AL-QALAM القلم
ISSN 2071-8683 E-ISSN 2707-0077
Volume 25, Issue, 1, 2020
Published by Institute of Islamic Studies,
University of the Punjab, Lahore, Pakistan.

Effect of Frayer Model and Think-Pair-Share as Target Assessment Methods on Academic Achievement of Prospective Science Teachers

i. Mubashara Akhtar
ii. Muhammad Saeed

i. PhD Scholar IER University of the Punjab, Pakistan
ii. Professor IER University of the Punjab, Pakistan

Abstract

This paper discusses the effect of Frayer model and Think – Pair – Share as Target Methods of assessment on prospective science teachers' academic achievement in the course of Curriculum Development. Student's learning outcomes were targeted and only those areas were covered that may be assessed through Frayer Model and Think – Pair – Share. Literature however is lacking in how these two assessment methods improve achievement and this study was conducted to address this research gap. The study carried quasi-experimental design of pre-test post-test. The sample was comprised of prospective science teachers studying the core course of Curriculum Development in a public sector university of district Lahore (Pakistan) and was divided into two groups - experimental group and control group with sample size of 51 and 36 students respectively. Pretest was taken from both the groups before exposing them to the treatment. Pretest and posttest were developed in the light of basic rules/principles of test construction and Bloom's Taxonomy of Educational Objectives. Validity of the test was ensured by three assessment and two research experts. The reliability of the test was ensured through conducting psychometric analysis on 200 students. The reliability of the final test 0.832 and the items selected having range of item difficulty between 0.2 – 0.8 and discrimination index 0.2 – 0.6. Treatment was carefully applied at the different intervals and the whole plan of experiment was validated by research experts. After treatment posttest was taken from both the groups to measure the effect of treatment on academic achievement. Results revealed that students who were assessed through Target methods of assessment showed better results as compared to the students received no treatment. Results showed that students showed better performance when they were assessed through Think – Pair – Share as compared to Frayer Model. On the basis of results, it was recommended to use Target assessment methods (Frayer model and Think – Pair – Share in the classrooms to improve the students' academic achievement and for future researchers it was recommended to use diverse methods of assessment in different subjects and across various levels to check the effectiveness of assessment methods.

Key words: *Frayer Model, Think – Pair – Share, Target Assessment, Academic Achievement, Prospective Science Teachers*

Introduction

Assessment is a broad term that includes methods to attain information on the students' achievement that how well they learn that help to make judgment about their academic achievement. It is a continuous process of assembling, evaluating and reflecting on facts to make informed and consistent judgment to improve future students' achievement. It includes both quantitative and qualitative description of students' achievement. Assessment always gives value judgment concerning the desirability of the results. It is basically a procedure in

which information is collected to make decision on different domains of learning such as; curricula, learning, educational policies and different other programs (Brookhart & Nitko, 2015). Regarding students' learning educators make many decisions. Identify students' strengths and weaknesses in learning, managing classroom instruction, treating learning difficulties of students, determines grades and delivering instructions and counseling is included in these decisions. The collection and use of suitable information is important in assessing the learning progress. Assessment and learning progress of students is not relevant to students' degree classification or allocation of grade only. Generally, it is about to be educational focus, allocation of time and learning patterns of students. It plays an important role in the life of students in order to drives their learning. Nobody can deny the importance of assessment but there is a need to be focus upon crucial elements of assessment which influence assessment procedure and alter the situation of teaching-learning process (Sainsbury, & Walker, 2008). Assessment serves many purposes at different levels. At higher education level, development of effective assessment methods can present innovative and distinctive challenges for both graduate and undergraduate courses. At graduate and post-graduate level many assigned tasks are project based rather than mere objective based. In teaching and learning process at this level, assessment methods are becoming motivating methods for evaluation and learning improvement in many situations. At higher education level, where there is large amount of information is needed on any specific context (mostly theoretical based) the assessment methods collaboration with objective based learning provide a satisfying and meaningful learning experiences to the students. In classrooms, while exploring the assessment and its application teachers want to know "what works" in education, but the truth is nothing works everywhere and everything works somewhere. Therefore, a research can never tell about the classrooms' situation to the teachers. We cannot get it through previous studies that what we should do after going to the classes because classrooms are far too complex for any possible prescription. It all depends on the context of the particular classroom and varies in different situations; what course of action is effective in one situation may be harmful in another.

