PJERE, June 2021, Vol. 9, No. 1, pp. 1-23

Effect of Context-Based Teaching on Grade VIII Students' Academic Achievement and Intrinsic Motivation in Science

Shumaila Tariq
M.Phil. Graduate, Institute of Education and Research, University of the Punjab Lahore
shumailatariq678@gmail.com

Muhammad Saeed
Professor & Chairman, Department of Educational Research and Evaluation, Institute of Education and Research, University of the Punjab, Lahore
drsaeed1961@hotmail.com

KEY WORDS

Context-based teaching, grade VIII Students, academic achievement, intrinsic motivation, science

ABSTRACT

Context-based teaching is a way of instruction in which contexts and applications of science are the starting point of teaching and then making it relevant to students' daily life. The main purpose of the study was to determine the effect of context-based teaching on students' academic achievement and intrinsic motivation in science. The study employed Quasi-Experimental, Interrupted-Time Series design. Sample of the study was 30 students of Grade VIII and duration of intervention was 12 weeks. Two types of instruments i.e. 1) Six achievement tests, and 2) Intrinsic Motivation Inventory (IMI) were used for data collection. Item analysis of all tests was conducted while Cronbach's alpha reliability coefficient for IMI was calculated which established at .744. Analysis of students' achievement test was done by using One-way repeated measure ANOVA, which showed significant difference among students' scores on tests. The analysis of IMI showed significant difference on paired-sample t-test scores. A significant difference was found in competence, relatedness and interest level of students before and

after intervention. It was concluded that context-based teaching may be used as an effective approach to teach science and helpful in enhancing intrinsic motivation of students.

Introduction

Context-based teaching is from one of the contemporary approaches to teaching and learning. Gilbert (2006) elaborated that the word context in grammatical sense is noun contextus, giving the meanings as coherence, connection, and relationship. So, context provides comprehensive and clear meaning of new ideas by making relevance in a wide range outlook. Contextual theory of teaching and learning stated that when learners gain new information or knowledge they try to relate it with their previous experiences, and if it appeal to students' personal practices then it is easy to grasp and retain the knowledge. This method of teaching and learning undertakes that mind naturally try to find meaning with reference to context that is, related to persons' own environment.

According to Bennet (2005), in order to make learners scientifically literate it is necessary to develop understanding with respect to context, after comprehending the context of content they may act and ponder properly on scientific problems. In the context of classroom when teacher makes learning material significant in the eyes of their learners by giving concrete routine life examples and connecting it with real- life implications,

ultimately practicing the theory (Kember & McNaught, 2007) exposed the worth of the task by engraving it and linking contents with leaners' need of understanding results in boosting up their motivation (Good & Brophy, 2000).

Bennett, Hogarth and Lubben (2006) conducted a study on context-based learning they concluded that those students who adopt contextual learning were improving their understanding level about chemical ideas and gained higher scores than those who adapt traditional way of learning. Murphy and Whitelegg (2006) also claimed that when students are exposed to contextual approach of teaching or humanistic approach including the real life materials to understand the concept of science, their motivation and retention level of science also increases. Gutwill-Wise (2001) worked with university fellows on context-based teaching approach in teaching of introductory chemistry courses. The results were compared with the students who followed traditional instruction approach. Analysis showed that students' performance was better in context-based instruction and more likely to join chemistry subject for further studies.

One of the most cited contemporary theory of intrinsic motivation is Self-Determination theory which was presented by Ryan and Deci (2007).This theory states that when people feel competent, feel related to something they freely seek and understand the things, find the task interesting and valuable, it can uplift students' intrinsic motivation. The need

of being competence can be met when the task or object is challenging because when students find a task difficult they feel competent and try to master it. To meet with the need of relatedness, the object of learning should be relevant with the environment and also with individual inner thoughts so that it would be easy to relate the object with individual mind level.

