

Effect of Formative Assessment Techniques on students' Learning in the Subject of General Science at Elementary School Level

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KEY WORDS

Ongoing Process, Student
Learning, Student
Feedback, Student
Engagement in class

ABSTRACT

The main purpose of the study was to investigate the effect of formative assessment techniques on students' learning in the subject of General Science at elementary school level. The study used quasi experimental design which was conducted in a public sector elementary school of district Lahore, Pakistan. Participants of the study included 320 students in grade 7 who were divided into eight sections. Two intact groups of 7th grade were selected as study sample: one as experimental and other as control; each contained 40 students. The researcher developed 40 lesson plans and test. The instruments were validated through experts' opinion having expertise in research and science. To ensure the reliability, pilot study was conducted. The experimental intervention was conducted for 12 weeks. Results revealed that there was statistically significant difference in the scores of control and experimental group for both pre-test and post-test which means that there was a significant effect of formative assessment techniques on students' learning in the subject of General Science at elementary school level. It was recommended that teachers may use various formative assessment techniques in order to enhance students' achievement in the class.

Introduction

Formative assessment appears as an umbrella term in which under various teaching and learning techniques find their place. The definition is not the final one, as it is difficult to summarize what is involved in the formative assessment. "For almost fifty years, the term formative assessment has been around, but there is still no agreement as to what it means" (Wiliam & Leahy, 2015, p. 5). Classroom learning is formative to the degree to which the pupil outcomes are displayed, seen and incorporated in the decision-making processes of educators, pupils, and their colleagues, likely to be stronger or more well-founded than their judgments if no evidence exists (Black & William, 2009).

Black and Wiliam (1998), the seminal writers who articulated the need, purpose, and advantages of formative evaluation, developed their thinking and gathered evidence over time. They noted that formative testing produced substantial academic results for low student achievement and helped to close the performance gap. Teachers can help students participate in the learning process by using formative analysis and identify elements of the progress of the students towards understanding. Using evaluation, however, did not automatically fit into the usual routines of the classroom and summative evaluations remained the dominant form of evaluation.

Evaluations can be administered today before, during and after instruction has been carried. Their ground breaking article did not necessarily reveal something new, but revived important learning and evaluation concepts that had been ignored in many classrooms. Previous concerns about the validity and reliability of the assessment were of importance to the authors, particularly when students misunderstood or misinterpreted test questions (Wiliam & Black, 1998).

Black and Wiliam (1998) had long suggested that meaningful interactions between teachers and students led to learning in the classroom. Only when teachers knew how students were specifically could teachers adapt to the needs of the students. In addition, educators needed to make multidimensional and not just linear contextual instructional and evaluation decisions (McMillan, 2003), such as checking for units of skills (Sadler, 1989). It was not an easy or agreed process how best to accomplish this necessary feat. How the educator wanted to play a more supportive role, frame his or her pedagogical theory and use constructive input was of great importance.

The instructor must learn from the comments of the students about the students and participate in interpretive listening. Formative evaluation focused on the importance of teacher-student interactions, the influence of cognition response, and the role of the pupil in learning. It also stressed the teacher's decisions when capitalizing on the context of the situation in the classroom and key interactive learning moments (Black & Wiliam, 2009).

Teachers have key opportunities to make pivotal instructional in these interactive components of formative assessments. The decision process becomes interplay of the lesson's aims, the teacher's view of the lesson and students' orientation, and the tools at hand to execute the decisions (Schoenfeld, 2011). In the hectic environment of the modern classroom, these important interactions and instructional decisions can be missed, unless there is a deliberate plan to incorporate specific assessment practices.

Research has shown that there are conflicting views within K-12 education about the nature of assessment use. For the past twenty years, school administrators have adopted structured large-scale tests as the rule, and now a movement is starting to change this approach. There are calls for more formative thinking to be incorporated into the practice of teachers, but there is an evidence that teachers often have limited knowledge or differing ideas about formative assessments (Trauth-Nare & Buck, 2011). Most teachers have little training in evaluation and often base their attitudes as students themselves on their personal experiences with evaluation. Researchers found that most teachers in their classroom practice learn to standardize testing methods and few to alternative testing method. It is key to the interesting fact that attitudes of teachers with all forms of evaluation were influenced more by their own personal experiences or affective variables than by their professional development or cognitive variables.

