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Effectiveness of performance assessment on meta cognitive skills

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Abstract
Performance assessment is used to evaluate higher-order thinking and the acquisition of knowledge, concepts, and skills required for students to succeed in the 21st century. Metacognition is thinking about thinking and is a process consisting of planning, monitoring, cognitive strategies and awareness. The purpose of this article is identifying the impact of performance assessment patterns on students' meta-cognition by developing assessment model in a quasi-experimental study. The subjects were 87 preuniversity science students that select from population by random method and then randomly assign patterns to experimental group and control group. The tool used for the collection of data was O'Nils and Abedi (1996) Metacognitive Skills Inventory, and for analysis of date were used two factorrs covariate analysis (ANCOVA). Result showed that there is significant influence of performance assessment on all dimensions of metacognitive skills, as we find that in the all dimensions metacognitive skills in traditional assessment group scored significantly lesser than students who were in performance assessment group. Also boys and girls students did not differ in their scoring on metacognitive skills, as in all the dimensions. So the interaction between assessment group and sex on metacognitive skills was found to be non-significant**.**
Key words: Performance assessment, Metacognitive skills

1. Introduction

Education is chiefly concerned with developing and modifying the patterns of behavior in human beings, in the realms of thinking, feeling and acting. It uses the prescribed curriculum as a means for bringing about these changes. Every curriculum aims to bring about desired changes in the learner. Therefore, first of all, the intended learning outcomes or the instructional objectives must be identified in two dimensions behavioral processes and content of the curriculum. Evaluation is an integral part of educational system and can be of immense value in maintaining and enhancing the quality of teaching and learning. From the last decades of 20th century, modern psychological approaches like cognitive and constructivism were developed, and the basic psychological hypothesis were put into challenge. The basic hypotheses of the cognitive and constructivism is that the authentic learning, even in its very beginning level, requires the learners active efforts to build up knowledge through thinking and reasoning. Thinking plays an important role in this point of view. Cognitive and constructivist approaches have such an influence on education that now thinking skills are the center of more attention than any other time (Dembo, 1994). Learning and educational experts on complex learning have emphasized that objectives, methods and assessment tools should be selected and applied in a way that can assess comprehension, problem solving, thinking skills and the application of learned knowledge in real life. This can not be done by most of the common objective tests which are based on behaviorism theories. What has been said shows that new methods of assessment help teachers to reach to these goals.

In spite of the developments, many teachers continue using traditional methods and tools in assessment greatly because of the lack of familiarity with cognitive science results, and also the lack of experience in modern methods and skills of assessment. Consequently, they do not believe in strong learners´ roles in learning process and self evaluation. In this approach; tests and test results shape the educational processes. In a measurement driven instruction, the teacher tries to increase the level of students´ scores by emphasizing on the tips which will be presented in examinations. It usually occurs but can be followed by very unpleasant results such as: limiting the curriculum, illiteracy of the learners (Cizek, 1993). Also, teachers whose educational methods are based by "surface" assessments educate learners with low thinking skills (Lefrancois, 2000). Therefore, a lot emphasis on traditional methods and goals in assessment leads to the memory load and getting away from deep learning of basic thinking skills in education and training.

Performance assessment is one of the many issues examined in the education reform literature of recent years (Berk, 1986). They result in more higher level thinking or metacognitive skills. This advantage of performance assessment should be measured directly and explicitly. Unfortunately, few standardized measures of metacognitive skills (planning, monitoring, cognitive strategies, and awareness) exist.

2. Review of Related Literature

Boud & Associates (2010) studied development of professional skills such as problem solving, critical thinking, creativity, metacognition, autonomy in learning, and authenticity in learning through innovative forms of assessment.

Kabba (2008) conducted a study on performance-based assessment of 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.

According to Kearney & Perkins (2011), assessments' task must be authentic; that is, it must have a direct correlation or relevance to the students' world outside of the classroom. In designing authentic assessment tasks, we inevitably encourage learning that has applicability outside of the classroom, which makes the learning sustainable.

