The Effect of Using Performance-based assessment Strategies to Tenth-Grade Students' Achievement and Self-Efficacy in Jordan

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Abstract

The study aims at investigating 'The Impact of Performance-based Assessment Strategies on Students' Achievement and Self-Efficacy' in Jordan. In order to achieve that goal, a performance-based assessment strategy has been applied to 72 students in Al-Zarqa city representing a sample of 35 students in which the performance-based assessment strategy was applied to evaluate students' performance assignments, and 37 students who were evaluated in the more traditional manner. The study took 8 weeks, 5 hours per week. An academic final test and self-efficacy measure were applied after the completion of the study. The findings of the study have proved a statistical significance between the mathematical averages on the outcome test and the measure of overall self-efficacy and each of its dimensions in favour of the experimental group.

Keywords: Performance-based assessment strategy, performance tasks, alternative assessment tools, self-regulation, social efficiency, academic efficiency.

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1. Introduction

Student educational achievement is a basic principle for all forms of success at the level of professions, work and social life. In that sense, it has been observed that the issue of educational final results is of social significance; therefore, parents' attention to the educational achievement of their children ultimately means attention to their fate, future and lives. Of course, no one could deny that individual efforts such as motivation, work and perseverance have positive impact on accomplishing educational success. However, other important factors should not be ignored in the equation of success, such as the importance of the type of evaluation that measures students' achievement. Thus, the factor of determining the type of evaluation is necessary and crucial to students' achievement, as it increases their passion and motivation towards the process of learning (Baska, 2014; Mintah, 2003; Stavros & Anastasios, 2016).

Self-efficacy is also considered one of the important psychological variables, which guide individual behaviour and contribute to achieving personal goals (Caliskan & Kasikci, 2010), for the way individuals think, believe and feel affects their behaviour. Since these beliefs constitute the key to the driving forces of their behaviour, they interpret their achievements depending on the abilities they believe they possess, making them do their best to achieve success (Bandura, 1997; Peguero, & Shaffer, 2015).

Furthermore, the impact of self-efficacy is demonstrated through assisting individuals to determine the amount of effort exerted in a particular activity, the degree of perseverance to overcome obstacles and the degree of rigidity in the face of difficult situations. The greater the sense of self-efficacy, the greater is the effort, perseverance and rigidity (Christopher, 2009; Suryadi & Santoso, 2017). Thus, individuals with high self-efficacy deal with difficult problems and activities with a greater sense of calmness and composure (Matsuno, 2009). Similarly, if an individual believes in his/her ability to perform a task, this will enhance his concentration and effort in this task, whereas if the individual has the skill and knowledge to complete the task, this does not necessarily mean ability to complete it (McDonald & Bouds, 2003).

Regarding the pivotal role played by the mathematics teacher, s/he needs to utilise assessment strategies corresponding to students' needs and matching knowledge contained in the curriculum in order to increase their academic achievement and sense of their own effectiveness and to get rid of the traditional evaluation methods of teaching—even to trend towards alternative assessment, as this has a role in evaluating all aspects of the learner's personality. The modern concept of assessment aims at shifting from the traditional evaluation operations to the alternative assessment process that emerges from the saying, 'What is educated should be refined, and what cannot be refined is not worth it', taking the evaluation technique into account when reviewing the final results of the teaching and learning processes (Moorcroft & Berkowitz, 2000; Steinberg & Garrett, 2016).

Performance-based assessment requires students to engage in activities that enable them to have various performance skills and to produce outcomes that meet certain quality levels. These skills and procedural performance indicators should thus be identified, in order to evaluate the processes and outputs consistently and accurately, so that they will reflect the specific levels and document students' achievement (Allam, 2009; Dole, 2017).

In this case, there is an impulse to change the culture of the minimum level of education by shifting from the mere interest in knowledge to attention to scientific, creative, critical and constructive thinking alongside positive thinking through attention to collaboration-based behavioural performances among students, the necessity for assessment continuity, supporting comprehensive cumulative assessment, and training teachers in authentic, real evaluation methods and implementing evaluation results, i.e., taking into account the importance of improving the performance of both the teacher and the learner (Mueller, 2005).

