

## **Effects of Reciprocal Teaching on Students' Achievement in Physics at Secondary Level**

Ali Zaman\*

### **Abstract**

The study aimed to find the effects of Reciprocal Teaching (RT) on students' achievement in physics at secondary level. RT is an instructional strategy that was taken place in the form of a dialogue between teacher and students for the small text segments that involved four strategies in turns i.e. predicting, clarifying, questioning and summarizing. For this purpose, the posttest only quasi experimental design was used that involved two groups. One group was the experimental group that received an unusual treatment of RT and other group was control group that followed ordinary class room teaching. The population of the study was 12696 students who enrolled in the high schools in the area of District Nowshera, whereas 118 students were selected as the sample in four selected secondary schools. To find out the effect of RT by comparing experimental and control groups, a post test was administered. Descriptive statistics of t-test, ANOVA, Mean, Median, and Standard Deviation were used for data analysis. It was found that incorporation of RT has high effect on students' learning achievement than the traditional teaching. Significant difference between experimental and control groups was recorded. RT strategy is highly recommended in physics teaching to be used at secondary level for students' improvements in learning physics. Teachers should be given Pre service and in service trainings for incorporation of RT in classroom environment.

**Keywords:** Reciprocal Teaching, Instructional activity, Secondary level, Learning Achievement.

---

\* Higher Secondary School Teacher, District Nowshera, Pakistan.  
Email: ali\_nsr@yahoo.com

## Introduction

Science is the knowledge attained through observation or practice; it often describes any systematic field of study or knowledge gained through it. Physics is one of these systematic fields of study of science which gives knowledge to produce useful models of reality (Webster new world collegiate Dictionary, 2013). When the teachers encounter struggling students to gain expertise in their academic areas and academic achievements, they have to work hard for using different tactics, apply different options and intervening in order to fill the learning gaps like weaknesses in understanding and comprehension of a statement (Star, 2013.). This may exceed in science subject, discussing word problems as it needs more attention and interaction for concept clarity. Numerical problems need understanding and comprehension ability to answer. Koch and Eckstein (2005), suggested that high level skills are required to solve physics word problems when it is given in long sentence form. Performance in mathematics word problem and the performance in reading comprehension were strongly related with each other. The same strategy may be adopted in the numerical of physics where reading comprehension needs to improve with the help of reciprocal technique.

The term reciprocal means, two ways, mutual action, take in turns or goes both ways between more than one person (Vocabulary.com) i.e. two or more people make groups that they are conducting in the same way with agreement of helping and advantaging each other and to make support for each other. As quoted by Oczkus (2010), reciprocal teaching (RT) uses four roles of predictor, clarifier, questioner and summarizer, which make this method a scaffolding technique to improve learning difficulties. RT first time used by Palincsar and Brown (1984), to overcome problem of less attention as it provides interactive environment engages each student by assigning them a specific mandatory role in order to reduce the adverse effects of low attention and produce active environment. Findings of Palincsar and Brown (1986), revealed that, reciprocal teaching acts like the “reading vitamins” and there is proof that the students followed this method were strongly enriched using its four factors in ways other than knowledge of the content of readings. Students were found fully engaged and passionate with the method provided. In the view of Yvonne, Jodie & Elizabeth (2009), RT raises student’s confidence and its style convince them for learning as a result the comprehension and learning achievement improves, this method provides strategic learning, as students become

aware to find his/her weak areas where they feel deficiencies in reading. Phillipa (2010), expressed that if the students have the skill to read the text but they do not have competency of what does it mean then teachers can exercise RT productively as a teaching strategy if they want to develop understanding (for word problems) and critical thinking.

In the light of education policy (2009), the government is giving a lot of attention on Physics (Science education) teaching and learning. RT is considered a scientific method but still this method is not being properly practiced in Pakistan. Physics is the key science subject which needs high level skill to clarify the concepts, especially, numerical would be focused in which the four steps of RT i.e. predicting, clarifying, solving/questioning and summarizing. It can enhance students' cognitive development and retention at secondary level using specified research design.

### **Literature Review**

Reciprocal teaching is not only effective in English reading comprehension but almost in all subjects. As according to Blazer (2007), reciprocal teaching is planned as an instructional strategy that helps out the students in all subject contents to enhance their understanding in reading.

Riyanningish (2009), studied the effects of reciprocal teaching in chemistry, her study was to understand chemistry concepts of the students using reciprocal teaching technique. Riyanningish concluded that reciprocal teaching has outstanding results on students while using in chemistry for different lessons. The comprehension level was improved on the studied group using RT strategy. Supporting Riyanningish, the study of Oludipe (2014), asserted that reciprocal teaching is better not only for English comprehension, but the concept can also be incorporated in science subjects to teach different science concepts.