If students can see the relevance of science with their lives and perceive that it is meaningful to learn, they can expect that the knowledge they learn during their teaching practices will be more effective and important for students (Taasoobshirazi & Carr, 2008). In the literature, it is revealed that after teaching with contextual approach students understand the value of that particular content. Lye, Fry and Hart (2001) conducted a study which focused on gathering teachers' view about knowledge retention and task value in science by teaching with context -based instruction. The analysis of interviewed data revealed that students give more importance to science tasks when they were exposed to intervention. Niemiec and Ryan (2009) also suggested that effective interactions within learning environment can only take place when students are encouraged by doing the task perfectly. That task should be appreciated which meet with the competency of the students. This may occur in a context where the challenges are most appropriate and the feedback is relevant (unlike the norm-based ones).

This is also one of the important component of contextual teaching when integrated with motivational activities. Relatedness can be defined as

the desire to feel connected and accepted by significant (Deci & Ryan, 2002). The experience of relatedness aroused from real contact with environment and professionals, plays an important role in the internalization of valuable targets, in making the connection of individuals to society and primarily by identifying and imitating applications of science subject in real-world (Murphy & Whitelegg, 2006). Students need high level of interest to endure and stimulate intrinsic motivation (Hidi & Harackiewicz, 2000). They can secure two different types of interest i.e., dispositional interest and situational interest (Krapp, 2002).

Barber (2000) conducted research study on context-based instruction and its effect on cognition and interest of students. Two groups were involved in the research study. Experimental group was taught by using Advance Chemistry Salters approach based on context-based teaching and control group was taught by traditional way of teaching. The data were collected by interviews and surveys, analysis of data discovered that students' who experienced contextual teaching showed higher level of interest and engaged during activities. The analysis of students' interviews revealed that students become motivated and find it interesting to do activities when taught through context-based teaching. While the other group decrease their motivation level at the end of the course. However, the students also reported that they feel difficult in completing the assignments given in context-based instruction.

In this modern era of science and technology, it is important to make students' scientifically literate. But the methods of teaching followed rote memorization of facts and contents. To make students able to do inquiry it is the need of hour to develop scientific attitude at primary, secondary and higher secondary levels of education. It can be possible when students become self -motivated to learn science and understand the contexts of their learning. Present study was aimed at to determine the effect of context-based teaching on grade VIII students' academic achievement and intrinsic motivation in science. For this purpose following null hypotheses were formulated.

$H_0$1: There is no statistically significant difference between students' academic achievement in general science before and after intervention (context-based teaching).

$H_0$2: There is no statistically significant difference between students' intrinsic motivation in general science before and after intervention (context-based teaching).

H_0 2.1: There is no statistically significant difference between students' task value in general science before and after intervention (context-based teaching).

H_0 2.2: There is no statistically significant difference between students' competence level in general science before and after intervention (context-based teaching).

H_0 2.3: There is no statistically significant difference between students' relatedness level in general science before and after intervention (context-based teaching).

H_0 2.4: There is no statistically significant difference between students' interest level in general science before and after intervention (context-based teaching).

Methodology

The design of the study was quantitative and experimental in nature. It employed Quasi-experimental, Time series design. The population of the study was 56 students of grade VIII. The sample of the study was selected randomly, comprised of 30 students that formed single group. Two types of instruments a) Science Achievement Tests and b) Intrinsic Motivation Inventory (IMI) were used in this study. Six science achievement tests were developed on the basis of table of specifications from General Science Textbook of Grade VIII designed by Punjab Curriculum and Textbook Board Lahore. Three tests were taken before intervention and three were taken during intervention.

Second instrument IMI was developed by Ryan and Deci (2007), adopted for the study. It was based on five-point Likert type scale ranging from 1-7. IMI was translated in Urdu language and then validated by the experts. Achievement tests were also validated from the experts, two experts were assistant professors and one expert was MPhil. Scholar having science

background. After validating achievement tests and IMI, piloting of the instrument was done. To ensure reliability of tests item analysis (Item difficulty and discrimination) of the tests was done while for IMI Cronbach's Alpha coefficient was used. The value of Cronbach's Alpha coefficient established at .744 which was acceptable to launch the study.

The intervention was given to students for the duration of 12 weeks. Three chapters of General Science textbook i.e. 1) Human Organ Systems, 2) Pollution and Their Effects to Environment and 3) Lenses were taught during intervention. A total of 23 lesson plans were developed from these three chapters and then validated by three experts having mastery in research and test development in science subject.