According to Butler and McMunn (2006), quality assessment tasks should have the following essential characteristics: (1) have a clearly defined purpose, (2) aligned with the learning targets embedded in the curriculum, (3) function on a more general level to improve students' ability to comprehend, and deal with more complex material, (4) allow for more than one right answer, (5) lead to deep understanding, not surface learning, (6) improve students' cognitive abilities and encourage higher order skills, and (7) improve students' metacognition.

Lai (2011) argued meta-cognition as a multidimensional set of skills that involve "thinking about thinking." Meta-cognition entails two components: meta-cognitive knowledge and meta-cognitive regulation. Meta-cognitive knowledge includes knowledge about oneself as a learner and about the factors that might impact performance (declarative), knowledge about strategies (procedural), and knowledge about when and why to use strategies (conditional). Meta-cognitive regulation is the monitoring of one's cognition and includes planning activities, monitoring or awareness of comprehension and task performance, and evaluation of the efficacy of monitoring processes and strategies. Insights experienced while monitoring and regulating cognition play a role in the development and refinement of metacognitive knowledge. In turn, cognitive knowledge appears to facilitate the ability to regulate cognition.

Hartman (2001) reported that students who don't progress past the acquisition of basic study skills lack the metacognitive knowledge needed at the college level and "seem to have little knowledge of what they are doing when performing a task" (p. 35). These students generally have a hard time performing the following learning tasks:

1. Determining the difficulty of a task
2. Monitoring their comprehension effectively
3. Planning ahead
4. Monitoring the success of their performance
5. Using all relevant information
6. Using a systematic step by step approach to completing a task
7. Curtailing the frequent jumping to conclusions
8. Using adequate or correct representations

One of the ways of promoting metacognition is through assessment. Haefner (2004) described an approach to assessment that engages planning monitoring and evaluation, through three different mechanisms of assessment feedback. These engage students in setting goals, evaluating their performance and monitoring their understandings through techniques that are internal such as performance assessment.

According to Martinez & Katz (1996), there is evidence that the format of the assessment affects the type of thinking and reasoning skills that are used by students, with performance assessments being better suited to assessing high-level, complex thinking skills.

Herman, et al., (1994) argued that the performance-oriented question format also challenges students to think critically and allows students opportunities to draw on prior knowledge and relevant skills to solve problems.

This article tries to identify the impact of performance assessment patterns on students' meta-cognition by developing assessment model in an experimental study. Such an assessment requires the learners´ meta-cognitive skills growth which is totally ignored in the traditional pattern.

3. Objectives of the study

The present study aims to study:

1. The impact of performance assessment patterns on chemistry pre-university students' meta- cognitive skills.
2. Comparison of metacognitive skills of boys and girls in Iran/Malayer chemistry pre-university students.

4. Hypotheses of the study

1. There is a significant difference between the performance assessmenr group and the traditional assessment group in meta-cognitive skills.
2. There is a significant difference between boys and girls in metacognitive skills.

5. Methods

5.1 Participants

Participants in the present study were 87 chemistry pre-university students studying in Malayer city of Iran. Forty two of the participants were male students, and 45 were female students.

5.2. Design of the study

In this research with a design including two patterns of performance assessment and traditional assessment tries to do a quasi-experimental research to determine the effect of these patterns on the students´meta cognitive skills. The best design for this research from among different kinds of quasi experimental design is 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 will select sample subjects from population by random method and then randomly assign patterns to experimental group and control group.

5.3. Instruments

Metacognitive skills scale: This instrument was designed by O'Nils & Abedi (1996) to measure four dimensions of metacognitive skills. The instrument includes 5 statements to measure planning (4,8,12,16,20), 5 statements to measure monitoring or self-checking (2,6,10,14,18), 5 statements to measure cognitive strategy (3,7,11,15,19) and 5 statements measure awareness (1,5,9,13,17). Students were asked to rate the statements on a 4-point scale. The rating was scored on Likert-type scale. The scale ranges from 1 for " Not at all " to 4 " very much ". The obtained score was then divided by the number of items on the subscale to obtain a mean score that reflected the original unit of measurement. This procedure allowed the researcher to make comparisons between the subscales. The possible scores for forth the subscales could range from 5 to 20, with higher scores indicating more efficacious in each subscale. The validity and reliability (alpha above .70) of the instrument was initially established by the authors, but for performing in the Iranian context Cronbach coefficient alpha reliability of metacognitive skills questionnaire was investigated and reported .85. Context validity of the instrument was investigated by some experts. The results have provided sufficient evidence for the context validity of this instrument.