In 2010 Thompson and Wiliam (2010) introduced a new shift in the paradigms of assessment from traditional assessment methods to alternative assessment methods. Formative and summative assessment methods in regards to different methods of assessment have attracted educators' attention and they claim that different kinds of assessment helps to improve the learning of the students because assessment is the key feature of teaching and learning process. Davis and Karunathilake (2005), Joughin and Liu (2008), Pearce (2009), and Tinkler and Jackson (2004) doing their research on classroom assessment technique i.e. oral question answer and explored that assessment has a significant effect on students' learning. Enerson, Plank and Johnson (2007) conducted a research that how classroom assessment techniques are helpful for students to know the methods of learning the content. They explored that assessment helps the teachers to take overview on their students' work and identify the ways for improvement which automatically improves their learning. Nilson (2010) also conducted the research on the assessment methods and his work investigated that classroom assessment is teacher-oriented process but it also requires student participation equally for effective learning. Moreover, Vega and Tayler (2005) conducted research on assessment and explored that if students are involved in learning process than their knowledge and the level of participation with confidence increases as compared to the students who were engaged with traditional transmission of factual knowledge. Effective assessment methods and their appropriate use in the educational environment is a necessary component of teaching-learning process. Moreover, educational institutions are accountable for students' academic achievement and assessment provides a significant way to respond accountability. Different teachers use different assessment methods in their classrooms and

researchers also explored the effect of assessment methods such as: question answer method, activity method, discussion method, exit ticket, self-assessment, oral assessment, peer assessment etc. on to prospective science teachers' academic achievement. The assessment methods used in this study were: Frayer Model and Think – Pair – Share.

Frayer Model

Frayer Model is the assessment method used at the beginning of a lesson to assess students' prior knowledge about any concept being taught or discussed. It may be used to identify misconceptions of learning during teaching (Buehl, 2003). This method may be used before starting the instruction to check the prior knowledge of the students. The main purpose of the Frayer model (Buehl, 2003; Frayer, Fredrick, & Klausmeier, 1969) is that it provides opportunity to the students to define familiar and unfamiliar concepts. In Frayer model students define the concept, present its characteristics, give its examples (related to topic), non-examples (not related to concept i.e. what a concept is not helping define what it was). The teacher required the student to place this information on a paper or chart that is divided into four sections to give a clear representative picture of any concept. It develops the ability of analyzing and synthesizing among the students to think about examples and non-examples. It also helps students to revisit their prior knowledge about a concept and build new ideas related to that knowledge.

Sullivan (2014) explored that Frayer Model may be implemented in classrooms by following certain steps :

i. Demonstrate a chart (Frayer Model) to the whole class to make them clear about the usage of this method. Model a concept and the type of answers required to them by giving examples and non-examples to them. Pictures/symbols may also be used for this purpose.
ii. Review the list of concepts and ideas that with students while keeping in view their level of understanding.
iii. Ask the students to help you in building the Frayer Model on board/paper to make them clear about the activity.
iv. After this, ask students to make a Frayer Model either individually, in pair or in small group to check their understanding about the topic.
v. The students are allowed to share their charts with their groups and with the whole class. Students may add charts/figures/pictures/model etc. at any category to make the model represented.

Think – Pair – Share

Think – Pair – Share is the assessment method that may be used at any time during the lecture to activate thinking, process new ideas, or to reflect on learning. This method can increase success rate as well as willingness to participate in the classroom discussion. It may be implemented in classrooms by following certain steps:

i. **Preliminary stage**. At first stage, teacher explains the main objectives of the lesson, content matter, link previous knowledge with the new one by using method of his/her own choice and ask question from it.
ii. **Think**. Students think about the questions asked by the teacher individually and students who get successful get any grade or letter assigned by the teacher.
iii. **Pair**. Students are asked to pair with their class fellows to discuss their concepts. Mostly, this pairing is based on the pace of answers given by the students. furthermore, students who get good grade or letter from the teacher are allowed to discuss their views with the group
iv. **Share**. From each pair, one student presented their answers in front of the whole class and teacher or other student may give feedback on the answer given.

v. **Closing**. Teacher gives final remarks on the learning and outcomes. Teacher reflect on the understanding level of the students collectively and at the end assign home work to them by assigning the learning material being discussed in the next session or class (Pradana, Sujadi & Pramudya, 2017).