Araujo & Carniero (2016), emphasized that reciprocal teaching is very effective for the abilities of reading and interpretation in biology texts. RT in biology is more useful permitted a deep analysis of the complex text and the understanding of meaning of scientific terminologies. In biology, sometimes, the meaning of a text shows two or more meaning which needs conceptual clarity. This type of situation can be solved using the strategy of RT for achieving the real idea within the text. Zachary(2009), found improvement in the scores of academically weak students by applying RT strategy. The perception of these students has changed as compared to those students who were still exposed to

usual approaches. Intervention students felt more confident and they were more result oriented in the subject of biology.

Reilly, Parsons, & Bortolot (2009), found that after the intervention of three months to use method of reciprocal teaching, student's approach for solving mathematics related problems had been improved for the students of grade seven. Vilenius-Tuohimaa, Aunola, & Nurmi (2008), studied the effect of RT teaching on students' comprehension abilities for mathematics word problems. The outcome of study indicated that performance on Math word problems and text understanding was greatly associated with each other. It was found that the technical reading competencies were enhanced with the performance of word problems.

Mathematics is considered a necessary component for the solution of physics problems. It can be called the language of science, However, mathematics used in physics is a unique verbal communication of that scientific language (Redish, 2005). In this regard, physics numerical has a strong association with mathematics word problems. As RT enhances comprehension for mathematics word problems, it may be used to enhance comprehension in physics using method of Reciprocal Teaching.

Spiak (1999), as cited by Blazer (2007), studied the effect of reciprocal teaching in physics on 9<sup>th</sup> grade students and found their improved learning. This implies that reciprocal teaching plays a great role in physics teaching and learning. In an another study, physics reading comprehension difficulties were investigated among college students. RTM was implied and results showed remarkable outcomes in terms of students improvement in comprehension, awareness of their difficulties and self-monitoring (Koch & Eckstein, 2007). In the views of Shah (2013), a substantial improvement in students' understanding of reading strategies was found as a result of RT strategy. The students who were exposed to RT strategy got more competencies in respect of self-regulation and expertise for the text. According to Khattak (2015), RT promotes teaching-learning process with the cooperation of each other. It makes a democratic learning environment based on social interaction of peers to work with each other. In this method group work prevail self-confidence, self-thinking and sharing of knowledge.

According to Atta, Jamil, Kundi & Siddique (2013), reciprocal teaching leads to get better the abilities, schooling, information, cognition, behavior, interest, inter-personal intelligence and group significance of the learners. Students encountering the word problems feel difficulty to solve them. Lack of text comprehension ability is big hindrance for student's learning. It can be reduced using four strategies

of reciprocal teaching. In a nutshell, reciprocal teaching enhances different components like knowledge, comprehension & application of cognitive domain. RT provides opportunity of participation to every student, makes them curious and responsible which is shared in peer work and leading them towards success. Literature also asserts that RT strategy is a source for generating meta-cognition that leads to provide the skills of problem solving. Studies suggest that the social contact among the peers compose them to enhance their motivational level, provides courage for leading the group and to share their knowledge and skills like planning, monitoring and assessment.

### **Statement of the Problem**

In teaching-learning process, the logic based problems require ability of deep understanding. Reciprocal teaching technique plays a remedial role to overcome mentioned problems and improves students' academic achievements. This study aimed to effects of reciprocal teaching on students' achievement in physics at secondary level.

### **Objectives of the Study**

The study aimed to achieve following objectives:

1. To investigate the effect of RT for students' knowledge achievement in physics at secondary level.
2. To examine the effect of RT for enhancing students' comprehension ability in physics at secondary level.
3. To investigate the effect of RT for students' application achievement in physics at secondary level.

### **Hypotheses**

- H<sub>0</sub>1. There is no significant effect of RT on students' achievements for knowledge component in physics at secondary level.
- H<sub>0</sub>2. There is no significant effect of RT for students' comprehension achievement in physics at secondary level.
- H<sub>0</sub>3. There is no significant effect of RT on students' application achievement in physics at secondary level.