Thus, the new concept of assessment is linked to a diversity of sources, which reflect the level of student performance and achievements; subsequently, new values seeking self-development, continuous training and work to raise the level of achievement can be formulated, where a new category has been introduced to get involved in evaluating the learner's performance as the students and their parents who are benefiting from the educational process, thus giving them the opportunity to establish more open human relations between the learner and the teacher, the parents and the guide, as well as everyone who has the task of assessing the performance of the learner. These relationships are achieved through effective communication, which aims at instilling many educational values such as love of the teacher, dealing positively and recognising the value of what is being taught and realising self-worth (McMillan, 2001; Munzur, 2014).

In this regard, a study conducted by Orabi (2004) aimed at measuring the effectiveness of utilising alternative assessment methods for improving the primary fourth grade class's achievement and improving the students' ability to communicate mathematically and reduce the anxiety of mathematics. The results proved that alternative assessment has a great impact on improving students' outcomes. Another study carried out by Zimbicki (2007) aimed at identifying the effects of alternative assessment on students' motivation levels and self-efficacy. The results emphasised that levels of motivation and self-efficacy have reached the highest level when students were enroled in alternative assessment methods.

Cearfoss (2007) in his study endeavoured to demonstrate the relationship between students' traditional test-based performance and student performance based on a series of mathematics assessment tools for the intermediate classes. The results proved the effectiveness of the test based on the performance of a set of mathematical tasks. A study by Al-Balloonah (2010) examined the effectiveness of the performance-based assessment strategy in enhancing mathematical thinking and the ability to solve problems in high school students. The results found statistically significant differences between the mathematical averages in the mathematical thinking and problem solving tests in favour of the experimental group.

Yasemin and Cavus (2014) in his study determining the effects of alternative assessment and evaluation methods on academic achievement in mathematics, persistence of learning, self-efficacy perception and attitude. The results show that alternative assessment and evaluation methods positively increased academic achievement, self-efficacy levels, attitudes and persistence of their learning.

In this respect, the teacher's implementing performance-based assessment strategy, introducing structured information to be collected during the study, providing feedback to students, collaborating in clarifying errors to be corrected, not to mention fostering students' participation in judgements all increase the sense of independence, self-worth and efficacy of the learner (Blazar, 2015; Bloxham & Carver, 2014; Hee Kim, 2014). As shown above, this study attempts to identify the effect of using performance-based assessment strategies in the achievement and self-efficacy among tenth grade students.

The importance of the study is to draw attention to the importance of diversification in assessment strategies and tools. It provides practical experience to employ this type of assessment by teachers and administrators of the educational process. This study also seeks to develop a real process of education, which is related to assessment, especially in mathematics, which often has low student achievement. The results of the study are expected to benefit educators and decision-makers in schools to adopt specific assessment strategies that help the student to develop his abilities and self-potential to help him to build his options, goals and expectations properly

1.1. Problems of the study

Through his work in teaching, the researcher has noticed a big difference between teachers in how they view the concept of assessment. Some regard tests as the tool that determines what knowledge

the learner has gained; others believe that alternative assessment tools evaluate all aspects of the learner's skills and cognitions. Through observing the results of the international tests (TIMSS) applied to students, it was noted that students' achievement and self-efficacy in mathematics were poor due to teachers' measuring the students' achievement solely with tests rather than with assessment tools concerned with measuring all aspects of the learner's personality. In general, the students' achievement in mathematics at the Jordanian public schools is measured by using the directly traditional cognitive aspect-oriented assessment, which is not commensurate with the kind of mathematical proficiency that includes skills and orientations beside the theoretical knowledge. Since the skills represent a practical interpretation of information that emphasises the learning of concepts and the development of self-efficacy, the problem of the study centres around investigating the effect of applying alternative assessment strategies to the achievement and self-efficacy of tenth grade students through answering the following questions:

1. What is the impact of performance-based assessment strategies on the achievement of 10th grade students?
2. What is the impact of performance-based assessment strategies on 10th grade students' self-efficacy?

