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Different Learning Levels in Multiple-choice and Essay Tests: Immediate and Delayed Retention

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This study investigated the effects of different learning levels, including Remember an Instance (RI), Remember a Generality (RG), and Use a Generality (UG) in multiple-choice and essay tests on immediate and delayed retention. Three-hundred pre-intermediate students participated in the study. Reading passages with multiple-choice and essay questions in different levels of learning were given to the participants to investigate the effects on both immediate and delayed retention. The findings revealed that to evaluate immediate retention, multiple-choice questions at remember levels are effective, but for enhancing delayed retention, essay questions, especially at UG level, are more effective. The results of the study suggest that tests can be used as aids to retention beyond their primary evaluation function.

Keywords**:** Multiple-Choice Questions, Essay, Remember an Instance, Remember a Generality, Use a Generality, Immediate and Delayed Retention

Instructional assessment plays an essential role in the progress of the instructional process. Assessment is an integral part of teaching and learning process. Students‘ learning can be measured by different procedures. One of these procedures, widely used by teachers in the classroom, is an achievement test.

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Achievement tests are generally used for assessing students‘ learning. They are also considered a tool for enabling teachers to judge whether students have mastered the learned skills and knowledge, and thus, to find out whether the planned behavioral objectives are achieved (Daraghmah, 1997). In addition, evaluation by teacher-made tests plays an important role in educational system, and is a crucial area for research (Haynie, 2003).

According to Farhady, Ja'farpour and Birjandi (2004), tests are used for variety of purposes: to measure students' knowledge in relation to future tasks, which they are expected to perform, to place students at appropriate levels, to grant certificates, to determine whether students can continue in future studies, etc. Therefore, tests seem to be powerful aides because many people, including language testers, teachers, parents, administrators, governments, the public, and many other individuals and organizations are affected by test scores.

In addition, tests are important in measuring learning and enhancing long-term retention (Tulving, 1967). Inserting a recall test into the learning sequence increases the likelihood that the learner will remember something during the later test (Carrier & Pashler, 1992). Many studies show the positive effect of tests on long-term retention (Haynie 1992, 1997, 2003; Nungester & Duchastel, 1982). Retention learning is learning that is assessed with tests taken two or more weeks after presenting the information. Initial testing occurs at the time of instruction or immediately thereafter, but delayed retention tests are administered two or more weeks after instruction and initial testing to measure retention (Haynie, 1992, 1997, 2003; Nungester & Duchastel, 1982).

According to Bloom (1956, as cited in Daraghmah, 1997), it is the responsibility of the educational settings to seek learning conditions which enable each individual to reach the highest possible level of learning . He classified six hierarchical categories according to the cognitive processes. The descriptions of the major categories in the cognitive domain are: 1)Knowledge levels, at which students are required to memorize facts and knowledge;2) Comprehension levels, at which students are required to interpret

information in their own words;3) Application levels, at which students are required to use what they have learned in a new situation;4) Analysis levels, at which students are required to break down the instructional task into its components;5) Synthesis levels, at which students are required to make some inferences and come up with conclusions; and 6) Evaluation levels, at which students are required to judge and value the merit of the learned materials, and make a decision.

Merrill (1983, as cited in Daraghmah, 1997) has proposed different kinds of taxonomies which are the focus of this research, and are based on two dimensions: 1) the type of instructional content, and 2) the level of instructional performance. The former is defined as all knowledge and information that are required by students to learn during their learning. Merrill (1983) had classified content type into four types. They are: (1) concepts, (2) principles, (3) procedures, and (4) facts. The latter level is defined as the student's behavior which he or she shows after the instructional process has taken place. He, accordingly, proposed a taxonomy that includes four levels: 1) Remember an Instance level (RI) at which students are required to recall or recognize specific information, such as remembering names, dates, symbols, labels, etc. ; 2) Remember a Generality level (RG), at which students are required to remember general information and basic ideas, such as recalling a definition of principle, concept, or procedure. 3) Use a Generality level (UG), at which students are required to apply a generality to a new instance; and 4) Find the generality level (FG), at which students are required to derive or invent a new generality from new instances that students have not seen before (Daraghmah, 1997). Alderson (2000) believes that “such lists or taxonomies are seductive because they offer an apparently theoretically justified means of devising test tasks or items, and of isolating reading skills to be tested” (p.11). He further mentions that they are potentially very powerful frameworks for test construction, and will doubtless continue to be used.

Reading assessment is an important factor in improving teaching and learning of reading. Through reading assessment, we can assess and understand the strengths and needs of our students

to teach them well (Snow, 2002, as cited in Roediger & Karpicke, 2007). Alderson (2000) stated that it is important to understand that there is no best method for testing reading. However, claims are made for certain techniques. For example, multiple-choice questions and essay type tests might give the impression that testers have discovered a panacea. Some researchers found that essay type questions, which require students to write the answer in their own words, have more effect on students‘ delayed retention than multiple-choice ones. These require students to recognize and mark the correct answer from a number of options (Roediger & Marsh, 2005; Stalnaker, 1951, as cited in Christian, Timothy, Richards, & Wood, 2002; Woodford & Bancroft, 2005), especially at high levels of learning or UG level (Hambleton & Murphy, 1992).On the contrary, others, (e.g., Bridgman & Lewis, 1994; Nungester & Duchastel, 1982) found that multiple-choice type questions have more effect than essay questions, especially on remember levels of learning (RI and RG levels). However, some other researchers discovered that there are no differences between the effects of essay versus multiple-choice question types on all levels of learning (Bridgman & Rock, 1993).