Researchers Grisay, (1991), Harlen and Malcolm (1996), Pinger, Rakoczy, Besser, and Klieme (2018) and Tomlinson and Mc Tighe, (2006) explored the overall effect of assessment methods on students' achievement at different levels. Also in Pakistani education system, traditional assessment methods just measure the limited performance of the students instead of guiding them in the process of learning. They have more focus on the capacity of students rather than on their abilities to think systematically, comprehend and analyze the things. In view of this approach, the current study was designed to determine the effect of assessment methods (Frayer Model and Think – Pair – Share) on students' achievement. These methods may enhance students' learning at undergraduate level and make them able to think more critically.

The present study has its roots in Webb (1997, 2002) method of alignment which is a handful approach to find out the match between the educational objectives and assessment methods used (Blank, 2002).

Research Objectives

The objectives framed for this study were

i. Investigate the effect of Target methods of assessment (Frayer Model and Think – Pair – Share) on prospective science teachers' academic achievement.
ii. Identify the best Target method of assessment in regard to promoting prospective science teachers' academic achievement.

Research Methodology

This research study was experimental in nature and designed to explore the effects of Target methods of assessment on prospective science teachers' academic achievement in university classroom. Pretest Posttest Quasi experimental design was used for this study. Pre-test of both the groups were taken. At the time of study, there were 238 prospective science teachers enrolled in Institute of Education and Research, University of the Punjab, Lahore, Pakistan. The researcher took two sections with a total of 87 prospective teachers of 5th semester of Bachelors of Science Education as sample of the study. Two intact groups were chosen for the study and these groups were assigned to experimental and control groups by lottery method.

Research Instruments

The instruments used in this study were lesson plans and achievement test (pre-test and post-test). The lesson plans for this study were prepared by considering learning objectives and targets of assessment. The lesson plans for this study were developed by keeping in view the learning target types that were knowledge, reasoning, performance and product as mentioned in figure 1.

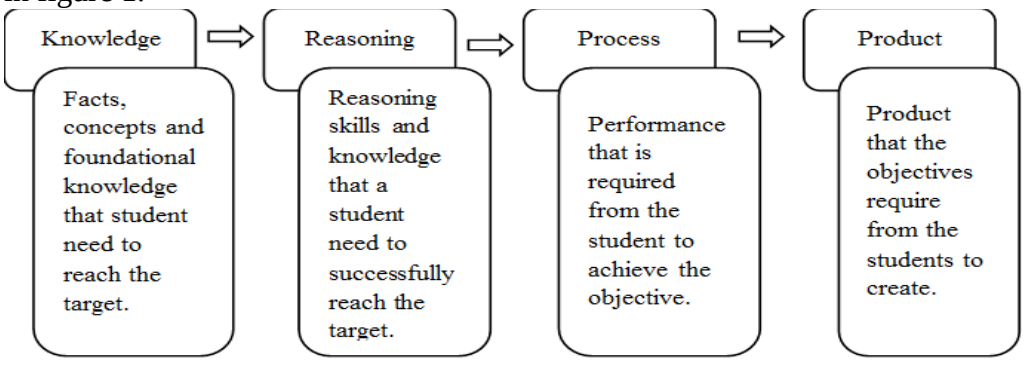

Figure 1. Learning target types

Based on students' learning outcomes (SLOs), an achievement test was developed by using Item Response Theory (IRT). While constructing the test, whole syllabus was reviewed. All the objectives were enlisted and assessed through the test. A two-way table of specification was constructed by keeping in view the Bloom's Taxonomy of Educational Objectives. Since achievement test (pre-test and post-test) was developed at undergraduate level, therefore the test will contain items of all the cognitive levels of Bloom's taxonomy i.e. knowledge, comprehension, application, analysis, synthesis, and evaluation. Students learning outcomes (SLOs) were assessed through various item formats e.g. MCQs and short answers. Instruments were validated by five assessment and curriculum experts. The reliability of the achievement test was determined by piloting it on 200 students that were selected from a public sector university. The reliability of the test by using Chronbach's alpha was 0.832. To evaluate the data, ConQuest software was used. Succeeding measures to select the items were:

Difficulty index = 0.2 --- 0.8
Discrimination Range = 0.2 - 0.6
Point Bi-serial less than 0.8 (State Board of Education, 2014)

Intervention Procedure

The lessons were planned in such a way that every individual got an opportunity to participate in the study and exposed to Target assessment methods i.e. Frayer Model and Think – Pair – Share. The researcher taught the same content to both the treatment group and the comparison group. The study was lasted for the whole semester (16 weeks). Separate portfolio of every student was organized in which their record was maintained. Students received the feedback promptly to make excel. The experimental group was tested after applying every assessment method to measure the significant effect of that assessment method on students' achievement. After applying the treatment both the groups were tested (post-tested). The researcher compared the achievement of both the groups. The scores of pre-test and post-test of each group were also compared to check the effectiveness of the Target methods of assessment.

Results

The study revealed Target methods of assessment have positive effect on academic achievement of prospective science teachers at undergraduate level. The data collected for the study was analyzed by using different statistical techniques. Results revealed are as follows:

Table 1.*Comparison between experimental group & control group based on pretest scores*

Groups	N	Mean	SD	df	t-value	Sig.
Experimental Group	36	6.389	3.587	85	2.790	.06
Control Group	51	6.980	3.630			

Table 1 indicates the achievement scores of experimental group and control group in pretest by applying independent sample t-test. The pretest scores of experimental group (M= 6.389, SD= 3.587) and control group (M= 6.980, SD= 3.630) using an alpha level of significance .05. that indicated that the values of experimental and control group were not significantly different. The calculated t-value (2.790) at df=85 was greater than the critical / table value (1.290) on 0.05 level of significance. Similarly, the value of p was 0.06 < 0.05 which indicate that no significant difference present in control and experimental groups before experiment.

Table 2. *Comparison between experimental group & control group based on posttest scores*

Groups	N	Mean	SD	df	t-value	Sig.
Experimental Group	36	22.805	3.160	85	7.416	.000
Control Group	51	16.921	3.948			

Table 2 indicates the achievement scores of experimental group and control group in posttest by applying independent sample t-test. The scores of experimental group (M= 22.805, SD= 3.160) and control group (M= 16.921, SD= 3.948) using an alpha level of significance .05. The values of experimental and control group were significantly different in posttest. The calculated t-value (7.416) at df=85 was greater than the critical / table value (1.290) on 0.05 level of significance. Similarly, the value of p was 0.000 < 0.05 which indicate significant difference in achievement scores of experimental and control group existed which reflected that the students of experimental group showed better performance in posttest than control group.

Table 3. *Comparison between experimental group & control group based on Frayer model*

Groups	N	Mean	SD	df	t-value	Sig.
Experimental Group	36	5.346	.666	85	14.759	.000
Control Group	51	2.550	.987			

Table 3 indicates the values of experimental group and control group across Frayer Model after applying independent sample t-test. It was applied to compare the scores of experimental group (M= 5.346, SD= .666) and control group (M= 2.550, SD= .987) across Frayer Model using an alpha level of significance .05. The calculated t-value (14.759) at df = 85 was greater than the critical / table value (1.290) on 0.05 level of significance. Similarly, the value of p was 0.000 < 0.05 which indicate that the students of experimental group showed better performance in Frayer Model than control group.