1.2. Limitations of the study

The study was limited to the mathematics textbook for the tenth grade in Jordan, Chapter II, the analytical geometry, in the second semester of the year 2016/2017, the book consists of four units: (Homosexuality and Triangulation; Analytical and Space geometry; Statistics and Probability and Financial Mathematics). This book taught to all 10th grade students in Jordan, and the sample size of the present study is limited to 57 students on Jordan. This might limit the generalisability of the findings of the present study to other situations.

2. Methodology

The semi-experimental approach was carried out to determine the effect of the independent variable, assessment strategy, on the dependent variables, academic achievement and self-efficacy, to interpret the phenomenon and to conclude causes and effects.

The performance tasks of the unit (analytical geometry) were prepared in the mathematics book for the 10th grade and its evaluation tools [the oral expression card, Estimation, Checklists or (monitoring), Student Learning Card (Student Record), Teaching Card (Teacher's Record), Student Achievement Index) and description of each performance based assessment method, and define its objectives.

The performance tasks for the experimental group students were presented in the form of a 10-minute class training, Then corrected and evaluate the students' responses, Where students' performance is described in performance-based assessment tools, prepared for this purpose, which has been described previously, while the control group was dealing with the exercises in the textbook.

2.1. Study participants

Participants in the study were all regular 10th grade students in the schools of Al-Zarqa First Directorate for the first semester 2016–2017. The number of schools containing the tenth grade (23) schools, one school was chosen in a simple random way, the researcher contacted the Directorate of Education, and to provide him with the name of a school containing the 10th grade students randomly; the sample was randomly selected from a school including the 10th grade class. Then, two groups from the 10th grade were randomly selected; one group was randomly assigned as an experimental group consisting of 35 students, the other as a control group made up of 37 students.

The choice of sample to implement the strategy is not incompatible with generalising the results of the study to the ninth grade students in general; this is because the study population is exposed to a unified education system, taught the same math. textbook.

2.2. Instrumentations of the study

2.2.1. The achievement test

Objectives of the Analytical and Space Geometry chapter were set out from the 10th grade book, the second semester, during which time the test was constructed, and a specification table was prepared for the Analytical and Space Geometry chapter to determine the number of questions per lesson and to determine the scores of each question. Accordingly, the test consisted of eight multiple-choice questions, fill-in-the-blank questions, proof questions, drawing and representation skills questions, essay questions and conclusion questions. The students answered the questions within 45 minutes after studying the unit. The total score of the test was 20 points.

The test and its answer key were shown to 10 arbitrators, to give their observations in the design of the test, the validity of its paragraphs, the level of difficulty, language formulation and achievement of the objectives for which it was developed. The paragraphs of the test were modified according to the observations. The first question was changed from essay to multiple-choice questions. Two separate paragraphs of the test were merged: the first and second paragraphs of the second question after each represented a single question. The second paragraph of the last question was replaced with another paragraph proposed by the arbitrators.

Validity of the test: The test was presented to 12 reviewers for their comments on test design, vertebrates, level of difficulty, language formulation and achievement of the objectives for which they were developed, the test paragraphs were modified according to the reviewers' notes.

Reliability of the test: The test was applied to a preliminary sample of 30 students outside the main sample of the study, selected from the same population; the Cronbach's Alpha formula was used, attaining 0.86 which is a good rate and acceptable for the purposes of the study.

2.2.2. The measure of self-efficacy

Bandura (1998) defines self-efficacy as an attribute of the individual's personality that enables him to predict his ability to succeed in a particular situation by assessing the behaviour required to achieve the desired results.

This measure was built after examining a number of self-efficacy measures such as Bandura (1998) and Moreno and Kilpatrick (2018). Three dimensions of self-efficacy were identified as follows:

• Self-organisation: The individual possesses motivation to accomplish tasks by setting logical objectives related to tasks, using appropriate strategies to achieve these objectives, and self-monitoring to modify them.
• Social competence: the ability to form and maintain social relationships and to participate in certain activities.
• Academic competence: the ability to carry out a series of tasks or actions, organise learning activities and face difficulties.

