



**RESEARCH PAPER**

**Effect of Brain-Compatible Classroom on Prospective Teachers' Interest at University Level**

Aisha Sami\*<sup>1</sup> Rizwan Akram Rana<sup>2</sup>

1. Ph. D Scholar, Institute of Education and Research, University of the Punjab, Lahore, Punjab, Pakistan.
2. Professor (Rtd.), Institute of Education and Research, University of the Punjab, Lahore, Punjab, Pakistan

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**\*Corresponding Author**

aisha.sami.pu@gmail.com

**ABSTRACT**

In this study, prospective teachers' interest was measure by quasi-experimental research to explore the effect of a Brain-Compatible classroom at the university level. The researcher chooses a purposive sampling technique by taking intact groups as the sample of the study. Pretest-posttest non-equivalent control group design was practice by providing intervention to experimental group as a Brain-Compatible classroom, and traditional teaching-learning process to control group students. A close-ended questionnaire was developed on the 5-point Likert Scale to evaluate prospective teachers' interest in the course Teaching of Chemistry. Mean difference, and standard deviation (S.D) were calculate in the descriptive statistical analysis, while an independent sample t-test used for determining the mean difference between the two groups. This study would be beneficial for the teaching-learning process in Pakistan. It also gives reflect to develop Brain-Compatible classroom practices in Pakistan.

**Introduction**

Quality of instruction is directly related to the quality of education (Hussain & Mahmood, 2010). It is associated with the expertise and experience of a teacher who adopts innovative instructional approaches (Hussain, 2012). Every student's learning behavior is different; hence a multidimensional teaching methodology should be used in the class (Duman, 2010). It allows students to get knowledge in a variety of interesting and fun ways that lead to meaningful understanding (Kolb & Kolb, 2005).

Brain-Compatible elements in the Integrated Thematic Instruction model (ITI) developed by Kovalik in 1994 to improve learning (Contemporary Learning Experiences, 2006; Kovalik, 1994). Formerly known as ITI, the Highly Effective Teaching (HET) model is a Brain-Compatible model grounded in the biology of

learning, effective instructional strategies, and the development of a conceptual curriculum (Kovalik & Olsen, 2010). Research has provided evidence of significant gains in student achievement using the Highly Effective Teaching (HET) Model (Kovalik & Olsen, 2010).

Learning with full of interest corresponds to learning by doing (Cooperstein & Kocevar-Weidinger, 2004; Hussain, 2012). Teachers can apply the newly settled Brain-Based Teaching Method (BBTM) into their classrooms organized with various diverse teaching approaches and activities for students' interest and their active learning (Saleh & Subramaniam, 2018). A Brain-Based Teaching Method (BBTM) can best be applied in Brain-Compatible classrooms. In the comparison of conventional teaching methods, the active learning approaches have been perceived to work more efficiently (Dougherty et al., 1995), and it enhanced knowledge retention, their interest, and higher grades in the assessment of students (Dougherty et al., 1995).

Teachers of science subjects can now work on top of Brain-Compatible learning & applications of neuro-developmental; to deliver novel and innovative ways to influence the students' interest (Caine & Caine, 1994). Brain-Based Learning Principles practically worked through cognitive practices and the enriched environment, for example, using suitable words, appreciating & praising, performing soft tones, use soothing colors, making a safe & friendly environment, cracking jokes, encouraging happiness and smiles, exploring actual-life problems, endorsing critical thinking, and providing nutritional advice were found supportive in facilitating students towards their effective learning (Saleh & Subramaniam, 2018). The various teaching approaches and numerous learning ways, for instance, visual, and auditory used in the study were able to work best with Brain-Compatible teaching-learning and offer innovative traditions to reach the students' interest (Lombardi, 2008).