It has also been shown that the grading and appraisal activities of educators can be affected by class size, school size, and subject area away from formative evaluations (Duncan & Noonan, 2007). There seems to be a pattern of evaluation use focused on traditional summative paper and pencil evaluations, possibly for their time-saving elements, usability familiarity, or ease of grading. This is an interesting phenomenon as many educators can easily remember their youth's unfair trading practice. Such negative experiences, many of them from their college years, can persist into adulthood and affect how educators use evaluation and should be discussed in discussions about the purposes of knowing evaluation (Guskey, 2006).

This issue can be transferred to programs for teacher education. Bonner and Chen (2009) found that pre-service teachers consider evaluations and grades as necessary.. The teacher candidates had a positive view of constructivist approaches, but in traditional approaches they thought about evaluation. Educators can tell pre-service teachers about the benefits of learning assessment, but at the same time perpetuate the grade-only culture itself (Mitton-Kukner, Munroe, & Graham, 2015).

Even though teachers claimed that assessments other than standardized evaluations were necessary in several situations, they did not generally use them (Brookhart, 2004). In other cases, educators only used non-graded formative assessments 12 percent of the time throughout the year and 25 percent of the time when teaching used graded evaluations (Bell & Cowie, 2001). Curiously, one study noted teachers shifting their

perspectives to evaluations before and after periods of high stress testing, and the researchers suggested interviewing teachers' multiple times over a school year (Polly et al., 2014). Providing opportunities for teachers to articulate their views can help shed some light on why they held all other conceptions and used certain evaluation practices.

Olafson, Schraw and Vander Veldt (2010) saw a connection between the epistemological and ontological views of teachers when examining how educators feel about their pedagogy. The epistemological view refers to one's collective belief in the acquisition of knowledge, and the ontological view refers to the collective belief in reality and being. Both views of the world work in tandem and become a determining factor in the perception of pedagogy and education by an educator (Olafson et al., 2010). Teachers with more sophisticated views of the world are more likely to emphasize higher-order thinking in their instruction and evaluation, and teachers with less sophisticated views of the world are more likely to emphasize traditional student testing and mastering basic concepts. It was also noted, however, that teachers may embrace a more sophisticated view, but their actual practices vary in lesson execution and appraisal usage. Further research is needed to examine how teachers view themselves, their students, and how they make decisions for instruction and assessment in this complex relationship (Olafson et al., 2010).

In addition, Dyer (2013) stated that several brief assessment methods mentioned below can be used well for formative evaluation (i.e. to test the students' comprehension of the topics you have just taught). They can also be used as short calculations, however, which will attach some weight and be aspect of the rank of the course. You'll have to change them a little to allow marking, of course. One solution is random grading. For instance, ask the whole class to complete a short assignment and then collect and evaluate some attempts randomly. This method requires the event to be done by all students in the class. Pre-announce your plans in the syllabus. A category roster matrix will assist in maintaining equal collections. Grading is more work for you, but more students are interested in classroom work with the payoff.

Significance of the Study

This study is significant as findings may be useful for the parents, administration, teachers, students and the society's attention to the standing of creating an adequate student learning through formative assessment techniques. Accordingly, this study finding may be help school administrators and curriculum designers to develop strategies that promote formative evaluation methodologies and make them better suited to General Science learning in elementary school. In addition, the results of the study should act as a cause for other researchers concerned in this area.

Statement of the Problem

This research showed the effect of formative assessment techniques on students' learning in the Subject of General Science in public sector elementary schools of Lahore. Teaching staff should compare their ratings to other teachers to make sure they evaluate students equally. We also find comments more successful than marks to boost student performance and to help us achieve higher expectations. The frequency of marks cannot always be dropped or decreased easily. However, students and parents now and then select to know in what way they do compare to other students. Teachers change teaching methods to satisfy a variety of student needs.

They confirm that lessons involve different methods to explain new concepts, offer choices for independent classroom work and encourage students to help their peers by using a new concept. Teachers vary teaching methods to see a variety of student's needs. We ensure the classes provide different styles to teach new ideas, deliver alternative teaching solutions and inspire students to help their peers who have learned a new concept.