Results

Data were analyzed by using descriptive and inferential statistics. To use statistical technique data must be in continuous form, test scores were already in continuous form and were recorded on ratio scale because zero is meaningful here.

Therefore, to analyze science achievement a test, one-way repeated measure ANOVA was used because six different tests were conducted at different times so, this statistical technique was appropriate.

Intrinsic motivation inventory was the second type of instrument, as the responses gathered from IMI was in the range of 1-5. By computing the scale score the nature of data becomes equal interval so, paired samples t-

test was used to analyze students' intrinsic motivation before and after intervention.

Table 1

Analysis of Achievement Tests by Using One-Way Repeated Measures ANOVA

Sr. No	Achievement tests	*M*	*SD*	*df*	*F*	Wilks' Lambda
1	Cell Division	10.46	.358	5	17.23	.225*
2	Biotechnology	13.03	.400	25		
3	Chemical Reactions	12.33	.588			
4	Human Organ Systems	13.00	.657			
5	Pollution and Their Effects on Environment	14.63	.232			
6	Lenses	13.63	.481			

*P<0.05

Table 1 shows mean and standard deviation of achievement tests scores and comparison of six achievement tests. One-way repeated measures' ANOVA was conducted to compare students' scores on six achievement tests. Because the tests were taken on six different times therefore repeated measure ANOVA was used. The highest mean value was 14.63 with minimum standard deviation .232 of achievement test-5 which showed that maximum students gained more than average marks during intervention. The lowest mean score value was 10.46 with standard deviation of .358 indicated that in achievement test-1 the performance of students was not well and this test was conducted before intervention.

Inferential statistics revealed positive effect of intervention because significant difference was observed between achievement tests scores conducted before and during intervention. Effect size indicated relative magnitude of the difference present between two sets of data. The value ranges form 0-1, where .2 is regarded as small effect size, .5 as medium effect size and .8 as large effect size (Cohen, 1988). Wilks' Lambda = .225, F (5, 25) = 17.23, p< .0005, multivariate partial eta squared = .775 which showed large effect size. As results were significant for further analysis pairwise comparison of the tests was done. Analysis showed significant difference between pre and post achievement test scores. So, the null hypothesis regarding academic achievement was rejected.

Table 2

Analysis of Students' Intrinsic Motivation level before and After Intervention

Intrinsic Motivation	*M*	*SD*	*t-value*	*df*	*p*
Before Intervention	84.33	8.45	-6.53	29	<.001
After Intervention	95.33	8.65			

A paired sample t-test was conducted to determine the effect of context-based teaching on students' intrinsic motivational level. There was statistically significant increase in students' intrinsic motivation level from (M= 84.33, SD= 8.45) to (M= 95.33, SD= 8.65), t (29) = -6.533, p< .001 (two-tailed). The mean score increase was 11 with a 95% confidence

interval. The eta squared statistic (0.59) indicated large effect size (Cohen, 1988). As the test results were significant it means that there was statistically significant effect of intervention (context-based teaching) on students' intrinsic motivation and after subjected to intervention students' becomes intrinsically motivated. Therefore, null hypothesis related to intrinsic motivation was rejected.

Table 3

Analysis of Sub-Constructs of IMI Before and After Intervention

Sub-Constructs of Intrinsic Motivation	Time of Intervention	*M*	*SD*	*t-value*	*p*	df
Task Value	Before	28.80	2.42	-2.34	0.26	29
	After	30.63	3.29			
Competence	Before	16.90	2.85	-4.28	<.001	
Level	After	19.53	3.09			
Relatedness	Before	18.20	3.38	-3.44	.002	
Level	After	20.10	2.72			
Interest Level	Before	20.87	3.51	-7.65	<.001	
	After	25.26	2.99			

Paired samples t-test was conducted to check out the effect of context-based teaching on students' task value, competence, relatedness and interest level in science subject before and after intervention. There was statistically significant increase in students' interest level from (*M*= 20.87, *SD*= 3.51) to (*M*= 25.26, *SD*= 2.99), *t* (29) = -7.658, p< .000 (two-tailed). The mean score increase was 4.39 with a 95% confidence interval. The eta

squared statistic (0.66) indicated large effect size (Cohen, 1988). So, null hypothesis regarding interest level was rejected.