In previous studies, numerous researchers defined the term 'interest' in psychology and the educational psychology field (Hidi, 2006; Krapp & Prenzel, 2011). Interest is also defined as self-sustain motivations that lead the individuals to involve in certain and specific activities, matters, and ideas for their own sake (Hidi & Renninger, 2006). Interest is unique from "enjoyment while learning" as it's the only element from the huge possibility of enjoyment that possibly will be the consequence of several diverse causes. As Krapp and Prenzel, (2011) discussed that "content specificity" is a vital representative of interest, discriminate it from similar motivational concepts. In the National Curriculum of Chemistry at IX- X Grades (2006), the goal for emerging learners' interest is included with high importance in Pakistan curriculum documents (National Curriculum of Chemistry at IX- X Grades. Ministry of Education, 2006). The study is based on the objective, to dig out the effect of a Brain-Compatible classroom on prospective teachers' interest at the university level.

Following null hypotheses was formulated to conduct the study:

- H<sub>01</sub>: There is no significant mean difference between gain scores of prospective teachers' interest in Brain-Compatible and traditional classroom at the university level.
- H<sub>02</sub>: There is no significant mean difference between pretest-posttest scores of prospective teachers' interest in Brain-Compatible and traditional classroom at the university level.
- H<sub>03</sub>: There is no significant mean difference between pretest scores of prospective teachers' interest factors in Brain-Compatible and traditional classroom at the university level.
- H<sub>04</sub>: There is no significant mean difference between posttest scores of prospective teachers' interest factors in Brain-Compatible and traditional classroom at the university level.

### **Material and Methods**

In this experimental research, the positivist approach is used. The quasi-experimental research design was taken to collect the data. The pretest-posttest nonequivalent control-group design was used to conduct the research. Researcher taught the course "Teaching of Chemistry", B.S.Ed. Hons. degree program to both experimental and control groups students to measure the effect of Brain-Compatible classroom on prospective teachers' interest. Students having a Science background enrolled in IER as B.S.Ed. (Hons.) were considered as the population of the study. By taking the intact groups of two classes, the purposive sampling technique was applied for the sample of the study. Through the random assignment of two sections as an experimental and control group selected having 37 and 32 Chemistry students in both groups. The Brain-Compatible classroom was an experimental group, which received the intervention, though the control-group students were tackled through a traditional teaching and learning process.

### **Instrumentation of the Study**

For determining the effect of the Brain-Compatible classroom on prospective teachers' interest, the researcher developed an instrument to explore the difference between two (Brain-Compatible and Traditional) classes. A closed-ended questionnaire based on 5-point Likert Scale was developed and administered before and after the intervention. The questionnaire was allocated to ensuring the elements of a Brain-Compatible classroom mentioned here, such as;

- i. Absence of Threat (AOT)
- ii. Meaningful Content/ Relevancy (MC/R)
- iii. Enriched, Stimulating Environment (ESE)

- iv. Adequate Time for Completion and Reflection (AT/R)
- v. Immediate, Meaningful Feedback (IMF)
- vi. Choices & Control (CHO)
- vii. Social Interaction / Collaboration (SI/C)
- viii. Mastery/ Application (M/AP)
- ix. Movement (MOV)

Statements were in mixed form without any title of specific heading in the questionnaire. Validity and reliability were ensured through experts' opinions and piloted testing. The Cronbach's alpha reliability was .898 of 49 items from 65 students who didn't take part in the intervention. Exploratory factor analysis was also run to put the items into a factor according to their correlation value. Students of the experimental group offered several teaching-learning activities that were not shared with the control group students. All activities fulfilled the elements of a Brain-Compatible classroom. Few activities used in the intervention were:

- KWL Charts (Absence of threat)
- Science Exhibition (Collaboration/ Movement)
- Models Construction(Choices)
- Work-Sheets(Immediate Feedback)
- Group Activities (Social Interaction/ Movement)
- Assignments and Presentation (Mastery/ Choices)
- Articles Searching (Meaningful Content)
- Concept Maps (Choices)
- Videos Demonstration (Enrich Environment)
- Quiz Competition (Adequate Time)
- Paper Pencil Tests(Mastery/Feedback)

### **Results and discussion**

In the descriptive statistical analysis mean difference, and Standard Deviation (SD) were considered, though, in inferential statistics, an independent

sample t-test for the mean difference the pretest-posttest analysis was applied amongst both groups.