Objectives of the Study

Following were the objective of the study:

1. To find out the effect of formative assessment techniques on students' learning in the subject of general science through comparing pre-test of control and experimental groups at elementary level.
2. To find out the effect of formative assessment techniques on students learning in the subject of general science through comparing post-test of control and experimental groups at elementary level.

Research Hypotheses

The study based on following research hypotheses

H₀₁: There is no significant effect of formative assessment techniques on students' learning in the subject of general science through comparing pre-test of control and experimental groups at elementary level.

H₀₂: There is no significant effect of formative assessment techniques on students' learning in the subject of general science through comparing post-test of control and experimental groups at elementary level.

Research Methodology

The study carried out Quasi Experimental pre-test post-test control group design. Creswell (2012) described quasi-experiments as being common to educational research because preciously creating groups would create disruptions to Formative Assessment Techniques. Experimental studies aim to examine whether the participant's behaviour or internal processes was affected by treatment. This involves experimental manipulation of learning situations artificially. The study was conducted in

public elementary school of district Lahore. In order to determine the effect of formative assessment techniques researcher conducted pre-test and post-test in the subject of General Science. For analysis of data, an inferential statistical technique was used in this study.

Population and Sample

A public-school of elementary level was selected for population of the study. The total number of students in 7th grade was 320 divided into eight sections were consider as a population of the study. School was selected conveniently from which two intact groups randomly assigned control and experimental of 7th grade were selected as sample of the study. The sample size of control group was 40 and of experimental group was also 40.

Instrumentation

Based on nature of the research study, the pre-test post-test non-equivalent groups design was applied. The purpose of pre-test was to make sure the equivalency of the student learning of control and experimental groups before treatment. The researcher prepared test as post-test, which was administered among the students after treatment. Test was pilot tested before administration. Pilot- testing was detained at elementary public-school of district Lahore. The post-test aimed to measure the students' learning according to the content and objectives of the first six units of General Science subject taught to the two groups during the experimental period. Scores of tests were collected, compiled and scored at the end. Researcher was used three levels of cognitive domain (knowledge, comprehensive and analysis) because it was included in the national curriculum (2006) in General Science. The validity of the pre-test and post-test was ensured by the experts' opinion. Therefore, four experts from relevant field were consulted for the validation of the instrument. Amendments were made as per suggestions given by the experts. For the confirmation of reliability of the test, item analysis was done. Item difficulty and item discrimination index was checked for each of the item given in the test.

Hence all items included in the test possessed reasonable difficulty (ranged .32-.70) and discrimination values (ranged .42 -.78). As per literature, item difficulty should range between .27 to .84, so all items were within this range. Likewise, literature says that approaching the discrimination to 1, the item will be more appropriate from the context of discrimination between high and low achievers, as test items were quite acceptable in this regard.

Data Analysis and Findings

Inferential statistics (independent sample t-test and paired sample t-test) were applied to find out the differences of control and experimental groups before and after intervention. There were 40 students of control group and 40 students of experimental group. Both groups belonged to two different sections: A1 and A3. Control group was taught with traditional

teaching method in which teacher delivered lecture and students were supposed to learn it.

Table 1

Comparison of Pre-test between Control and Experimental Group

Measure	Group	N	M	SD	t-value	df	P
Pre-Test	Control Group	40	10.35	6.63	0.695	78	0.489
	Experimental Group	40	11.27	5.17			

Table 1 shows an independent sample t-test to find out the effect of formative assessment techniques on students' learning in the subject of General Science at elementary school level. There was statistically significant difference found in the scores of pre-tests for both control (M=10.35, SD= 6.63, t=0.695) and experimental groups (M=11.27, SD=5.17, t=0.695) at $p \leq 0.05$ level of significance. The value of significance indicated that null hypothesis was accepted, as there was a significant effect between the mean scores of two tests. So, there was no significant effect of formative assessment techniques on students' learning in the subject of General Science in pre-test.

Table 2

Comparison of Post-test between Control and Experimental Group

Measure	Group	N	M	SD	t	df	P
Post-Test	Control Group	40	19.20	9.03	5.161	76.540	<.001
	Experimental Group	40	30.42	10.37			

Table 2 shows that an independent sample t-test was applied to find out the effect of formative assessment techniques on students' learning in the subject of general science at elementary school level. There was statistically no significant difference was found in the scores of post-tests for both control (M= 19.20, SD= 9.03, t=5.161) and experimental groups (M=30.42, SD=10.37, t=5.161) at $p \leq 0.05$ level of significance. The value of significance indicated that null hypothesis was rejected, as there was a significant effect of formative assessment techniques on students' learning in the subject of general science level after intervention.

