

Effectiveness of Assessment patterns in chemistry Learning

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Abstract: This study aims at determining: (a) whether there is any difference between chemistry learning achievements of students taking the chemistry class with the implementation of Performance Assessment and ones joining the class without the implementation of Performance Assessment if the prior knowledge was statistically controlled, (b) Differences of scores in male and females' students after the implementation of performance assessment and traditional assessment in class. The experiment was conducted in 2 high schools in Malayer. The subjects were 87 pre-university science students (42 boys and 45 girls) that select from population by random method and then randomly assign patterns to experimental group and control group. Research instruments used included academic achievement pretest and post test that was prepared by investigator and teachers. The results have provided sufficient evidence for the context validity of these two instruments. Cronbach coefficient alpha reliability of chemistry academic achievement pre test was .81 and post test was .83. The results showed: (a) there were significant differences on chemistry learning achievement with and without the implementation of Performance Assessment on pre-university chemistry students. (b) Based on the statistical analysis of Anova of same subjects, it showed that there was a significant increase of scores of females' students to learn chemistry in classes with the implementation Performance Assessment.

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1. Introduction

Teaching and assessment go hand in hand. In the classroom, teaching cannot be truly effective if it is not linked to some form of authentic assessment. Likewise, assessment is useless if it is not based on what has been, or is to be, taught. Although this may sound obvious, teachers sometimes forget the close relationship between the two. Assessment is one of the crucial components of the instruction. People within the educational community, i.e. policymakers, educators, students, parents, administrators, have different ideas regarding the implementation of assessment strategies (Dietel, Herman, and Knuth, 1991). While some believe traditional assessment methods are more effective, others think that alternative assessment tools are superior. Researchers and educators use the term performance-based, alternative, and authentic assessment interchangeably. As Wangsatorntanakhun (1997) states the term, performance-based assessment, embraces both alternative and authentic assessment. Therefore, throughout this article, performance assessment is used to refer to alternative assessment.

Performance-based assessment is suitable for assessing nearly all types of science learning. It is particularly useful for assessing science-process skills, such as the ability to formulate a hypothesis;

think critically; solve problems; design and conduct investigations; use instruments; collect, analyze, and interpret data; and document and present findings from research projects. Performance-based assessment allows the student to construct his or her own answers as opposed to choosing from a group of answers. Both student and teacher are made aware of the skills and knowledge to be learned as well as the criteria for judging performance. Performance-based assessments "can be a learning experience in themselves. They can actually motivate students to learn more about the subject matter"(Doane, Rice, and Zachos 2006). Science is also a performance-based enterprise, and we should expect our students to demonstrate scientific knowledge and understanding through performance.

Assessment tasks must be a part of the regular teaching and learning program (Victorian Curriculum and Assessment Authority, 2010). There is a widely held belief that assessment drives student learning (Joughin, 2010; Boud, 1990) and that students' experience of assessment in higher education is that it is central to their learning experience (James, McInnis & Devlin, 2002). If we are to accept the point of view that students place value, artificial though it may be, on their assessments, it offers us, as their instructors, the opportunity to improve the

student experience by designing assessments that foster the type of learning we want to encourage.

Many of researches have shown strong links between the implementation of performance assessment and high quality learning (Darling-Hammond & Snyder, 2000; Ridley & Stern 1998; Brown, Collins & Duguid, 1989). The use and implementation of performance assessment has two significant features; it has the ability to reengage students in the development of content-based knowledge through strengthened links with the outside world; and, it has the capacity to enhance student learning through the provision of skills such as metacognition, critical thinking and creativity (Darling-Hammond & Snyder, 2000).

According to Kabba (2008), Performance-based assessment requires students to demonstrate their learning and understanding by performing an act or a series of acts. This type of assessment is appropriate to use in a project-based, problem-based, or inquiry-based science classroom because it is consistent with the way students learn—by investigating a question or problem using tools and materials (i.e., performing an act). Since students in a project-based classroom learn by producing a product or performing an act, it is only fitting for them to be assessed using methods similar to those used to teach them—thus, aligning assessment with instruction.

Sari & Wiyarsi (2011) investigated the effect of performance assessment on chemistry learning achievements of students in Yogyakarta. The results showed a significant difference on chemistry learning achievement with and without the implementation of Performance Assessment on students of class.

Kearney & Perkins (2010) examined the relationship of performance assessment and students learning in the classroom. Research conducted in the School of Education at the University of Notre Dame, Australia where 280 undergraduate primary education students were surveyed prior to undertaking ASPAL and after undertaking ASPAL (Authentic Self & Peer Assessment for Learning). The results indicated students that were more engaged, had increased efficacy and felt that they were a part of the educative process, rather than being subjected to it. Research has shown strong links between the implementation of performance assessment and high quality learning

Klein & et al., (1997) examined whether the differences in mean scores among gender on science performance assessments are comparable to the differences that are typically found among these groups of traditional multiple-choice tests. To do this, several hands-on science performance assessments and other measures were administered to over 2,000 students in grades five, six, and nine as part of a

field test of California's statewide testing program. Girls tended to have higher overall mean scores than boys on the performance measures.

This research seeks to investigate whether the using performance assessment method can be effective in the improvement of students' chemistry academic achievement? In order to respond to the question above, the following hypotheses were outlined and examined:

1. There is a significant difference between the performance assessment group and the traditional assessment group in chemistry academic achievement.

2. There is a significant difference between boys and girls in chemistry academic achievement.

2. Materials and method:

2.1 Participants

Participants in the present study were 92 chemistry pre-university students studying in Malayer city of Iran. Forty six of the participants were male students, and 46 were female students.