The researcher explored the findings that there is a prominent difference reflects due to the intervention on the experimental group students. A Brain-Compatible classroom puts high interest among students at the university level. When prospective teachers of Chemistry enhance their interest level in the Brain-Compatible classroom, they will practice in their professional lives as well. The analysis of data represents the values as mentioned in the tables.

**Table 1**  
**Prospective teachers' pretest-posttest and gain scores difference in the interest of (experimental and control) both groups**

	Groups	N	Mean	SD	df	t-test	Sig. (2-tailed)	Cohen's d
Gain Scores	Experiment	37	22.46	20.53	67	3.206	.002	0.77
	Control	32	5.72	22.83				
Pretest Scores	Experiment	37	180.78	8.78	48.78	-.669	.507	0.16
	Control	32	182.78	14.80				
Posttest Scores	Experiment	37	203.24	19.28	64.37	3.716	.00	0.88
	Control	32	188.50	13.50				

Table values revealed that net gain of interest in pretest-posttest scores of both intervened and traditional groups were 16.74 as experimental group gain score is 22.46 and control group gain score is 5.72. It shows a significant effect of increased interest values after the intervention, in a comparison between both groups. In pretest scores of control group students interest value is leading by two scores than the experimental group. But the trend going to be changed as in post-test values as an experimental group take a lead by twenty scores. Cohen's d effect size of pretest determines the small (0.16) value while posttest and gain score show large effect size >79% i.e., 0.88 and 0.77 respectively.

**Table: 02**  
**Difference of pretest scores on interest factors of prospective teachers' experimental & control group**

Factors	PRE-Test Groups	N	Mean	SD	Df	t-test	Sig. (2-tailed)
Factor 1 MC/R	Experimental	37	15.16	1.143	39.904	1.194	.240
	Control	32	14.53	2.794			
Factor 2 INT	Experimental	37	26.32	2.982	48.151	1.494	.142
	Control	32	24.78	5.141			
Factor 3 ESE	Experimental	37	14.62	1.800	49.212	.972	.336
	Control	32	14.03	3.000			
Factor 4 MOV	Experimental	37	14.22	1.766	67	1.054	.296
	Control	32	13.78	1.641			
Factor 5	Experimental	37	25.92	2.597	67	-2.575	.012

IMF	Control	32	27.53	2.590			
Factor 6	Experimental	37	15.11	1.329	67	-.979	.331
AT/R	Control	32	15.56	2.435			
Factor 7	Experimental	37	19.11	1.430	67	-.044	.965
AOT	Control	32	19.13	1.773			
Factor 8	Experimental	37	15.43	1.725	67	-.504	.616
SI/C	Control	32	15.66	1.961			
Factor 9	Experimental	37	24.76	2.671	67	1.290	.201
CHO	Control	32	23.91	2.798			
Factor 10	Experimental	37	13.92	1.801	67	-2.229	.029
M/AP	Control	32	14.91	1.873			

The table discloses that all ten factors shown different effects in pre-test scores of measuring interest levels among university-level prospective chemistry teachers in both groups, i.e., experimental and control.

In respect of mean values, the highest mean score is noticed towards the factor "Interest (INT)", where the experimental class means score value is 26.32 (2.98), and its control group mean score value is 24.78 (5.14), which is highest among all. It is also observed that in the comparison of both groups its t-test value remains insignificant at the level of  $p \leq .05 = 0.142$ . While the second-high score mean values came under the factor "Immediate Meaningful Feedback (IMF)", which shows significant results in the pre-test scores among experimental and control group students. Its value reveals that the control class means scores are higher than the experimental group i.e., 27.53 and 25.92 respectively. The t-test score value is significant at  $p \leq .05 (.012)$  while the control group score is leading in this trend. In the factor "Mastery/ Application (MAP)" the control group reflects larger scores than the experimental group. This factor shows a significant p-value which is less than  $.05 = .029$  and t-test value is -2.229.