Table 3

Comparison of Pre-test and Post-test in both Control and Experimental Group

Measure		N	M	SD	t-value	df	P
Control Group	Pre-Test	40	10.35	6.63	9.064	39	<.001
	Post-Test	40	19.20	9.03			<.001
Experimental Group	Pre-Test	40	11.27	5.117	12.675	39	
	Post-Test	40	30.42	1.37			

Table 3 shows that a paired sample t-test was conducted to find out effect of formative assessment techniques on students' learning in the subject of general science and elementary school level. There was statistically significant found in the scores of control group for both pre-test (M= 10.35, SD= 6.63, t=9.064) and post-test (M=19.20, SD=9.03, t=9.064) at $p \leq 0.05$ level of significance. The value of significant (p value) indicated that null hypothesis as there was no significant effect of formative assessment techniques on students' learning in the subject of general science at elementary school level was rejected, as there was a significant effect between the mean scores of two tests.

Table 3 shows that a paired sample t-test was showed to find out effect of formative assessment techniques on students' learning in the subject of general science at elementary school level. There was statistically significant difference was found in the scores of experimental groups for both pre-test (M= 11.27, SD= 5.17, t=12.675) and post-test (M=30.42, SD=10.37, t=12.675) at $p \leq 0.05$ level of significance. The value of significant (p value) indicated that null hypothesis as there was no significant effect of formative assessment techniques on students' learning in the subject of general science at elementary school level was rejected, as there was a significant effect between the mean scores of two tests.

Conclusion and Recommendations

This study has some recommendations for the teachers to practicality formative assessment as follows: The results of the present study were supported by Dyer (2013) who stated that several brief assessment methods mentioned below can be used well for formative assessment techniques (i.e. to test the students' comprehension of the topics you had just taught). They can also be used as short calculations, however, which was attached some weight and the aspect of the rank of the course. You'll have to change them a little to allow marking, of course. One solution is random grading. For instance: ask the whole class to complete a short assignment and then collect and evaluate some attempts randomly. This method requires

the event to be done by all students in the class. Pre-announce your plans in the syllabus. A category roster matrix was assisting in maintaining equal collections. Grading was more work for you, but more students were interested in classroom work with the payoff.

Results of the study further revealed that well set questions, to which understudies react utilizing CRS (Classroom Response System) all through a lesson. May offer assistance understudies keep up consideration and remain, persuaded to memorize (Cain, Dark & Rohr, 2009). It was also concluded that debates illustrate various ways of thinking about and solving a problem. Yet debates show higher thinking in order yet expertise in problem-solving. Divide the class into several sections (probably as many divisions as there are ways to approach the problem) without moving seats around.

Ask the big groups to consider from the various perspectives and come up with arguments to justify the way of thinking. Dyer (2013) further concluded that give students five minutes to talk in pairs or small groups that are similar to each other. Then call the class to regroup and tell the various parts to volunteer their way of thinking with examples. If you used this to address strategy to analyze advantages and disadvantages, do find a third group that does not have to take sides, but has reasons for an agnostic approach.

External testing services often design summative evaluation and measure it through grading mechanisms and data sets. Before research on evaluations began to have a positive impact on evaluation perceptions of teachers, many teachers felt evaluations were intended to convey information to external audiences and rarely provide evidence of how students learn. Teachers believed that their attempts to move beyond traditional forms of evaluation were thwarted (Delandshere & Jones, 1999).

Role-playing fits well in courses in history, literature, and biochemistry. Divide the class into as many parts as you need to play a role. Ask them to prepare their arguments or organize their actions to reflect their position (different characters of a game, different historical classes, different enzymes that could react and form new ones). Set the context and ask students to briefly discuss how their position will respond in pairs or small groups. Then ask each section for representative descriptions. Draw attention to the possible consequences of unexpected actions.