5.4. Sample and population

The sample included for this research was 87 students from pre university students who were studying in 2 schools in Malayer city (2011-2012). At the first stage from among 20 schools (1050 students), 2 schools were selected randomly (boys and girls pre university schools). At the second stage from each school 2 classes were selected and assigned to experimental and control group randomly.

5.5. 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 an exam was taken on chemistry as a pre-test on both groups. Because the test was done in the second half of the academic year, the topics were 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; performance- based assessment, post-test in metacognitive skills was done on both groups in the same condition. The post-test was contained the second half of the book and it was done in traditional method for the control group and performance- based method for the experimental group.

6. Analysis and Interpretations of results

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

6.1 Results

Total metacognitive skills scores: Two factors covariate analysis (ANCOVA) revealed a significant influence of performance assessment on metacognitive skills, as the obtained F value was found to be statistically significant (F=115.275; p=.000) indicating that a significant difference is between the performance assessment group and the traditional assessment group in metacognitive skills scores. However, it is found that the sex did not have significant influence over mean scores on metacognitive skills scores, as the obtained F value was found to be statistically non- significant (F=1.284; P=.261). The interaction between performance assessment group and sex was also found to be non-significant (F=.031; p=.861).

Monitoring subscale scores: Two factors covariate analysis (ANCOVA) revealed a significant influence of performance assessment on monitoring sub scale, as the obtained F value was found to be statistically significant (F=36.613; p=.000) indicating that a significant difference is between the performance assessment group and the traditional assessment group in post test of monitoring sub scale. However, it is found that the sex did not have significant influence over mean scores on post test of monitoring sub scale, as the obtained F value was found to be statistically non- significant (F=.000; P=.998) . The interaction between performance assessment group and sex was also found to be non-significant (F=3.214; p=.077).

Planning subscale scores: It is found that the performance assessment has significant influence over mean scores on post test of planning sub scale, as the obtained F value was found to be statistically significant (F=72.410; p=.000) indicating that a significant difference is between the performance assessment group and the traditional assessment group in post test of planning sub scale. So it is found that the sex did not have significant influence over mean scores on post test of planning sub scale, as the obtained F value was found to be statistically non- significant (F=.832; P=.364) . The interaction between performance assessment group and sex was also found to be non-significant (F=.229; p=.634).

Cognitive strategy subscale scores: It is evident that the performance assessment has significant influence over mean scores on post test of cognitive strategy sub scale, as the obtained F value was found to be statistically significant (F=77.399; p=.000) indicating that a significant difference is between the performance assessment group and the traditional assessment group in post test of cognitive strategy sub scale. So it is found that the sex did not have significant influence over mean scores on post test of cognitive strategy sub scale, as the obtained F value was found to be statistically non- significant (F=1.143; P=.288). The interaction between performance assessment group and sex was also found to be non-significant (F=3.365; p=.070).

Awareness subscale scores: It is found that the performance assessment has significant influence over mean scores on post test of awareness sub scale, as the obtained F value was found to be statistically significant (F=85.614; p=.000) indicating that a significant difference is between the performance assessment group and the traditional assessment group in post test of awareness sub scale. So it is found that the sex did not have significant influence over mean scores on post test of awareness sub scale, as the obtained F value was found to be statistically non- significant (F=1.151; P=.287) . The interaction between performance assessment group and sex was also found to be non-significant (F=.049; p=.825).

7. Main finding:

The main findings of the present study are:

1. A significant influence of performance assessment was found on all dimensions of metacognitive skills, as we find that in the all dimensions metacognitive skills in traditional assessment group scored significantly lesser than students who were in performance assessment group. In other words, performance assessment had positive impact on metacognitive skills of students.
2. Boys and girls students did not differ in their scoring on metacognitive skills, as in all the dimensions, 'F' value revealed non-significant.