## **Significance of the Study**

The study may help to improve the performance of the nine grade students to understand physics laws and problems using RT-Method. Study would be useful to enhance cognitive achievements specifically knowledge, comprehension and application. The study will enrich the teaching learning process at secondary level and motivate the teachers for using such technique that help them to make ensure coordination and positive communication. Study will help to improve students' reading comprehension that is required to solve numerical. This study will help to increase retention for nine grade physics students at secondary level. The study will help those students who cannot accomplish their work independently without collaboration of the peers. Study may be useful to highlight the importance of reciprocal teaching for incorporating it in curriculum at secondary level.

## **Methodology**

The Posttest-only Quasi experimental design was used which involves two groups; one experimental group and the other was control group. The experimental group received a new (unusual) treatment that is "Reciprocal Teaching Technique". The control group received traditional lecture method. Both groups were given the posttest ( $O_1$ ,  $O_2$ ) after the treatment ( $X_1$ ,  $X_2$ ). Both groups comprised equal number of students. Four teachers were selected and they were trained regarding reciprocal teaching using a specific training manual made for reciprocal teaching technique.

## **Posttest-only Quasi Experimental Design**

$X_1$   $O_1$

$X_2$   $O_2$

## **Population**

District Nowshera consists of two tehsils i.e. Tehsil Nowshera and Tehsil Pabbi. Tehsil Nowshera has 35 boys' high schools in which eight high schools are situated in urban and 27 are in rural area. Total enrollment of the students in those schools was 12696, which was the population of the study.

## Sample of the Study

Sample was comprised of 118 students in four randomly chosen schools. Two schools were situated in urban area whereas two were in rural area. This strategy was adopted for the reason to touch different areas and see the effect of RT on schools situated at different demographic locations. Each school had only one science section. Therefore, on behalf of student's 1<sup>st</sup> term scores, each section was equally divided into two groups; i.e. experimental and control.

## Instruments for the Study

Two instruments were used in this study i.e. RT based lesson plan & achievement test.

## Statistical Analysis

The results were shown in tabulated form. t- test, Mean, SD, and ANOVA were used to analyze the data taken from four different schools by using achievement test.

## Results

Here are Pre-Treatment Effects of the study- based on 1<sup>st</sup> term schools' results.

Table1:  
*Comparison on 1<sup>st</sup> term scores*

Analysis	Group	N	Mean	Std. Deviation
Pre-scores Analysis	Control	59	34.8305	7.28994
	Experimental	59	34.8136	7.38235

Table 1 expresses that before treatment the groups were equally divided in experimental and control groups by using first term schools' results.

Table2.  
*Group Comparison on 1<sup>st</sup> term scores using independent sample*

Analysis	t	df	Sig. (2-tailed)	Mean Difference
Pre-scores analysis	0.013	117	0.99	0.0169

Level of significance is 0.05 level

Table 2 also shows that before treatment “p” value is greater than alpha so both groups were equal.

Table 3:  
*Comparison of control and experimental group regarding knowledge component on achievement test (post test)*

Category	Group	N	Mean	Std. Deviation
Knowledge	Experimental	59	13.78	5.593
	Control	59	8.68	3.121

Table 3 signifies that, Mean =13.78 and Standard deviation = 5.593 for experimental group were higher than that of control group (Mean=8.68, SD=3.12). It shaped up that, the difference between experimental and control group average scores were promisingly high in experimental group.

Table 4:  
*Significance of difference for experimental and control group regarding knowledge component on achievement test (post test)*

Category	t	df	Sig(p) (2-tailed)	Mean Difference
Knowledge	6.119	117	.000	5.102

The mean difference is significant at the 0.05 level.

In Table 4, “p” value was .000 < 0.05 level, showing the difference of scores between experimental and control group for knowledge component.

*Table 5:  
Comparison of control and experimental group regarding comprehension level on achievement test (post test)*

Category	Group	N	Mean	Std. Deviation
Comprehension	Experimental	59	22.29	5.666
	Control	59	13.12	4.406

In Table 5, analysis of the study for comprehension component of cognitive domain revealed that means and standard deviations for experimental group (22.9, 5.666) were greater than that of control group (13.12, 4.40). Data indicated that, the difference between the experimental and control group average scores were favorably high for experimental group.

*Table 6:  
Significance of difference for experimental and control group regarding comprehension component on achievement test (post test)*

Category	t	df	Sig. (2-tailed)	Mean Difference
Comprehension	9.812	117	.000	9.169

Data in Table 6 indicated that, significance  $p$  value was  $.000 < 0.05$  level generated statistically significant results and this provided the significant difference of scores between experimental and control group for Comprehension component.

