The sample consists of 200 students from eight sections of four randomly selected schools situated at Purulia, Birbhum, Malda and Hoogly. The (2 × 2 × 3) factorial design was used for the study. At the beginning, an entry level test (ELT) has been administered to cheek the homogeneity of the groups and to categorize the students on the basis of their cognitive achievement. After administering the entry level test, four treatment groups have been formed. Gr I and Gr III have taught with AOM whereas Gr II and Gr IV taught with ITM for eight weeks. After experimentation, common standardized CRTs (post test)viz. CRT II and CRT III has been administered to all the sections. In order to test retention of the learnt knowledge, CRT IV, which is the combination of CRT II and CRT III has been administered after 15 days from the date of post test. Results indicate that that both ITM and AOM are equally effective on the criteria of immediate learning but AOM group establishes superiority than the ITM group on retention.

Key Words: Chemistry teaching, Inductive thinking model, Advance organizer model, Cognitive achievement.

INTRODUCTION

Teaching of science is not just handing out facts and information about science. Besides motivating and presenting things in an interesting way, the teacher must be able to create suitable learning experiences which reflect an atmosphere for students' self exploration, problem solving, inductive reasoning, etc.(Venvile and Dawson,2005) To achieve this, there are varieties of methods of teaching available and the teacher has to select such method or methods, which are suitable for the given set of students in a given context (Gilbert, 2011)). Most of the experts believed that teaching learning process is the key factor for understanding the concepts of chemistry. To adjust with the rapid explosion of knowledge of chemistry, the learners must be prepared to process information suitably and meaningfully so that the information can be treated for a longer time and can be used in different situations of life (Ray ,2008 ; Smith,2009). To accomplish these objectives, the learners have to frame a concept in his cognitive domain. Transfer of learning mainly depends on concept formation because these concepts are the key building blocks of the structure of knowledge.

Literature Review

Aziz (1990) conducted a study whose objectives was to compare the effectiveness of information processing model in the teaching of chemistry with traditional lecture method in relation to gender. The result of the analysis showed that the performance of the students taught through model approach was superior than the performance of the students taught through traditional approach.

Jamini (1991) investigated the relative effectiveness of AOM and CAM on conceptual learning efficiency and retention of chemistry concepts in relation to divergent thinking which indicated that although both AOM and CAM were effective in fostering concept learning, AOM was comparatively more beneficial in concept learning to pupil with high divergent thinking while CAM was more beneficial to pupils with low divergent thinking.

Remadevi (1998) conducted a study to find out the effectiveness of Information Processing Models (IPM) in the teaching of chemistry in comparison with the Conventional Method (CM) at Higher Secondary Schools of Kerala in relation intelligence and scientific attitude. The findings of the study revealed that the pupils taught through IPM were found to have significantly higher achievement than those taught through CM with respect to knowledge level of cognitive achievement, comprehension level of cognitive achievement and application level of cognitive achievement at .01 level.

Sreelekha and Nayar (2004) conducted a study to compare the achievement level between traditional method and concept attainment model in the teaching of chemistry with respect to knowledge, understanding and application objectives. The major finding was CAM was effective in improving the overall level of achievement in chemistry.

Domin (2008) used an advance organizer pertaining to the nature of science (NOS) aspect of the role creativity plays in science, incorporated into a problem-based laboratory activity of an undergraduate first-year chemistry curriculum. The results of this study indicate that the different versions of the advance organizer differ with respect to altering students' conceptualization of creativity: specifically, only the indefinite explication of the intended learning outcome led to a significant change in the percentage of students holding more informed views. This finding suggests that a relatively small change in instructional design can advance improvement in achieving NOS learning outcomes within a large-scale content-based science course.

Khan and Saeed (2010) conducted a study to investigate the effectiveness of concept formation teaching model over traditional method in the teaching of chemistry at IXth grade students' achievement. The results of the study indicated that concept formation teaching model was more effective as compared to traditional method. Furthermore, concept formation teaching model appeared to be favorable for both boys and girls for the understanding of Chemistry concepts.

Khan et al (2011), conducted a study to examine the effect of inquiry-based instruction as a supplementing strategy on the academic achievement of secondary school students in the subject of chemistry. The results of the study indicate that inquiry based instruction, as a back up strategy to support traditional teaching methods. Improved students' achievement in the subject of chemistry at secondary level with higher achievement gains for the groups of high achievers.