8. Discussion

This study examined the impact of performance assessment method on metacognitive skills among chemistry pre-university students in Malayer city. In order to confirm or reject the hypotheses formulated, we have tried to compare our results with further studies done in the same area.

Neimi(2007), examined effect of performance assessment on metacognitive skills. In addition, quantitative data findings confirmed these results and also indicated the significance effect of performance assessment on metacognitive skills.

O'Neil & Brown (1998), investigated the effect of assessment on metacognitive and affective processes of children in the context of a large-scale mathematics assessment program. Mathematical items were presented in both multiple-choice and open- ended formats to 8th-grade students(N=1,032) as part of the California Learning Assessment System. Metacognition and affect were measured following each format for boys and girls of various ethnic groups. Results indicate that open-ended question formats have differential effects. Open-ended questions induced more cognitive strategy usage, less self-checking, and greater worry than did multiple-choice questions.

9. Conclusion

This study investigated the effects of performance assessment on metacognitive of pre university students and analysis of result show that there is a significant influence of performance assessment on all dimensions of metacognitive skills, as we find that in the all dimensions metacognitive skills in traditional assessment group scored significantly lesser than students who were in performance assessment group. In other words, performance assessment had positive impact on metacognitive skills 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.

Furthermore some suggestions may be addressed to the concerned educators in order to enhance the metacognitive skills of students. 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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List of tables:

Table1. Mean and standard deviation of Metacognitive skills in performance and traditional assessment groups

Metacognitive skills	Groups							
	Experimental				Control			
	Mean		St.D		Mean		St.D	
	pretest	posttest	pretest	posttest	pretest	posttest	pretest	posttest
Monitoring	13.33	3.13	16.38	2.63	13.02	1.93	13.4	1.82
Planning	15.16	2.73	17.23	2.19	13.6	2.44	13	2.29
Cognitive Strategy	14.59	2.68	17.14	2.1	13.28	2.13	12.91	2.28
Awareness	12.21	2.9	16.28	2.03	11.61	1.99	12	2.04
Total	55.3	67.04	9.05	6.95	51.5	51.3	5.53	6.09

Table 2. Covariate analysis to comparison of mean in post test of total score of metacognitive skills and subscales

	source	ss	df	Ms	F	sig
Metacognitive Skills Total score	Covariant(Pretest)	34.526	1	34.526	.794	.376
	Covariant(IQ)	18.538	1	18.538	.426	.516
	Group	5015.718	1	5015.718	115.275	.000*
	Sex	55.86	1	55.86	1.284	.261
	Group * sex	1.335	1	1.335	.031	.861
Monitoring	Covariant(IQ)	.398	1	.398	.078	.781
	Covariant(pretest)	1.254	1	1.254	.245	.622
	Group	186.980	1	186.980	36.613	.000*
	sex	1.849E-5	1	1.849E-5	.000	.998
	Group * sex	16.415	1	16.415	3.214	.077
Planning	Covariant(IQ)	1.983	1	1.983	.387	.536
	Covariant(pretest)	8.337	1	8.337	1.626	.206
	Group	371.213	1	371.213	72.410	.000*
	sex	4.268	1	4.268	.832	.364
	group * sex	1.173	1	1.173	.229	.634
Cognitive strategy	Covariant(IQ)	.292	1	.292	.061	.805
	Covariant(pretest)	6.862	1	6.862	1.443	.233
	Group	368.082	1	368.082	77.399	.000*
	sex	5.435	1	5.435	1.143	.288
	Group * sex	16.002	1	16.002	3.365	.070
Awareness	Covariant(IQ)	1.269	1	1.269	.300	.586
	Covariant(pretest)	1.288	1	1.288	.304	.583
	Group	362.627	1	362.627	85.614	.000*
	sex	4.873	1	4.873	1.151	.287
	Group * sex	.208	1	.208	.049	.825

*Significant at 0.05 levels