The measure of self-efficacy consists of 45 phrases, divided into three dimensions, each dimension consisting of 15 paragraphs given to the students and asking them to choose only one of three alternatives of different scales – 'I agree,' 'I agree to some extent,' 'do not agree' – which are given the following scales, respectively: 3, 2 and 1. The negative expressions are given the following scales, respectively: 1, 2 and 3, in the case of answering 'I agree,' 'to some extent,' or 'disagree' with a range of degrees between 45 and 135.

Validity of the scale: The scale was shown to 10 arbitrators to verify its validity. In addition, the expressions were modified in accordance with the arbitrators' observations, where the change in some words based on what referred to by the arbitrators.

Internal consistency: The scale was applied to a sample from outside the research sample and from the same population, which consisted of 30 students. The correlation coefficients were calculated on each paragraph and dimension to which they belonged, as well as calculating the correlation coefficients between each paragraph and the scale as a whole. The results showed that all measures of the correlation coefficients on each paragraph on the dimension to which the paragraph belonged were statistically significant at the significance level $\alpha = 0.05$. The correlation coefficients ranged from 0.22 to 0.71. This indicates that what the paragraph measures is measured by the dimension to which it belongs; consequently, the correlation coefficients measured on each paragraph on the scale as a whole are statistically significant, which demonstrates that what the paragraph measures is measured by the scale as a whole.

Reliability of the scale: The Cronbach's Alpha coefficient was calculated, which reached 0.87, which is an acceptable value for the study.

2.2.3. Performance tasks

Performance-based assessment is the real assessment that determines tasks which require detailed performance, providing the learner a chance to observe and apply acquired knowledge, learned either directly or through constructive learning, as soon as s/he starts to build new perceptions and relationships that connect learned facts and concepts which enable him/her to make correct decisions in order to overcome task-related problems (Bloxham & Carver, 2014). At the procedural level, the performance-based assessment is applied to judge the extent to which the student has acquired the requisite skills while implementing them in a series of activities to show the student's proficiency and achievement of educational objectives in mathematics and the adequacy of the educational process, by observing and keeping an eye on performance using tools evaluating the level of student achievement and degree.

After reviewing the previous studies that examined the performance-based assessment, the classification adopted by Allam (2009) was based on identifying the most common performance task formulas, as follows:

• **Oral expression**: Language skills related to language communication, which are presented orally: reading, speaking, listening, uttering, debating and discussing.
• **Presentation of the work**: Assigning the student to certain tasks carried out and presented to the audience, whether they are the school administration, teachers, students, or even colleagues in the classroom. This formula aims at guiding the students to achieve distinctive levels of performance, discerning their understanding of information and acquisition of basic skills.
• **Writing**: An example of this type of task is the essay questions, in which the students express their knowledge in a written form, demonstrating their abilities and skills freely and without restrictions, such as writing a research report, a worksheet or solving an open equation.
• **Manual practical performance**: This task requires the student to perform a task with a high degree of proficiency with the least effort in the shortest possible time, such as preparing scientific sheets; implementing appropriate devices; designing models and graphs, reports and statistics; and designing models of geometric shapes and extracting their space and sizes.
• **The free and extensive answer**: It requires drawing upon the higher capabilities of students such as inference, analysis, thinking, problem solving, and it measures the students' ability in these skill sets. These types of task reveal the processes used by the student in forming an answer and steps taken to solve the problem.

2.2.4. Instruments of evaluating performance tasks used in the research

- **The oral expression card (verbal communication card)**: The researcher benefited from the oral expression card prepared by Bin Jahlan (2009) to evaluate the verbal communication skills, in which students orally express, in their own language, the ideas using symbols, words, and mathematical shapes which lead to an understood concept. The verbal communication card consists of basic skills, subdivided into subskills, where the student gradually scores points with a special section for observations, be it the teacher's or student's observations, such as excellent, very good, good, and acceptable.
- **Estimation**: A table to evaluate students' performance in solving the given task, so that all performance components are estimated at each end, provided that the estimation of one of them does not affect the rest of the components' estimation. It uses graduated points rather than bilateral ones, as in the monitoring lists (e.g., good, medium, low) (Allam, 2009).
- **Checklists or (monitoring)**: A list of actions that a teacher or student observes during the performance of a task or teaching skill.
- **Student Learning Card (Student Record)**: The student records the performance of his or her work, explaining the steps of the solution or the assignment that s/he is doing by reviewing his/her ideas about the achievement of the given task.
- **Teaching Card (Teacher's Record)**: The teacher records the student's performance during the task assigned by recording the notes that the student can take advantage of when discussing it.
- **Student Achievement Index**: A collection of guidelines that guide students to a number of criteria that must be highlighted in their mathematical writings in order to communicate their mathematical ideas to others (Hee Kim, 2014).