2.2 Design of the study

In this research with a design including two patterns of performance assessment and traditional assessment was a quasi-experimental research to determine the effect of these patterns on academic achievement in chemistry. The best design for this research from among different kinds of quasi experimental design was an independent bi- group design with pretest and post test. The most common sub experimental research design includes two groups: An experimental group and a control group. The researcher selected the sample from population by random method and then randomly assigns patterns to experimental group and control group.

2.3 Instruments

Academic achievement pretest and posttest in chemistry: The academic Achievement pretest and post-test in chemistry were prepared by the researcher and teacher and were used to measure the academic achievement of pre university students on the subject chemistry. Context validity of the academic achievement pretest and post-test were investigated by teachers who were professional in chemistry. The results have provided sufficient evidence for the context validity of these instruments. Cronbach coefficient alpha reliability of chemistry academic achievement pre test was .81 and post test was .83.

2.4 Sample and population

The sample included for this research was 92 students from pre university students who were studying in 4 schools in Malayer city (2011-2012). At

the first stage from among 20 schools (1050 students), 4 schools were selected randomly (boys and girls pre university schools). At the second stage from each school 1 class was selected and assigned to experimental and control group randomly.

2.5 Procedure of data collection

Multi stage cluster random sampling in selection of schools and classes of Malayer city was used. After choosing the samples, in the first step the teachers were acquainted to the performance- based assessment method and the experimental group students have also been completely justified on the new method and their participation. Before using the method a test was taken on chemistry as a pre-test on both groups (male and female). Because the test was done in the second half of the academic year, the chemistry pretest was only from the first half of the book. The tests were same in this stage for both groups.

In the second step, in both classes of experimental groups the teaching and the other activities of the

teachers by performance- based continued for 4 months to assess the level of learning of the students and planning on reactions to improve their learning.

In the third step at the end of the semester, post-test in chemistry was done on both groups in the same condition. The post-test was contained the second half of the book.

2.6. Analysis and Interpretations of results

In the present study, descriptive statistics were used to show mean and standard deviation of chemistry achievement in both groups. Two factors covariate analysis (ANCOVA) were used to investigate the impact of performance assessment on chemistry achievement with regarding to effect of pretest.

3. Results

Mean and standard deviation of chemistry academic achievement post test based on the gender and group before controlling pretest are presented in the following table.

Table 1: Mean and standard deviation of chemistry academic achievement post test before control based on the gender and group

Sex	Group	Mean	S.D
Boy	Experimental	12.19	1.83
	Control	6.81	3.04
Girl	Experimental	14.19	2.62
	Control	7.92	1.86

As seen from the table above the mean of girls' post test of chemistry academic achievement scores in performance assessment group is about 6 scores higher than the mean of girls' scores in traditional assessment group, as from the table 1 it is evident that mean of chemistry academic achievement scores for boys in performance assessment group is about 5.5 scores higher than boys' mean in traditional assessment group. A close look at the table further

revealed that girls' means in both group of experimental and control group were higher than the boys' means.

Two factors covariate analysis test to comparison of mean of the students' post test of chemistry academic achievement scores in performance assessment group and traditional assessment group based on the gender are presented in the following table.

Table 2: Covariate analysis to comparison of mean in post test of chemistry academic achievement based on the gender

Source	SS	df	Ms	F	Sig
Covariant(Pretest)	36.80	1	36.80	9.14	.003
Covariant(IQ)	54.34	1	54.34	13.50	.000
Group	237.74	1	237.74	59.07	.000*
Gender	23.92	1	23.92	5.94	.017*
Gender * group	1.38	1	1.38	.345	.559

*Significant at 0.05 levels

As seen from the table above according to two factors covariate analysis, it is found that the performance assessment has significant influence over mean scores on post test of chemistry academic achievement, as the obtained F value was found to be statistically significant (F=59.075;

p=.000) and also significant at 0.05 levels, indicating that a significant difference is between the performance assessment group and the traditional assessment group in post test of chemistry academic achievement. So it is found that the gender has significant influence over mean

scores on post test of chemistry academic achievement, as the obtained F value was found to be statistically significant ($F=5.944$; $P=.017$) and also significant at 0.05 levels. The interaction between performance assessment group and gender was found to be non-significant ($F=.345$; $p=.559$).

4. Discussion

This study investigated the effects of performance assessment on chemistry achievement of pre university students and analysis of result show that there is a significant influence of performance assessment on academic achievement, in traditional assessment group scored significantly lesser than students who were in performance assessment group. In other words, performance assessment had positive impact on chemistry achievement of students but unfortunately some teachers think performance assessment is a continuous process which is too complicated to be undertaken, and most of them have no awareness and not interested in the new forms of assessment.

In order to confirm or reject the hypotheses formulated, we have tried to compare our results with further studies done in the same area.

Sari & Wiyarsi (2011) examined effect of performance assessment on chemistry learning. In addition, quantitative data findings confirmed these results and also indicated the significance effect of performance assessment on learning.

Kearney & Perkins (2010) investigated the relationship of performance assessment and students learning in the classroom. Result has shown strong links between the implementation of performance assessment and high quality learning.

Furthermore some suggestions may be addressed to the concerned educators in order to increase students' learning. The organization of some training, seminars and workshops of pre-university school teachers have to be organized in order to learn them some updated method of assessment and improving their experience. The school headmasters have to create a good environment to facilitate the pre-university teachers to perform new method of assessment as possible as they can.

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