The research literature indicates there is a controversy on the different effects of multiple choice and essay type questions on retention learning at different learning levels, which motivated the researchers to conduct this research. Therefore, the purpose of the research was to investigate the effects of different learning levels in multiple-choice and essay type tests on immediate and delayed retention. Accordingly, the following six research questions were presented:

1) Is there any difference between the effect of essay type and multiple- choice tests on immediate retention at RI level?

2) Is there any difference between the effect of essay type and multiple-choice tests on immediate retention at RG level?

3) Is there any difference between the effect of essay type and multiple-choice tests on immediate retention at UG level?

4) Is there any difference between the effect of essay type and multiple-choice tests on delayed retention at RI level?

5) Is there any difference between the effect of essay type and

multiple-choice tests on delayed retention at RG level?

6) Is there any difference between the effect of essay and multiple-choice tests on delayed retention at UG level?

Method

Participants

Three hundred pre-intermediate female students between the ages of 16 and 18 from the Iran Language Institution participated in this study. They were randomly divided into two groups; each group consisted of 150 students, within which three sub-groups (each group consisting of 50 students) were given multiple-choice tests, including three levels of learning RI, RG, and UG, and three groups (each group consisting of 50 students) were given essay tests including, RI, RG, and UG levels.

Instrumentation

A standard test, Comprehensive English Language Test (CELT), including a reading passage and 30 structure questions was used. A passage entitled "Common Cold", which discussed the idea of the spread of the common cold and ways of its prevention, and whose difficulty level was compatible with students' proficiency level, was given to the students to read (Appendix A). Multiple-choice questions were used at three different levels of learning. At RI level, where students remember specific information, a question such as "How long does the common cold last?" was given. At RG level, where students remember general information, a completion item such as "The major symptoms of colds are …." was given. At UG level, where students generalize to new situations, an item, such as "You cannot take a vaccine for one time to prevent cold, but you can take it to prevent …" was given. The same questions were used in an essay format at three levels of learning where students were to write their answers (see Appendix B).

Procedure

Prior to the experiment, in order to test the homogeneity of

the sample, the standard test, CELT, was used. The test was given to 350 students. The time allowed was an hour. Among these students, 300 students, based on 1 Standard Deviation above and below the mean, were selected and assigned randomly into two groups (multiple-choice group and essay group) , each of which consisted of 150 students. Each group was divided into 3 sub-groups (each containing 50 students). The first sub-group received multiple-choice questions at RI level; the second sub-group received multiple-choice questions at RG level; the third sub-group received multiple-choice questions at UG level; the forth sub-group received essay questions at RI level; the fifth sub-group received essay questions at RG level; and finally, the sixth sub-group received essay questions at UG level. Each booklet included five questions related to the passage. The number of the questions at three different levels were the same, but their formats were different i.e., one was a multiple-choice type and the other was an essay type because the aim was to investigate which type of tests (Multiple-choice test and essay test), at RI, RG, and UG levels, had significant influence on immediate and delayed retention. The students were given 20 minutes to read the passage and 10 minutes to answer the questions. The delayed retention tests were administered three weeks later. The students were not given the passage, but only the questions that were given to the same students in the same way as in the initial testing. In this phase, the effect of each level, both in multiple-choice and essay tests, were investigated on delayed retention.

Design

In this study, the dependant variables were immediate and delayed retention, and the independent variables were different levels of learning (RI, RG, and UG) in both multiple-choice and essay tests. The students were randomly assigned into two groups, each containing three sub-groups, based on the results of the standard test, CELT.

Results

In this study, an independent sample t-test was used for two independent groups. Alpha was set at the $p<.05$ level for all tests of significance.

Data Analysis for Hypothesis 1

Null Hypothesis 1: There is no difference between the effect of essay and multiple-choice tests on immediate retention at RI level.

The mean score of the group who took multiple-choice questions at RI level equals 12.62 and the mean of the group who took essay questions equals 8.58 in initial testing, so the mean of multiple-choice questions at RI level is higher than essay one. As the results of the t-test analysis in Table (1) indicates, t (98) = 7.216, P = .00 <.05 with a 95% level of confidence, there is a significant difference between the effect of essay and multiple-choice tests on immediate retention at RI level. Therefore, the first null hypothesis was rejected.

Table 1
Independent sample t-test for RI level in initial testing

	Leven's test for equality of variances		t-test for equality of means		
	F	Sig	t	df	Sig (2-tailed)
Equal variances assumed	1.709	.194	7.216	98	.000

Data Analysis for Hypothesis 2

Null Hypothesis 2: There is no difference between the effect of essay and multiple-choice tests on immediate retention at RG level.