Table 4. *Comparison between experimental group & control group based on Think-Pair-Share*

Groups	N	Mean	SD	df	t-value	Sig.
Experimental Group	36	7.720	.540	85	23.990	.000
Control Group	51	2.849	.713			

Table 4 indicates the values of experimental group and control group after by applying independent sample t-test. It was applied to compare the scores of experimental group (M= 7.720, SD= .540) and control group (M= 2.849, SD= .713) across Think-Pair-Share using an alpha level of significance .05. The values of experimental and control group were significantly different. The calculated t-value (23.990) at df = 85 was greater than the critical / table value (1.290) on 0.05 level of significance. Similarly, the value of p was 0.000 < 0.05 which indicate that the students of experimental group showed better performance in Think-Pair-Share than control group.

Table 5. *Comparison between Frayer Model and Think – Pair – Share*

Methods	Mean Difference	Sig.(2-tailed)
Think - Pair - Share Frayer Model	2.373	.000

Table 5 indicates the mean difference among two methods of assessment i.e. Think-pair-share and Frayer Model. The mean difference in the achievement scores of students across both methods was 2.373 that show that the Think-pair-share is most effective method for students than Frayer Model. Similarly, the value of p was 0.000 < 0.05 which indicate significant difference in achievement scores of students across think – pair – share and Frayer model existed.

Discussion

In Pakistani classrooms, usually traditional assessment methods are used to measure the academic achievement of the prospective science teachers' and it was the unique experience for the prospective science teachers' to be assessed by Target methods of assessment. During instruction, different materials such as: play cards, exit slips, worksheets and written tests

were used to assess the performance of prospective science teachers. Nxumalo (2007) supports the findings of this study in a way that he explored that assessment is the essential component of teaching learning process and described it as a mean of informing teachers and students about their progress that will benefit teaching learning process in positive ways. Assessment and its implication with teaching and learning are the important element for classroom practices. Researchers have been done many work in the field of assessment also express their view about the teacher knowledge regarding to the assessment. Teacher should have knowledge about the assessment (Louden, 2005; Matters, 2006).

The findings of the study explored that Frayer Model provide a kinesthetic way to improve academic achievement. This finding supports the findings of researchers (Monroe & Pendergrass, 1997; Talla, 2015) who explored the effect of Frayer Model on knowledge development of students and the results revealed that Frayer Model is helpful in improving knowledge of students. Kimbell and López (2009) also stated that the Frayer model has been shown to increase depth and breadth of word knowledge of students.

Think – Pair – Share is also very useful to teachers as well for students because it can be used as a valuable form of formative assessment (Cooper, & Robinson, 2002). The results of the study explored that Think – Pair – Share increases the performance and understanding of the students and the findings of Heward (1994) also justify that think-pair-strategy is one way to incorporate cooperative learning into a classroom develop a meaningful understanding of class material.

References

Brookhart, S. M., & Nitko, A. J. (2015). Educational assessment of students (7th ed.). Boston: Pearson.

Sainsbury, J. E., & Walker, A. R. (2008). Assessment as a vehicle for learning: Extending collaboration into testing, Assessment & Evaluation in Higher Education, 33(2), 103-117. doi: 10.1080/02602930601127844

Thompson, M., & Wiliam, D. (2010). Tight but loose: A conceptual framework for scaling up school reforms. In E. C. Wylie (Ed.), Tight but loose: scaling up teacher professional development in diverse contexts (RR-08-29, pp. 1-44). Princeton, NJ: Educational Testing Service.

Davis, M. H., & Karunathilake, I. (2005). The place of the oral examination in today's assessment system. Medical Teacher, 27(3), 294-297.

Joughin, G., & Liu, N. F. (2008). How assessment supports learning: Learning-oriented assessment in action. Hong Kong: University Press.

Pearce, L. (2009). How to examine a thesis. Buckingham: Open University Press.

Tinkler, P., & Jackson, C. (2004). The doctoral examination process: A handbook students, examiners and supervisors. Buckingham: Society for Research into Higher Education.

Enerson, D. M., Plank, K. M., & Johnson. R. N. (2007). An introduction to classroom assessment techniques. Retrieved from http://www.uc.edu/content/dam/uc/cetl/docs/classroom_assessment_tec hniques.pdf

Nilson, T. (2010). Good for living?: On the relationship between globalization and life expectancy. World Development, 38(9), 1191–1203.