Although a few studies have been undertaken to develop instructional materials based on different teaching models for the teaching of science, but so far rare evidence of teaching chemistry at higher secondary level based on ITM and AOM has been noticed. To bridge this gap an attempt has been made in the present study. It is expected that the findings of the study would throw some ray of light to indicate the effective strategy for teaching chemistry at higher secondary level in West Bengal.

Objectives of the study

The Objectives of the study can be stated in terms of some specific objectives, which are:

1. To find out the relative effectiveness of ITM and AOM on cognitive learning in Chemistry on the criteria of immediate learning and retention.
2. To assess the effects of affiliating boards on cognitive learning in Chemistry on the criteria of immediate learning and retention.

3. To assess the interaction effects of Models of teaching, Levels of achievements and affiliating boards in chemistry on the criteria of immediate learning and retention.

Hypotheses

In order to carry the study smoothly , following null hypotheses have been framed :

$^{o}H_1$: The effect of teaching through ITM and AOM do not differ significantly in teaching chemistry on the criterion of immediate learning.

$^{o}H_2$: The effect of teaching to the students under two different boards/councils through either models do not differ significantly on the criterion of immediate learning.

$^{o}H_3$:The effect of teaching between high, average and low achievers under two different boards/councils through either models do not differ significantly on the criterion of immediate learning

$^{o}H_4$:There would be no significant first order interaction effects due to the variation of instructional models and the levels of achievements of the students on the criterion of immediate learning.

$^{o}H_5$:There would be no significant first order interaction effects due to the variation of instructional models and the affiliating boards on the criterion of immediate learning.

$^{o}H_6$:There would be no significant first order interaction effects due to the variation of levels of achievement of students and the affiliating boards on the criterion of immediate learning.

$^{o}H_7$:There would be no significant second order interaction effects due to the variation of models of instruction, levels of achievement of students and the affiliating boards on the criterion of immediate learning.

$^{o}H_8$: The effect of teaching through ITM and AOM do not differ significantly in teaching Chemistry on the criterion of retention of learnt knowledge.

$^{o}H_9$: The effect of teaching to the students under two different boards/councils through either models do not differ significantly on the criterion of retention of learnt knowledge.

$^{o}H_{10}$:The effect of teaching between high, average and low achievers under two different boards/councils through either models do not differ significantly on the criterion of retention of learnt knowledge

$^{o}H_{11}$:There would be no significant first order interaction effects due to the variation of instructional models and the levels of achievements of the students on the criterion of retention of learnt knowledge.

$^{o}H_{12}$:There would be no significant first order interaction effects due to the variation of instructional models and the affiliating boards on the criterion of retention of learnt knowledge.

$^{o}H_{13}$:There would be no significant first order interaction effects due to the variation of levels of achievement of students and the affiliating boards on the criterion of retention of learnt knowledge.

$^{o}H_{14}$:There would be no significant second order interaction effects due to the variation of models of instruction, levels of achievement of students and the affiliating boards on the criterion of retention of learnt knowledge.

METHODOLOGY

Population

The population of the study was the students, those who have taken Chemistry as an elective subject of higher secondary schools, affiliated by the W B C H S E and C B S E in West Bengal.

Sample

Multistage sampling technique was used to select sample. Students of four higher secondary school, two each from W B C H S E and C B S E from four districts namely, Purulia, Birbhum, Malda and Hoogly, selected randomly who opted Chemistry as elective subjects. The sample consisted of 200 students.

Factorial design for the study

In the present study the (2 × 2 × 3) factorial design was used. This design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as intact classes,

which may be similar (Best, 1999). Hence, without disturbing the natural settings of the classrooms, intact class groups were selected for the study.

Experimentation

The whole sample were divided into four treatment groups namely treatment group I to treatment group IV with a total sample of 200. Entry level test (CRT – 1) was administered to check the homogeneity of the group as well as to categorize the students as high, average and low achievers before giving the treatment to all the groups. Treatment group I and III were exposed with AOM while Treatment group II and IV were exposed with ITM. CRT – 2 and CRT – 3 were administered after the completion of treatments to measure the immediate learning. In order to check the retention of learnt knowledge, CRT- 4 was administered after 15 days.