Results were also significant for competence and relatedness level as competence mean score from (*M*= 16.90, *SD*= 2.85) to (*M*= 19.53, *SD*= 3.09), *t* (29) = -4.282, p< .000 (two-tailed) was observed. The mean score increase was 2.63 with a 95% confidence interval. The eta squared statistic (0.38) indicated small effect size (Cohen, 1988).So, null hypothesis regarding interest level was rejected. There was statistically significant increase in students' relatedness mean score with science subject from (*M*= 18.06, SD= 3.38) to (*M*= 20.10, *SD*= 2.72), *t* (29) = -3.446, p< .002 (two-tailed). The mean score increase was 2.04 with a 95% confidence interval. The eta squared statistic (0.28) indicated small effect size (Cohen, 1988). So, null hypothesis regarding interest level was rejected.

Results were insignificant in terms of task value however increase in students' mean score from (*M*= 28.80, *SD*= 2.42) to (*M*= 30.63, *SD*= 3.29), *t* (29) = -2.344, p< 0.26 (two-tailed) was found. The mean score increase was 1.8 with a 95% confidence interval. The eta squared statistic (0.15) indicated small effect size (Cohen, 1988). So, null hypothesis regarding interest level was accepted.

Discussion

The findings of present study revealed that other studies have also similar findings. As the first result of this study is context-based teaching is

helpful in improving academic achievement of the students in science subject. A similar study conducted by Majid and Rohaeti (2018) on context-based teaching and chemistry learning have also the supported results like there was significant difference between the two variables tested (achievement and attitude) reviewed by context-based chemistry learning (F = 25,019; p<0.05). They also explained the effect size which was 0.987 regarded as large effect size. The results of the descriptive analysis indicated that the experimental class (M = 60.60) has a higher mean value than the control class (M = 55.39) so it can be interpreted that students' achievement in experimental group was better than the control group and supported this study's result.

Another study conducted by Podschuweit and Bernholt (2017) on similar topic of context-based teaching with quasi-experimental design. It showed that in the pre-test, students reached on average score of M = 12.03 out of 25 (SD=5.02) t-test revealed no significant differences between both groups in the pre-score (p=0.757). After the intervention, students obtained a mean score of 15.84 (SD=4.27) with (p= *0.02*) and showed significant difference. So, the results of this study also supported the result of present study.

Moreover, Ilhan, Yildirim, and Yilmaz (2016) studied the effect of context-based chemical equilibrium on grade 11 students' learning, motivation and constructivist learning environment. The results of this study

reported that students' learning enhance when they gone through the intervention. The motivation levels of students to learn chemistry concepts were also high and they reported that context-based instruction build the constructivist learning environment. Hence, the results are also consistent with the present study findings.

Furthermore, Köse and Tosun (2015) analyzed the results of context-based learning on students' knowledge, attitude and motivation in biology by using MANOVA which revealed that there are significant differences between control and experimental group and results were in favor of experimental group. The result also showed that, students' knowledge about five topics increased by context-based approach in experimental group. This increase of knowledge may be the result of contexts used to teach experimental group students because contexts allow students to relate their content knowledge with the external environment and develop better understanding of the subject. So, these results supported the findings of present study.

Kuhn and Müller (2014) in Germany have similar results about context-based teaching with newspaper story problems and its effect on students' physics achievement. They analyzed physics achievement between two groups i.e. control and experimental. By applying ANCOVA they concluded that experimental group and control group have significant difference after exposing to context-based teaching with newspaper story

problems. Therefore, these findings of the study are steady with the present study findings.

Another study designed by Putter-Smits, Taconis, and Jochems (2013) on context-based material to enhance students' learning and the results showed a higher competence score on the cognitive dimension of students rather than other dimensions like affective and psychomotor. Similarly, Luy et al. (2002) pointed out that if particular information was linked to a context, the students remembered it easier and retained it longer, as compared to the information without meaning they had to remember. This was confirmed by a comparative review of the strengths and limitations of this approach in teaching. The qualitative analysis showed that contextual approach of teaching helped the students in retaining content knowledge. So, it shows the confirmation of consistent results with present study findings.