The tools in their initial form were presented to five arbitrators who specialise in measurement and educational evaluation as well as curriculum and instruction in mathematics, in order to verify the suitability of the paragraphs and formulation of the task presented to the students. Based on the observations of the arbitrators, final necessary amendments were made. Thus, the content was verified and the performance-based assessment strategy was applied to the experimental group during the teaching of the second semester and the traditional method of assessment for the control group by the researcher. The performance tasks for the students in the experimental group were presented in a 10-minute classroom training format, then corrected and evaluated by the students. The performance achieved by them is described in the performance-based assessment tools designed for this purpose, described above.

2.3. Group equivalence

The equivalence of the study groups was confirmed in the pre-application of the achievement test and the self-efficacy in which the value of *F* was calculated for the performance of the study sample on the achievement test, with a value of 0.60 and statistical significance of 0.44. This indicates the equivalence of the two groups of the study, the value of Wilkes Lambda was calculated for the performance of the sample of the study on the self-efficacy scale, with a value of 0.21 and a statistical significance of 0.65, which indicates the equivalence of the two study groups.

3. Finding and discussion

3.1. First: what is the impact of performance-based assessment strategies on the achievement of 10th grade students?

To answer this question, the arithmetic means and standard deviations of the study sample's performance were calculated based on the group achievement test, and Table 1 illustrates these results. Note that the total score of the test is (20) degrees.

Table 1. Means and standard deviations of the sample performance of the study on the achievement test according to the group

Group	N	M	SD
Performance-based assessment strategies	35	17.57	1.29
Traditional assessment	37	13.58	2.46

Table 1 shows that there are apparent differences in the means of students of the experimental group and students of the control group scores on the achievement test. The analysis used ANOVA. Table 2 shows the analysis results of the experimental group and control group scores in the achievement test.

Table 2. ANOVA of the students of the experimental and control groups' scores in the post-application of the achievement test

	Sum of squares (SS)	DF	Mean squares (MS)	F-value	Sig. level
Group	298.134	1	298.134	74.445	0.00
Error	292.346	73	4.005		

Table 2 demonstrates that there is a statistical function difference ($\alpha = 0.05$) between the averages of the post-test performance of the experimental and control groups, in favour of the experimental group members who have been subjected to the performance-based assessment strategy, which emphasises the impact of the performance-based assessment strategy on academic achievement.

This result can be attributed to the fact that the performance-based assessment has helped students demonstrate their skills in performing assignments, demonstrate learning, accept teacher guidance seriously, and benefit from student critique and guidance in developing their potential, which positively reflects student achievement that is consistent with the results of studies conducted by (Chamoso & Caceres, 2008; Hancock, 2007; Kilano ,2012; Kincal & Ozan, 2018; Orabi,2004; Ross & Bruce, 2006; Stears & Gopal, 2010)

This result can be attributed to the fact that the performance-based assessment has helped student evaluation, learner follows a systematic process while evaluating his learning period, and obtains the control of his own learning by using self-control and so achieves systematic learning (Guskey, 2010; Remesal, 2011). Therefore, by using student evaluation methods, which take the students at the centre, academic achievement can be increased.

3.2. Second: what is the impact of performance-based assessment strategies on 10th grade students' self-efficacy?

To answer this question, the arithmetic means and standard deviations of the performance of the study sample were calculated on the measure of self-efficacy and each dimension in accordance with the group. These results are illustrated in Table 3. Note that the total score of the scale is (135) degrees.