Buehl, D. (2003). Wait. Let me think about that. Retrieved from http://www.weac.org/News_and_Publications/education_news/2002-2003/read.aspx

Buehl, D. (2014). Classroom strategies for interactive learning. Newark, DE: International Reading Association.

Frayer, L. E., Fredrick, W. C., & Klausmeier, H. J. (1969). A Schema for testing the level of concept mastery. Paper presented at Wisconsin research and development center for cognitive learning. University of Wisconsin. Madison, Wisconsin.

Sullivan, M. T. (2014). Using adapted Frayer Model as graphic organizer for graph vocabulary. In N. Sonda & A. Krause (Eds.), JALT2013 Conference Proceedings. Tokyo: JALT.

Pradana, O. R. Y., Sujadi, I., & Pramudya, I. (2017). Think pair share with formative assessment for junior high school student. International Conference on Mathematics and Science Education, 1(1), 1-7. doi :10.1088/1742-6596/895/1/012032.

Grisay, A. (1991). Improving assessment in primary schools: APER research reduces failure rates. In P. Weston (Ed.), Assessment of pupils' achievement: Motivation and school success (pp. 103-118), Amsterdam: Swets and Zeitlinger.

Harlen, W., & Malcolm, H. (1996). Assessment and testing in Scottish primary schools, The Curriculum. Journal, 7(1), 247-257.

Pinger, P., Rakoczy, K., Besser, M., & Klieme, E. (2018). Interplay of formative assessment and instructional quality interactive effects on students' mathematics achievement. Learning Environ Res, 21(1), 61-79. doi: 10.1007/s10984-017-9240-2

Tomlinson, C. A., & Mc Tighe, J. (2006). Integrating differentiated instruction and understanding by design: Connecting content and kids. Retrieved from file:///D:/New%20folder/DOCUMENTS/Downloads/Integrating%20Diff%20Instr%20and%20UbD%20Tomlinson%20McTighe.pdf

Webb, N. L. (1997). Criteria for alignment of expectations and assessments in mathematics and science education (Council of Chief State School Officers and National Institute for Science Education Research Monograph No. 6). Madison: University of Wisconsin, Wisconsin Center for Education Research.

Webb, N. L. (2002). Alignment study in language arts, mathematics, science, and social studies of state standards and assessments for four states.Washington, DC: Council of Chief State School Officers.

Blank, R. (2002). Models for alignment analysis and assistance to states. Washington, D.C.: Council of Chief State School Officers.

Nxumalo, Z. F. (2007). The role of continuous assessment in primary school (Master's Dissertation). University of Zululand. Retrieved (7 August, 2018) from http://uzspace.uzulu.ac.za/handle/10530/531

Louden, W., Rohl, M., Barrat-Pugh, C., Brown, C., Cairney, T., Elderfi eld, J., House,H., Meiers, M., Rivalland, J., & Rowe, K.J. (2005a). In teachers' hands: Effective literacy teaching practices in the early years of schooling. WA: Edith Cowan University.

Matters, G. (2006). Using data to support learning in schools: students, teachers, systems. Melbourne: ACER Press.

Monroe, E. E., & Pendergrass, M. R. (1997). Effects of mathematical vocabulary instruction on fourth grade students. Reading Improvement, 34(3), 120-132.

Talla, S. S. (2015). Using Frayer model to develop students' vocabulary knowledge on the xb grade of smanegeri 1 Leihitu (Published Master Thesis). English Education Study Program, Language and Art Department, Pattimura University, Ambon.

Kimbell, K., & López. (2009). Teaching vocabulary: Frayer Model. Retrieved from woodard.latech.edu/~kklopez/EDCI424/Vocabulary%20Handout.pdf

Cooper, J. L. & Robinson, P. (2002). Getting started: Informal small-group strategies in large classes. New Directions for Teaching & Learning, 2000(81), 17-24.

Heward, W. L. (1994). Three low-tech strategies for increasing the frequency of active student response during group instruction. In R. Gardner III, D. Sainato, J. O. Cooper, T. Heron, W. L. Heward, J. Eshleman & T. A. Grossi (Eds.), Behavior analysis in education: Focus on measurable superior instruction (pp. 283-320). Pacific Grove, CA: Brooks/Cole.