Analysis and interpretation

In the present study eight section of four school was used as sample. So homogeneity of the was checked through Levene's test (Levene 1960). On the basis of scores obtained through the entry level test (CRT I) following ANOVA (Table I**)** table was constructed to check the homogeneity between different groups.

The 'F' value thus obtained was found to be 1.58 which is not significant even at 0.05 level. It indicates that all the groups taught through different models of teaching are homogeneous in nature.

Pertaining to $^{o}H_1$

It is observed from Tables 2 that the F ratio for the main effects of model (A) is 0.63 at df 1 which is not significant at 0.01 level on the criterion of immediate learning. It has also been found from the Tables 3 that the values of 't' between AOM and ITM is 1.00 for cognitive learning which is not significant even at 0.05 level of significance. So, the null hypothesis $^{0}H_1$ is accepted. It may, thus be interpreted that there is no significant difference between the mean achievement scores of all levels of cognitive learning under study to the effects of instructional models (AOM and ITM) on the criterion of immediate learning.

Pertaining to $^{o}H_2$:

F-ratio for the main effects of Boards under study (B) is 1.95 (Table 2) which is not significant at 0.01 level ($p < 0.01$) on cognitive learning on the criterion of immediate learning. 't' value (1.78) also indicates its non significant nature (Table 3). So, the null hypothesis $^{0}H_2$ is accepted. It may, thus be interpreted that there is no significant difference between the mean achievement scores of all levels of cognitive learning under different boards i.e. WBCHSE and CBSE on the criterion of immediate learning.

Pertaining to $^{o}H_3$:

Table 2 indicates that the F ratio for the main effects of level of cognitive achievement (L) is 78.81 at df 2 which is significant at 0.01 level ($p < 0.01$) on cognitive learning on the criterion of immediate learning. For the present study, level of cognitive achievement is stratified into three category i.e. high achievers, average achievers and low achievers. So further analysis was carried out using 't' critical ratio . From Tables 3 it is found that 't' value between high achievers and average achievers is 6.19, between high achievers and low achievers is 11.89 , between average achievers and low achievers is 6.58 which are significant at 0.01 level of significance. It may, thus be interpreted that there is significant difference exist between high achievers, average achievers and low achievers in the mean achievement scores on the criterion of immediate learning.

Pertaining to $^{o}H_4$:

From Table 2 it is observed that F-ratio for interaction between instructional models and level of cognitive achievement is 1.11 (df 2, 188) which is lower than that of theoretical value ($F = 3.09$ for df 2 and 188 at $p<0.05$) and consequently it is not significant even at 0.05 level of significance. Hence, the null hypothesis is accepted. Therefore, there is no significant first order interaction effects due to the variation of instructional models and the levels of achievement of the students on the criterion of immediate learning.

Pertaining to $^{o}H_5$:

Table 2 shows that F-ratio for interaction between instructional models and affiliating boards is 1.66 (df 1, 188) which is lower than that of theoretical value and consequently it is not significant even at 0.05 level of significance. This supports to accept null hypothesis. Therefore, there is no significant first order interaction effects due to the variation of instructional models and the affiliating boards on the criterion of immediate learning.

Pertaining to $^{o}H_6$:

Table 2 shows that F-ratio for interaction between level of student cognitive achievement and affiliating boards is 0.26 (df 2,188) which is lower than that of theoretical value and consequently it is not significant even at 0.05 level of significance. Hence, the null hypothesis $^{o}H_6$ is accepted. Therefore, there is no significant first order interaction effects due to the variation of levels of achievement of students and the affiliating boards on the criterion of immediate learning.

Pertaining to $^{o}H_7$:

It is found from Table 2 that the 'F'-ratios for the second order interaction effects of A,B and L (A × B × L) are not significant at 0.01 level ($p>0.01$) but significant at 0.05 level for cognitive learning on the criterion of immediate learning. F-ratio for degree of freedom (df) 2 and 188 is 3.29 which is higher than that of theoretical value ($F = 3.09$ for df 2 and 188 at $p<0.05$) but lower than that of F-ratio ($F= 4.82$ at df 2 and 188 at $p<0.01$) at 0.01 level of significance. So, the null hypothesis $^{0}H_7$ is accepted at 0.01 level but rejected at 0.05 level.