Black and Wiliam (1998) had suggested that meaningful interactions between teachers and students led to learning in the classroom. Only when teachers knew how students were specifically could teachers adapt to the needs of the students. In addition, educators needed to make multidimensional and not just linear contextual instructional and evaluation decisions (McMillan, 2003) such as checking for units of skills (Sadler, 1989). It was not an easy or agreed process how best to accomplish this necessary achievement. How the educator wanted to play a more supportive

role, frame his or her pedagogical theory, and use constructive input was of great importance. The instructor must learn from the comments of the students about the students and participate in interpretive listening. In this research both science teachers implemented the annotated student drawings as a formative assessment strategy in their classrooms with 5th and 6th graders. The main purpose of the science teachers was not only to uncover students' initial knowledge, but also to format, organize and revise their teaching intervention by using this strategy. In terms of cognitive level of the students, first drawings were full of lack of understanding, incomplete understanding, alternative conceptions or misconceptions in the 1st drawings. Both science teachers were quite enthusiastic about using different strategies in their classrooms with the students. So, they gained info about their students' cognitive levels on the concepts as much as they could from the 1st drawings. They did not prefer to use traditional teaching techniques in the classroom (Bulunuz, 2019).

Considering that the conceptualization of formative assessment as an integration of different strategies constitutes a complex practice, empirically shown by Vingsle (2014), substantial support would be particularly essential for teachers' implementation of this type of formative assessment practice. This conjecture is supported by studies that have shown that professional development programmes, in formative assessment as a unity of strategies, with considerable support but without the amount of time and expertise available in the present study have failed to exert a substantial impact on teachers' practice to the extent that increased student achievement was obtained (Randel et al., 2016).

The students' role in the formative assessment practice may also support each other's learning through peer-assisted learning, involving peer-assessment and subsequent peer feedback through explanations and suggestions to peers on how they can act to reach their learning goals (Gielen, Peeters, Dochy, Onghena, & Struyven, 2010).

The researcher found that Strategic questioning and 3-way summaries was effective formative assessment technique. Strategic questioning was a technique in which with persons, small groups, or the whole class, questioning strategies can be used. Good formative assessment approaches include examining students to answer higher-order questions like "how" and "why." Students need to think more deeply about higher-order questions. This will help the educator distinguish the students' comprehension level and scope. Three-way summaries were a technique in which the aim now was to use changed ways of thinking and attention to detail. Students could effort in groups or individually. They write three separate summaries in response to a question or subject investigation: a) 10–15 words long; b) 30–50 words long; and c) 75–100 words long. You can even use Facebook to have pupils. You're likely to have a lot of students

already using it. You will have experience with limited language and characters exchanging messages.

This study concluded that the formative assessment techniques improve the students' learning in the subject of General Science at 7th grade. Formative assessment focused on the importance of teacher-student interactions, the influence of cognition feedback, analyzing students' work, round robin chart technique, strategic questioning technique, 3-ways summaries technique, and think pair share techniques are also effective learning strategies for students. The assessment dimensions do not simply refer to procedures, processes or devices. It has a broader scope and also includes incidents in the assessment of everyday school work. These criteria can include both formal, planned procedures which inform students that they are being evaluated, and informal, interacting procedures between teachers and students and themselves.

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Following Suggestions were designed in the light of above findings.

1. Formative assessment techniques are useful for students' learning in the class. Analyzing students' work, round robin chart technique, strategic questioning technique, 3-ways summaries technique, and think pair share techniques maybe conducted by the teachers for developing students' personality.
2. For teachers' professional development, training workshops and seminars may be conducted on formative assessment techniques.
3. The curriculum developers and textbook authors are recommended some formative assessment techniques for various lessons so that the teachers may use those along with other situational assessment techniques in the class.
4. Further research may be conducted on independent effect of the different formative assessment techniques so that it could be explored that which formative assessment techniques should be

more preferred by teachers while teaching the subject of General Science at elementary grade level.

5. Future studies may be conducted at secondary and higher secondary levels to investigate effect of formative assessment techniques on students' learning various subjects using other instruments.

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Citation of this Article:

Moud, R. & Saeed, M. (2021). Effect of Formative Assessment Techniques on students' Learning in the Subject of General Science at Elementary School Level. *Pakistan Journal of Educational Research and Evaluation*, 9(1), 70-82.