All other factors including "Meaningful Content/ Relevancy (MC/R)"; "Interest (INT)", "Enriched, Stimulating Environment (ESE)"; "Movement (MOV)"; "Adequate Time for Completion and Reflection (AT/R)"; "Absence of Threat (AOT)"; "Social Interaction/ Collaboration (SI/C)"; "Choices (CHO)" reveals insignificant results in pre-test scores in t-test where the  $p > 0.05$  that considered insignificant difference among treatment and control groups.

**Table 03**  
**Difference of posttest scores on interest factors of prospective teachers' experimental and control groups**

Factors	POST-Test Groups	N	Mean	SD	df	t-test	Sig. (2-tailed)
Factor 1	Experimental	37	16.65	2.771	67	1.909	.061
	Control	32	15.50	2.125			
Factor 2	Experimental	37	28.59	4.693	67	2.220	.030
	Control	32	25.91	5.366			

Factor 3	Experimental	37	16.84	2.048	67	3.687	.000
ESE	Control	32	15.03	2.008			
Factor 4	Experimental	37	17.97	1.740	50.297	7.600	.000
MOV	Control	32	13.63	2.803			
Factor 5	Experimental	37	29.54	3.159	61.502	2.702	.009
IMF	Control	32	27.84	1.986			
Factor 6	Experimental	37	15.95	3.358	52.061	-.697	.489
AT/R	Control	32	16.38	1.540			
Factor 7	Experimental	37	21.19	2.623	67	2.388	.020
AOT	Control	32	19.63	2.814			
Factor 8	Experimental	37	14.46	1.556	55.049	-2.314	.024
SI/C	Control	32	15.53	2.185			
Factor 9	Experimental	37	21.95	1.026	41.169	-2.358	.023
CHO	Control	32	23.00	2.342			
Factor 10	Experimental	37	16.32	2.506	67	2.258	.027
M/AP	Control	32	15.03	2.207			

The table reveals that among the ten factors major factors contribute to showing significant effects in post-test scores of measuring interest level among university-level prospective chemistry teachers in both experimental and control groups. In the comparison of both (experiment, & control) group students, their p-value is  $\leq 0.05$ . Only two factors “Meaningful Content/ Relevancy (MC/R)” and “Adequate Time for Completion and Reflection (AT/R)” reflect an insignificant role in post-test scores.

The factors which reflect the highly significant p- values i.e., 0.00 are “Enriched, Stimulating Environment (ESE), Movement (MOV), Immediate, Meaningful Feedback (IMF)” whereas “Immediate, Meaningful Feedback (IMF)” have highest mean values among all factors that are 29.54 (3.15) and 27.84 (1.98) of both experimental and control group interest scores in posttest respectively.

The remaining factors including “Interest (INT)”; “Absence of Threat (AOT)”; “Social Interaction/ Collaboration (SI/C)”; “Choices (CHO)” and “Mastery/ Application (M/AP)” also express the visible difference in their t-test scores.

It is also noticed that the experimental group leading the mean score values in all factors except the factor “Adequate Time for Completion and Reflection (AT/R)”; and “Social Interaction/ Collaboration (SI/C)” and “Choices (CHO)” where control group students' interest level exceeds. The mean score values of the factor “Adequate Time for Completion and Reflection (AT/R)” is 15.95 for the experimental group and 16.38 for the control group students. While in the factor “Social Interaction/ Collaboration (SI/C)” the mean score values are 14.46 and 15.53 of experimental and control group students respectively. In the factor “Choices (CHO)” the mean score values of interest are 21.95 and 23.00 to both experimental and control class students. Therefore it is concluded that the null hypothesis which declares that “there is no significant mean difference between factors of interest in

post-test scores of prospective teachers' (experimental and control group) at university level" is rejected because major factors represent the significant difference of interest level among both groups by experimental group students.