Pertaining to $^{o}H_8$:

F ratio for the main effects of model (A) is 7.71 at df 1 and 188 which is significant at 0.01 level ($p < 0.01$) on cognitive learning on the criterion of retention of learnt knowledge (Table 4) . 't' critical ration between AOM and ITM is 6.11 for cognitive learning which is also significant at 0.01 level of significance (Table 5). So, the null hypothesis $^{0}H_8$ is rejected. Hence, there is a significant difference exist between the mean achievement scores of all levels of cognitive learning under study to the effects of instructional models (AOM and ITM) on the criterion of retention of learnt knowledge.

Pertaining to $^{o}H_9$:

It is observed from Tables 4 that the F ratio for the main effects of boards under study (B) is 0.00 at df 1and 188 which is not significant at 0.01 level ($p < 0.01$) on cognitive learning on the criterion of retention of learnt knowledge. It has also been found from the Tables 5 that the values of 't' between WBCHSE and CBSE is 0.05 for cognitive learning which is also not significant even at 0.05 level. So, the null hypothesis is accepted. Thus, there is no significant difference exist between the mean achievement scores of all levels of cognitive learning under different boards i.e. WBCHSE and CBSE on the criterion of retention of learnt knowledge.

Pertaining to $^{o}H_{10}$:

It is observed from Tables 4 that the F ratio for the main effects of Level of cognitive achievement (L) is 77.41 at df 2 and 188 which is significant at 0.01 level ($p < 0.01$) on cognitive learning on the criterion of retention of learnt knowledge. So, the null hypothesis $^{0}H_{10}$ is rejected. It may, thus be interpreted that there is significant difference exist between high achievers, average achievers and low achievers in the mean achievement scores on the criterion of retention of learnt knowledge. It has been found from the Table 5 that the values of 't' between high achievers and average achievers is 5.89, between average achievers and low achievers is 12.22 and between average achievers and low achievers is 6.48 which are significant at 0.01 level of significance. Therefore, a significant difference exist between high achievers , average achievers and low achievers in the mean achievement scores for retention of learnt knowledge.

Pertaining to $^{o}H_{11}$:

Table 4 shows that F-ratio for the interaction of instructional models and the levels of achievement of the students is 0.96 at df 2 and 1888 which is lower than that of theoretical value (F = 3.09 for df 2 and 188 at p<0.05) and consequently it is not significant even at 0.05 level of significance. Hence, the null hypothesis is accepted. Therefore, there is no significant first order interaction effects due to the variation of instructional models and the levels of achievement of the students on the criterion of retention of learnt knowledge.

Pertaining to $^{o}H_{12}$:

F-ratio for the interaction between affiliating board and instructional models is found to be 1.54 at df 1 and 188 (Table 4) which is lower than that of theoretical value and consequently it is not significant even at 0.05 level of significance. Hence, the null hypothesis is accepted. Therefore, there is no significant first order interaction effects due to the variation of instructional models and the affiliating boards on the criterion of retention of learnt knowledge.

Pertaining to $^{o}H_{13}$:

From Table 4 it is observed that F-ratio for the interaction of level of students' cognitive achievement and affiliating boards is 1.65 (df 2,188) which is lower than that of theoretical value. Hence, the null hypothesis is accepted. Therefore, there is no significant first order interaction effects due to the variation of levels of achievement of students and the affiliating boards on the criterion of retention of learnt knowledge.

Pertaining to $^{o}H_{14}$:

Table 4 shows that F-ratio for the second order interaction between three variables is 2.34 at df 2 and 188 which is less than that of theoretical value. Hence, the null hypothesis is accepted Therefore, there is no significant second order interaction effects due to the variation of levels of achievement of students and the affiliating boards on the criterion of retention of learnt knowledge.

DISCUSSIONS

Immediate learning

Regarding the effects of model, the findings of the study revealed that in case of immediate learning the achievement of students on total cognitive level under Advanced Organizer Model (AOM) and Inductive Thinking Model (ITM) did not differ significantly. It can be concluded from the finding that none of the model establishes superiority over other for teaching chemistry at the higher secondary level on the criterion of immediate learning. The finding mostly corroborates the other finding of the studies of Chitrive (1983), Pandey (1986), Jamini (1991), Gupta (1993), Agarwaal (2004), Sadhu and Singh (2005) and Wanjari (2005).