*Table 7:  
Comparison of Control and Experimental group for Application component on Achievement test (post test)*

Category	Group	N	Mean	Std. Deviation
Application	Experimental	59	15.76	7.751
	Control	59	11.73	7.506

Table 7 for application component of cognitive domain shows that mean and standard deviation for experimental group was 15.75 & 7.751 respectively was better than that of control group (Mean=11.73, SD= 7.50). It shows that the mean difference between the scores of experimental and control group were high on the part of experimental group.

*Table 8:*  
*Significance of difference for experimental and control groups regarding application part on achievement test (post test)*

Category	t	df	Sig. (2-tailed)	Mean Difference
Application	2.872	117	.005	4.034

The mean difference is significant at the 0.05 level.

In Table 8, Information described that, *p* value was significant at 0.05 level yielded statistically significant results and this provided the difference of scores between experimental and control group for application component.

## **Discussion**

The study has a great deal of consistency with the previous studies and research work of Johnson (1982), Palincsar & Brown (1984) and Schunk (2005). It is also consistent with the findings of Slavin (2008), Rizvi (2012) and Elsie (2014) who implied RT for whole class comprehension and the study of Phillipa (2010) for applying RT for word problems. Consistent with the literature of Palincsar and Brown (1984), the roles of teachers and peers were shifted to each other continuously in the form of predictor, clarifier, questioner and summarizer resultantly created the environment produced the results which shows that for knowledge, comprehension and application components of cognitive domain students' scored better at the side of experimental group due to incorporation of RT i.e. new treatment given to experimental group has high effects on students' cognitive achievement. Consistent with the research of Palincsar and Brown (1984), facts and figures based on findings provided the results that students' retention of experimental group in physics is highly improved due to new treatment of RT. Elsie (2014), found significant difference between all groups of different schools and on the positive sides of experimental group.

## **Conclusion**

The following conclusions were drawn.

The effect of reciprocal teaching provided excellent learning achievement; number of high achievers lies at the side of experimental group. Although the scores were varying in both experimental and control groups; however experimental group is more homogenous with

respect to learning achievements as compare to control group. Reciprocal teaching method appeared to be superior to that of conventional method when used in physics for the students of Grade Nine. The method has high effects on development of students' knowledge component of cognitive domain at secondary level. Comprehension part of cognitive domain was positively affected by reciprocal teaching for experimental group when taken in comparison with control group. Facts also concluded that, method of RT has strongly developed the application component of cognitive domain for the students of experimental group.

## **Recommendations**

The following recommendations were drawn:

Reciprocal Teaching was found better than traditional methods for grade nine physics. It is therefore recommended that physics teachers must use reciprocal teaching method for the improvement of students' learning achievements. Teachers are recommended to be trained for better implementation of reciprocal teaching in classrooms. Training should be provided to class teachers using the basic four elements of reciprocal teaching.

It may be made a part of in-service training of teachers along with the materials required for reciprocal teaching technique and during training emphasis should be given on activities that teachers may further implement in their class rooms.

Present system of education in Pakistan is highly emphasized on cognitive development of students, in this manner, RT-method is highly recommended for students of physics to enhance their cognitive achievement at secondary level.

Method of Reciprocal teaching should be used for understanding of logic and comprehension used in physics numerical at secondary level.

Results of the study are recommended to be shared with the stake holders concerning with curriculum development and policy making at secondary level in order to take better decisions for incorporation of reciprocal teaching, related materials and training.

The study also recommended the incorporation of reciprocal teaching for secondary classes, to prevent heavy failure of students in board's examinations.

As in present system of education in Pakistan the single teacher classes are prevailing, RT-technique provided the peer-work lessen the work burden on teacher's part.

## References

- Araujo, P., & Carniero, S.H.M. (2016). Reading in Biology Classes—A Different Teaching Activity, *Journal of Scientific Research*, 7(7) , 1044-1050
- Atta, M.A., Jamil, A., Kundi, G.M., & Siddique, M. (2013), Effect of co-operative learning on the educational Attainments of students at elementary school level. *Gomal University Journal of Research*, 2, 2, 87-92.
- Blazer, C. (2007). *Reciprocal teaching. Information Capsule*. Research Services, Miami-Dade County Public Schools. ERIC document reproduction services No. ED541081.
- Education Policy. (2009). Retrieved July, 28, 2015, from <http://www.UNSECO.org.pk/teachereducation/files/national%20education%20policy.pdf>
- Elsie, F. (2014). *Reciprocal Teaching: Investigation of its effectiveness as a method of whole class reading comprehension instruction at Key Stage Two*, (Unpublished Dissertation), University of London. 26,116.
- Khattak, K. (2015, 2<sup>nd</sup> May, 2015). *Training of teachers in higher education imperative for optimum learning outcomes*, Retrieved from <https://www.thenews.com.pk/print/38219-training-of-teachers-in-higher-education-imperative-for-optimum-learning-outcomes#>
- Koch, A., & Eckstein, G. (2005). Skills needed for reading comprehension of physics texts and their relation to problem-solving ability, *Journal of Research in Science Teaching*, 32 (6), 613-628
- Koch, A., & Eckstein, G. (2005). *Skills needed for reading comprehension of physics texts and their relation to problem-solving ability*, *Journal of Research in Science Teaching* 32(6).
- List of High Schools in Khyber Pakhtunkhwa. (n.d.). Retrieved September, 15, 2014, from <http://www.kpese.gov.pk/Downloads/SchoolStatistics/HighSchools.pdf>