Table 3. The means and the standard deviations of the performance of the study sample on the self-efficacy measure according to the group

Dimensions	Group	N	M	SD
Self-regulation	Performance-based assessment strategies	35	39.86	2.98
	Traditional assessment	37	33.57	5.18
Social efficiency	Performance-based assessment strategies	35	40.46	2.80
	Traditional assessment	37	35.11	4.70
Academic efficiency	Performance-based assessment strategies	35	39.71	3.05
	Traditional assessment	37	32.51	3.97
Self-efficacy measure	Performance-based assessment strategies	35	120.03	4.59
	Traditional assessment	37	101.19	7.91

Table 3 shows that there are obvious differences in the arithmetic means of the experimental group students' scores subjected to the performance-based assessment strategy and the control group on the measure of total self-efficacy and its sub-dimensions. To test these differences between the arithmetic means, Wilkes's value was calculated as a coefficient, 0.28; the corresponding *F* value (57.61), statistical function (0.00) and multiple variance analysis were utilised.

Table 4 shows the results of the analysis of the scores of the students of the experimental group and the control group on the self-efficacy measure in general and each dimension separately.

Table 4. Multivariate analysis of variance of the scores of students in the experimental and control groups in the post-application of the self-efficacy measure and its dimensions

	Dimension	Sum of squares (SS)	DF	Mean squares (MS)	*F*-value	Sig. level
Group	Self-regulation	711.508	1	711.508	39.298	0.00
	Social efficiency	514.622	1	514.622	33.912	0.00
	Academic efficiency	932.6	1	932.6	73.816	0.00
	Self-efficacy measure	6,383.672	1	6,383.672	150.627	0.00
Error	Self-regulation	1,267.367	70	18.105		
	Social efficiency	1,062.253	70	15.175		
	Academic efficiency	884.386	70	12.634		
	Self-efficacy measure	2,966.647	70	42.381		

Table 4 indicates that there are statistically functional differences in the post-performance averages between the experimental and control groups on the overall self-efficacy measure and each dimension separately attributable to the utilisation of the performance-based assessment strategy for the benefit of the experimental group that was exposed to the strategy, indicating the impact of the performance-based assessment strategy on self-efficacy.

This finding can be attributed to the fact that performance-based assessment has helped students to increase self-efficacy, their participation in the development of evaluation criteria, the arbitration of performance assignments, responsibility for demonstrating learning, seriousness of performance and progress, attention to teacher or student feedback, figuring out their colleagues' mistakes, critique of students' performance and feedback about it. All this has increased the students' personal strength, self-confidence and self-efficacy. This result is consistent with the results of studies conducted by Al-Zubbi (2013), Hussein and Tawfik (2016) and Zimbicki (2007), which refers to the impact of the performance-based assessment strategy in the development of self-efficacy.

Self-efficacy is related to learning and achievement (Dole, 2017). Students build a general provision about themselves according to their successfulness and unsuccessfulness that they experienced through their school years (Yasemin & Cavus, 2014). The result showed that performance-based assessment strategies was effective on making students give feedbacks to themselves that increased their self-confidence and self-efficacy and made students to be aware of their learning.

3.3. Recommendations

In the light of the findings, the study recommends the following:

1. The necessity of utilising alternative assessment strategies in the teaching of mathematics in particular and experimental subjects in general in the secondary stage.
2. Inclusion of alternative assessment strategies within the curricula of teaching mathematics in the faculties of educational sciences.
3. Training practical education students in the faculties of educational sciences to use alternative assessment strategies in the teaching of mathematics.

4. Training teachers to use alternative assessment strategies in general and employ them in teaching and evaluating students.

3.4. Suggestions

In order to complete the findings of the study, the researcher urges conducting further studies such as:

1. Studying the impact of other types of alternative assessment strategies on scholastic achievement and self-efficacy.
2. Studying the effect of combining two or more alternative assessment strategies in addressing the problems faced by teachers and students in teaching and learning mathematics.
3. Studying the effectiveness of performance-based assessment of secondary school students in aspects of learning mathematics such as some types of thinking.

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