Kukliansky and Eshach (2014), confirmed the significant students' learning achievement when teaching with context-based teaching. They proved that learning the contents of botany was more effective if they were connected to the previous experience that students had acquired in everyday situations. So, this research results also supported the results generated in the present study and shows the worth of the study.

The second main variable of the study was related to intrinsic motivation of the students. Vaino, Holbrook, and Rannikmäe (2012) conducted a study on context-based teaching and students' motivation. They

found that students' motivation after the implementation of the first module with contextual teaching and learning was higher in every subscale of motivation scale and these changes were statistically significant. The most noticeable change was observed in relatedness and interest level of students while minor change was observed in content value construct. These findings are aligned with the present study as the researcher have also found the same that there is a visible increase in students' interest and relatedness level but insignificant difference in task value.

Another study conducted by Ültay and Çalik (2012) on context-based model and its influence on students' motivation argued that when students' are provided with such activities that they can feel competent and related with their learning objects and environment their level of motivation becomes high and they found significant difference between pre and post scores gathered on motivation scale. So, these findings showed alignment of present study result with other studies. Similarly, Pilot and Bult (2006) also conducted a study on context-based chemistry teaching and its effect on motivation and interest. The findings showed that after using contextual approach students become motivated and interested to learn chemistry concepts. So, the present study findings are steady with the findings of aforementioned study.

Taasoobshirazi and Carr (2008) have also studied the effect of context-based physics instruction and they found significant difference in

students' attitude when they were exposed to intervention. Their interest level were raised and they feel themselves competent enough to learn physics concepts. Present study showed the alignment with the previous study's results.

Gutwill-Wise (2001) also administered a research study on impact of context-based teaching on students' intrinsic motivation to learn science concepts, results revealed that students have higher motivation in experimental group to learn science concepts as compared to control group. Kuhn and Muller (2014) reported in their study which was aimed at finding the effect of context-based teaching on students' achievement and motivation. They concluded that significant difference was found in students' motivation level before and after intervention. Hence, above mentioned studies showed consistent results with present study findings.

Another study conducted by Holman and Pilling (2004), was based on finding the effect of contextual approach on students learning, attitude and motivation. The results of the study indicated that students' attitude remained the same but statistically significant difference was found in learning and motivation as it showed positive correlation with motivation level of the students. These finding also supported the findings of this research study.

Conclusion and Recommendations

On the basis of findings and discussions it is concluded that context-based teaching is effective in improving students' academic achievement in science subject. It is also concluded that context-based teaching is effective in enhancing students' intrinsic motivation in terms of competence, relatedness and interest level but remained ineffective in improving task value of science subject. Based on the conclusion and discussion following are the recommendations of the study.

1. Context-based teaching can be used as one of the effective approach of teaching science to enhance students' academic achievement.
2. It is recommended that it can be used as one of the teaching approach to increase students' motivation in science subject. Science teachers can use this approach to make students' intrinsically motivated.
3. School management may use this approach of teaching to improve students' science learning and clarity in concepts.
4. To make the intervention more meaningful it is also recommended that random selection of participants may be done because it may provide better results in order to see the effect of context-based teaching more objectively.
5. Context-based teaching approach may be used to teach science at secondary or higher secondary level.

6. This approach can also be used to teach arts subjects. Because context can be developed or arts subjects, as real life examples do exist in social sciences and humanities.
7. In future, researchers may conduct study to find the relationship between task value and context-based teaching.

References

Barber, M. (2000). *A comparison of NEAB and Salters A-level chemistry: Student views and achievements* (Master thesis). University of York.

Bennett, J. (2005). *Bringing science to life: The research evidence on teaching science in context.* University of York.

Bennett, J., Hogarth, S., & Lubben, F. (2003). *A systematic review of the effects of context-based and Science-Technology-Society (STS) approaches in the teaching of secondary science*. EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

Cohen, J. (1962). The statistical power of abnormal-social psychological research: A review. *Journal of Abnormal Social Psychology, 65,* 145-153.