- Oczkus, & Lori, (2010). Reciprocal Teaching, Powerful hands on Comprehension strategy, *The Utah Journal of Literacy*, 16(1), 34-38.
- Oludipe, O. (2014, November 12), Thoughts on reciprocal teaching in chemistry [Blog post]., Retrieved, from <https://septiryan.wordpress.com/2012/09/30/reciprocal-teaching-applied-to-understand-chemistry-concepts/#comments>
- Palincsar, S.A., & Brown, L.A. (1984). Reciprocal Teaching of Comprehension Fostering and Comprehension Monitoring Activities, University of Illinois, Lawrence Erlbaum Associates, Inc. *Cognition and Instruction*, 1(2), 156-57.
- Phillipa, J.Q. (2010). *Using reciprocal teaching*, (Master thesis), Massey University, New Zealand, Retrieved November, 15, 2014, from [https://muir.massey.ac.nz/bitstream/handle/10179/2247/02\\_whole.pdf](https://muir.massey.ac.nz/bitstream/handle/10179/2247/02_whole.pdf)
- Redish, E.F. (2005). *Problem solving and the use of math in physics courses*. Proceedings of the Conference 'World View on Physics Education in 2005: Focusing on Change', Delhi, India, August 21-26, 2005
- Reilly, Y., Parsons, J., & Bortolot, E. (2009). *Reciprocal Teaching in Maths: a learning strategy that builds problem solving skills and improves mathematical literacy for students*, Proceedings of the Conference, Sunshine College, Victoria. pp.182-189.
- Riyanningsih, S. (2009). *Reciprocal teaching applied to understand chemistry concepts* [ Blog post], Retrieved from <https://septiryan.wordpress.com/2012/09/30/reciprocal-teaching-applied-to-understand-chemistry-concepts/>
- Schunk, D. H. (2005). *Self-regulated learning: The educational legacy of Paul R. Pintrich*. *Educational Psychologist*, 40(2), 85-94.
- Shah, S.A. (2013). *Improving students' English reading comprehension skills through Reciprocal Teaching Approach (RTA)* (Unpublished master's dissertation), Agha Khan University, Karachi, Pakistan.

- Slavin, E. R. (2008). Cooperative Learning, Success for All, and Evidence-based Reform in education, `Education et didactique, 2(2), 151-159.
- Star, J.R. (2013, April 4). For struggling learners, how do we fill their gaps and teach them on grade level all in one year [Blog post]. Retrieved from [http://researchmap.digitalpromise.org/ask\\_a\\_researcher/struggling-learners-fill-gaps-teach-grade-level-one-year/](http://researchmap.digitalpromise.org/ask_a_researcher/struggling-learners-fill-gaps-teach-grade-level-one-year/)
- Vilenius-Tuohimaa, P.M. Aunola, K. & Nurmi, J.E. (2008). The association between mathematical word problems and reading comprehension, *An International Journal of Experimental Educational Psychology, Volume 28(4)*, 409-426.
- Vocabulary.com. (n.d.). Retrieved March, 14, 2016, from <https://www.vocabulary.com/dictionary/reciprocal>
- Webster new world collegiate dictionary. (2013). Retrieved November, 20, 2014, from <http://www.sciencemadsimple.com/science-definition.html>
- Yvonne, R., Jodie, P., & Elizabeth, B. (2009). Reciprocal teaching in Mathematics, mav conference (2009) (pp. 182-189). Retrieved September, 11, 2016, from <http://www.mav.vic.edu.au/files/conferences/2009/13Reilly.pdf>

***Citation of this Article:***

Zaman, A. (2019). Effects of reciprocal teaching on students' achievement in physics at secondary level, *Journal of Science Education, 1(2)*, 31-44.