The reason of this finding may be due to the fact that both the AOM and ITM belong to the information sequenced. AOM is sequenced in deductive manner, whereas ITM is inductively sequenced. Both the models help in strengthening the cognitive structure, which lead to the cognitive development of the students. Cognitive development takes place through the cognitive processes which refer to those process through which knowledge is appeared and maintained. Hence, cognition is a processes acquiring information and understanding the world. From the findings of the present study it may be inferred that students learn the content in Chemistry and retain that in a better way through the properly sequenced information processing models, viz., AOM & ITM. It is also noticed that to collect information and to develop the basis knowledge level learning in both the models is found effective.

Retention of learnt knowledge

The ability to recall is a great asset in learning although remembering cannot be equated with learning. The knowledge gained just after the exposure to the new method is no doubt important, but what is more

important is the amount of knowledge retained with lapse of time after the exposure. The finding of the study highlighted that the mean achievements scores differ significantly when taught with AOM and ITM. It was found that the rate of forgetting under Advanced Organizer Model is 6.14% which was less than the rate of forgetting under Inductive Thinking Model (15.77%). Hence it may be concluded from the result that in case of long - term effects the Advanced Organizer Model may be better than that of Inductive Thinking Model. Findings of many studies, like Borine (1982), Chitrive (1983), Kaushik (1989) and Ghosh (1989) corroborate the finding of the present study but the work of Healy (1985) does not support the finding of the present study. In AOM students' get opportunity to discover the concept within their own structure because of the presentation of the organizer in advance. It help the learner in conceptualizing the facts easily resulting involvement of student's in the teaching – learning process. As of these factors inherent in the AOM, the students may be enabled to retain and reproduce larger amount of information.

Affiliating boards

Affiliating Boards was taken as one of the main independent variables in this study. The finding of the present study indicates that on the criterion of immediate learning as well as the retention of learnt knowledge the student under both the boards i.e. CBSE and WBCHSE does not shows any effective impact on their achievement.

Students' achievement level

The present study also conducted with another main independent variable, i. e., students' level of achievement. The finding reveals that mean achievement scores of high achievers differs significantly than that of average and low achievers on the criterion of immediate learning and retention of learnt knowledge. This may lead to conclude that the higher mental ability of high achievers has a directed impact on the achievement on immediate learning and retention of learnt knowledge irrespective of treatment models and affiliating boards. The parallel studies on models on teaching by Singh (1994), Ramdevi (1998) and Khan et.al. (2011) corroborate the finding of the present study.

On the criterion of immediate learning, the result of the study revealed that the mean achievement scores of high achievers, average achievers and low achievers was not significant when taught through AOM and ITM. Most of the time students remain passive recipient of the information. Apathy, non-involvement and low level of participation may have resulted in poor achievement of low achievers. It indicates that the performance of low achievers are independent of teaching strategies. But in case of retention of learnt knowledge mean achievement scores of high achievers, average achievers and low achievers differs significantly. It was found that retention capacity of high achievers, average achievers and low achievers are higher when taught with AOM than that of ITM. Hence, it may be said that in case of retention, intelligence, which is highly correlated with the level of achievement has a positive impact on their retention of learning. A few exceptions have been found in the results, i. e., average achievers and low achievers under CBSE did not show any significant difference in mean achievement scores on the criteria of retention of learnt knowledge.

First order interaction effect

In case of first order interaction effects between instructional models and affiliating Boards, it has been found the interaction effect under both the model viz. Advanced Organizer Model and Inductive Thinking Model did not differ significantly on the criterion of immediate learning. But in case of retention of learnt knowledge AOM is found to be effective than that of ITM for both the affiliating boards. The content of the curriculum under CBSE and WBCHSE is almost equivalent. That is why strategies did not affect the students' learning process.

Second order interaction effect

Second order interaction effects among three independent variables; instructional models, students' achievement levels and affiliating boards on students' achievement, the findings lead to conclude that second order interaction effects of three independent variables on two treatment groups do not differ significantly on

all levels of cognitive learning on the criterion immediate learning but in case of retention, significant effect exist. The present study indicates that the combined interaction effect of three independent variables; instructional models, students' achievement levels and affiliating boards has no differential impact on two treatment groups. But this does not mean that there is no effect of model, students' achievement levels and affiliating boards on the criteria on immediate learning. Actually, all these variables of learning have more or less equal effect on both the treatment groups.