## **Conclusion**

Science subjects turn out to be interesting when they provide practical opportunities (Osborne & Collins, 2000). For the development of constant interests among students, experiments work as a significant instrument that impacts on selections of courses later for higher education, and their careers (Krapp & Prenzel, 2011). The interest of students develops a long-lasting influence on their behavior towards the course of Chemistry which also affects their learning and even continues after school (Agogo, Odoh, & Simon, 2014). Many researchers studied the way teachers can enhance the interest of the students and their engagement in the classroom setup (Agogo, Odoh, & Simon, 2014). In the subject of Chemistry, a significant relationship reveals between the students' interest and their performances (Agogo, Odoh, & Simon, 2014). Likewise, the results of this study were verified through previous research outcomes.

Student's curiosity helps to develop their interest in the subject of science like Chemistry (Tytler, 2007). Jegede in 2007, explore that major source of anxiety for students is Chemistry teachers' inappropriate instruction style, teaching aids, chance to operate real items, and deficiency of their appreciation for students. Osborne and Collins (2001) concluded that teachers rarely relate the science (Chemistry) conceptions to daily life that's not as much of that requirement of the subject. On other hand, Constructivist teachers in Brain-Compatible classrooms carefully planned, structured, directed activities guide students in developing their skills and discovered the concepts which not distract them (Cooperstein & Kocevar-Weidinger, 2004). As Osborne and Collins discussed in 2000, the interest of students declines if fulfillment of curiosity requirements is missing (Osborne & Collins, 2000).

The study also justifies previous researches. There is no significant mean difference that occurs in pretest scores of both groups i.e. experimental (Brain-Compatible classroom) and control (traditional) group students' interest level. As the mean score value of control group students in the pretest of interest measurement is higher by 2 points than the experimental group. The results of table 01 are conferring that the mean score values of the treatment and control group in the pretest were 180.78 and 182.78 respectively.

On the flip side in the posttest scores of students' interest among both groups are significant, which reveals the elevation of posttest interest scores of experimental groups from 180.78 to 203.24 means score values. As the latest value reported from posttest scores. Hence the control group post scores seem to accelerate from pretest to posttest scores is 5.72. Therefore it is found that the intervention raised the interest level of the experiment group mean score with a gain value is 22.46 while the control group rises 5.72 scores. It shows increases interest level of the experimental group



during the whole duration as discussed under the analysis of hypothesis no.1 for gain scores in the interest of both groups' prospective teachers at the university level.

As hypothesis no.03 points to analyze the difference of interest factors in pretest scores of both groups. Consequently, the factors of interest in the pretest reveal that eight of its factors (i.e., MC/R, INT, ESE, MOV, AT/R, AOT, SI/C, CHO) exposed the insignificant difference in both groups, while factor 5 and 10 i.e., "Immediate, Meaningful Feedback (IMF)", and "Mastery/ Application (M/AP)" reported that control group students mean values are higher in these factors which made it significant with values of -2.575 and -2.22 mean difference.

In the posttest scores of measuring the difference of interest factors among both groups, results reflect the noticeable difference in the majority of factors for both groups. As the values of interest level in each factor rises in posttest scores except the value of the experimental group of factor no. 1, i.e., "Meaningful Content/ Relevancy (MC/R)" and factor no. 6, i.e., "Adequate Time for Completion and Reflection (AT/R)". It means these two factors don't show a significant impact on students' interest level before and after the intervention. It is also concluded that these two factors are equally raising the interest of both groups during the intervention. As meaningful content and its relevancy is important for both groups and similarly, time put its influence on experimental and control group students in the same way before and after the intervention.

In the nutshell, it is concluded that students' of the experimental group receive the intervention through a Brain-Compatible classroom elements application. It raises their interest level in the course "Teaching of Chemistry", while the control group students experienced traditional teaching-learning method; therefore their interest level remains constant. It refers that elements of Brain-Compatible classrooms facilitate in raising students' interest in the course "Teaching of Chemistry".

### **Recommendations**

It is recommended that Brain-Compatible classroom may increase the interest level of students. It should be applied in all educational institutes worldwide and Pakistan.

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