Deci, E. L., & Ryan, R. M. (2007). Self-determination theory questionnaire: Intrinsic Motivation Inventory (IMI). http://www.psych.rochester.edu/ SDT/measures/intrins.html.

Gilbert, J. K. (2006). Context based chemistry education on the nature of context in chemical education. *International Journal of Science Education, 28*(9), 957-976.

Good, T., & Brophy, J. (2000). *Looking in classrooms* (8thed.). Longman.

Gutwill-Wise, J. P. (2001). The impact of active and context-based learning in introductory chemistry courses: An early evaluation of the modular approach. *Journal of Chemical Education, 78*(5), 684-688.

Hidi, S., & Harackiewicz, J. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research, 70*, 151-179.

Holman, J., & Pilling, G. (2004). Thermodynamics in context: A case study of contextualized teaching for undergraduates. *Journal of Chemical Education, 81*(3), 373-375.

Ilhan, N., Yildirim, A., & Yilmaz, S. S. (2016). The effect of context-based chemical equilibrium on grade 11 students' learning, motivation and constructivist learning environment. *International Journal of Environmental & Science Education, 11*(9), 3117-3137.

Kember, D. C., & McNaught, C. (2007). *Enhancing university teaching: Lessons from research into award winning teachers.* Routledge.

Köse, E. O., & Tosun, F. C. (2015). Effect of context-based learning on students' achievement and attitudes in biology. *K. U. Kastamonu Egitim Dergisi, 23*(4), 1425-1436.

Krapp, A. (2002). Structural and dynamic aspects of interest development: Theoretical considerations from an ontogenetic perspective. *Learning and Instruction, 12*(4), 383-409.

Kuhn, J., & Müller, A. (2014). Context-based science education by newspaper story problems: A study on motivation and learning effects. *Perspectives in Science, 2*(1), 5-21.

Kukliansky, I., & Eshach, H. (2014). Evaluating a contextual-based course on data analysis for the physics laboratory. *Journal Science Education Technology, 3*(1), 108-115.

Lye, H., Fry, M., & Hart, C. (2002).What does it mean to teach physics' in context'? A first case study. *Australian Science Teacher Journal*, *48*(1), 16-18.

Majid, A. N., & Rohaeti, E. (2018). The effect of context-based chemistry learning on student achievement and attitude. *American Journal of Educational Research, 6*(6), 836-839.

Niemiec, C., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education, 7*(2), 133-144.

Pilot, A., & Bulte, A. M. (2006). Why do you need to know? Context-based education. *International Journal of Science Education, 28*(9), 953-956.

Podschuweit, S., & Bernholt, S. (2017). Composition-effects of context-based learning opportunities on students' understanding of energy. *Res Sci Educ, 48*(4), 717-752.

Putter-Smits, L. G. A., Taconis, R., & Jochems, W. M. G. (2013). Mapping context-based learning environments: The construction of an instrument. *Learning Environ Res, 16*(3), 437-462.

Ryan, R., & Deci, E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and wellbeing. *American Psychologist, 55*(1), 68-78.

Taasoobshirazi, G., & Carr, M. (2008). A review and critique of context-based physics instruction and assessment. *Educational Research Review, 3*(2), 155-167.

Ültay, N., & Çalik, M. (2012). A thematic review of studies into the effectiveness of context-based chemistry curricula. *Journal of Science Education and Technology, 21*(6), 686-70.

Vaino, K., Holbrook, J., & Rannikmäe, M. (2012). Stimulating students' intrinsic motivation for learning chemistry through the use of context-based learning modules. *Chemistry Education Research and Practice, 13*(4), 410-419.

Whitelegg, E., & Parry, M. (2006). Real-life contexts for learning physics: Meaning, issues and practice. *Physics Education, 34*(2), 68-72.

….✳✳✳….

Citation of this Article:

Tariq, S., & Saeed, M. (2020). Effect of Context-Based Teaching on Grade VIII Students' Academic Achievement and Intrinsic Motivation in Science. *Pakistan Journal of Educational Research and Evaluation, 9*(1), 1-23.