CONCLUSION

Effective classroom transactions are the prime area of teaching profession. A professional teacher seems to be an effective classroom teacher too. Since the theory of teaching is yet to be developed, endeavors have been stated to empirically verify the theoretically idea models of teaching into the classroom practices. Present study indicates some new focus towards the application of models of teaching in teaching Chemistry under the impacts of some variables like boards and level of students cognitive achievement. This finding may help the practicing teachers in their real classroom situations. Of course further studies in this field may be also throw new lights in the areas of teacher education course of our country.

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TABLES

Table 1: ANONA for entry level test (CRT I)

Source of Variance	Sum of Sq.	df	Mean Sq.	F
Between Groups	465.715	7	66.53	1.58^{ns}
Within Groups	8087.68	192	42.12	

ns = not significant

Table 2: Showing the Analysis of variance for cognitive learning on the criteria of immediate learning.

Source	Sum Square	df	Mean Square	F
B : Board (CBSE & WBBSE)	52.22	1	52.22	1.95^{ns}
A : Models (AOM & ITM)	16.94	1	19.94	0.63^{ns}
L : Levels (High, Medium & Low)	4226.41	2	2113.21	78.81**
B × A : Board × Method	44.39	1	44.39	1.66^{ns}
B × L : Board × Levels	13.93	2	6.97	0.26^{ns}
A × L : Method × Level	59.72	2	29.86	1.11^{ns}
B × A × L	170.47	2	85.24	3.29*
Error	5041	188	26.81	

ns = not significant, ** = significant at 0.01 level i.e. $p < 0.01$,
* = significant at 0.05 level i.e. $p < 0.05$

Table 3: Showing 't' value for main effect on the criteria of immediate learning

Sl No	Between	N		Mean		Standard deviation		df	't' value
		n_1	n_2	M_1	M_2	σ_1	σ_2		
1	$A_1 \times A_2$	100	100	34.39	33.80	6.52	7.35	99	1.00^{ns}
2	$B_1 \times B_2$	100	100	33.58	34.61	7.44	6.38	99	1.78^{ns}
3	$L_H \times L_A$	48	48	40.03	34.34	3.65	5.82	47	6.19**
4	$L_H \times L_L$	48	48	40.03	26.88	3.65	6.69	47	11.89**
5	$L_A \times L_L$	48	48	34.34	26.88	5.82	6.69	47	6.58**

ns = not significant, ** = significant at 0.01 level i.e. $p < 0.01$

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Table 4: Showing the Analysis of variance for total cognitive learning on the criteria of retention of learnt knowledge

Source	Sum Square	df	Mean Square	F
B : Board (CBSE & WBBSE)	0.05	1	0.05	0.00^{ns}
M : Methods (AOM & ITM)	772.24	1	772.24	27.41**
L : Levels (High, Medium & Low)	4346.89	2	2173.45	77.14**
B × A : Board × Method	43.25	1	43.25	1.54^{ns}
B × L : Board × Levels	92.80	2	46.40	1.65^{ns}
A × L : Method × Levels	53.82	2	26.91	0.96^{ns}
B × A × L	132	2	66	2.34^{ns}
Error	5296.89	188	28.17	

ns = not significant, ** = significant at 0.01 level i.e. $p < 0.01$

Table 5: Showing 't' value for main effect on the criteria of retention of learnt knowledge

Sl No	Between	N		Mean		Standard deviation		df	't' value
		n_1	n_2	M_1	M_2	σ_1	σ_2		
1	$A_1 \times A_2$	100	100	32.40	28.47	6.53	7.61	99	6.11**
2	$B_1 \times B_2$	100	100	30.42	30.45	7.78	6.91	99	0.05^{ns}
3	$L_H \times L_A$	48	48	36.67	30.75	4.75	5.52	47	5.89**
4	$L_H \times L_L$	48	48	36.67	23.27	4.75	7.32	47	12.22**
5	$L_A \times L_L$	48	48	30.75	23.27	5.52	7.32	47	6.48**

ns = not significant, ** = significant at 0.01 level i.e. $p < 0.01$