The mean score of the group who took multiple-choice

questions at RG level equals 8.22 and the mean of the group who took essay questions equals 9.56 in initial testing. Therefore, the mean of essay questions at RG level is higher than the multiple-choice one. As it is shown in Table (2), t (98) = -1.99, P = .049 <.05, there is a significant difference between the effect of essay and multiple-choice tests on immediate retention at RG level. Therefore, the second null hypothesis was rejected.

Table 2
Independent sample t-test for RG level in initial testing

	Leven's test for equality of variances		t-test for equality of means			
	F	Sig	t	df	Sig (2-tailed)	Mean dif.
Equal variances assumed	6.191	.015	-1.992	98	.049	-1.3400

Data Analysis for Hypothesis 3

Null Hypothesis 3: There is no difference between the effect of essay and multiple-choice tests on immediate retention at UG level.

The mean score of the group who took multiple-choice questions at UG level equals 12.40 and the mean of the group who took essay questions equals 10.16 in initial testing. Therefore, the mean of multiple-choice questions at UG level is higher than the essay one. As it is shown in Table (3), t (98) = 2.64, P = .009 <.05, there is a significant difference between the effect of essay and multiple-choice tests on immediate retention at UG level. Therefore, the third null hypothesis was rejected.

Table 3
Independent sample t-test for UG level in initial testing

	Leven's test for equality of variances		t-test for equality of means		
	F	Sig	t	df	Sig (2-tailed)
Equal variances assumed	28.934	.000	2.647	98	.009

Data Analysis for Hypothesis 4

Null Hypothesis 4: There is no difference between the effect of essay and multiple-choice tests on delayed retention at RI level.

The mean score of the group who took multiple-choice questions at RI level equals 12.10 and the mean of the group who took essay questions equals 10.96 in delayed testing. As it is shown in Table (4), t (98) = 1.75, P = .08 >.05, there is no significant difference between the effect of essay and multiple-choice tests on delayed retention at RI level. Therefore, the forth null hypothesis was not rejected.

Table 4
Independent sample t-test for RI level in delayed testing

	Leven's test for equality of variances		t-test for equality of means		
	F	Sig	t	df	Sig (2-tailed)
Equal variances assumed	.014	.905	1.753	98	.083

Data Analysis for Hypothesis 5

Null Hypothesis 5: There is no difference between the effect

of essay and multiple-choice tests on delayed retention at RG level.

The mean score of the group who took multiple-choice questions at RG level equals 11.18 and the mean of the group who took essay questions equals 7.86 in delayed testing. Therefore, the mean of multiple-choice questions at RG level is higher than the essay one. As it is shown in Table (5), t (98) = 4.66, P = .00 <.05, there is a significant difference between the effect of essay and multiple-choice tests on delayed retention at RG level. Therefore, the fifth null hypothesis was rejected.

Table 5
Independent sample t-test for RG level in delayed testing

	Leven's test for equality of variances		t-test for equality of means		
	F	Sig	t	df	Sig (2-tailed)
Equal variances assumed	11.336	.001	4.660	98	.000

Data Analysis for Hypothesis 6

Null Hypothesis 6: There is no difference between the effect of essay and multiple-choice tests on delayed retention at UG level.

The mean score of the group who took multiple-choice questions at UG level equals 5.96 and the mean of the group who took essay questions equals 10.00 in delayed testing. Therefore, the mean of multiple-choice questions at UG level is higher than the essay one. As it is shown in Table (6), t (98) = -7.16, P = .00 <.05, there is a significant difference between the effect of essay and multiple-choice tests on delayed retention at UG level. Therefore, the sixth null hypothesis was rejected.

Table 6
Independent sample t-test for UG level in delayed testing

	Leven's test for equality of variances		t-test for equality of means		
	F	Sig	t	df	Sig (2-tailed)
Equal variances assumed	16.282	.000	-7.160	98	.000

Discussion

The main objective of this study was to determine which levels of learning, both in multiple-choice and essay questions, have an effect on immediate and delayed retention. According to the results of the study, in multiple-choice questions, RI and UG levels but in essay questions, RG level have significant effects on immediate retention. If we consider the time effect (delayed retention) in multiple-choice questions of the RG level and in essay questions of the UG level, both have significant effects on delayed retention. However, at RI level, there were no significant differences between the two types of tests. The results of this study confirm previous studies. Different types of tests provide differentially effective cues for accessibility of memories (Tulving & Pearlstone, 1966). The results of which indicated that multiple-choice questions induce low levels of learning such as RI and RG levels whereas the essay questions induce high levels of learning, such as UG level in delayed testing. As Daraghmah (1997) concluded, essay questions have a greater effect on students' achievement than multiple-choice, especially when they are written at high levels such as evaluation, synthesis, problems solving, etc. Hambleton and Murphy (1992) came to the same results. After comparing the data, they found that the essay questions lead to better results in the students' achievement. This was in terms of higher order levels in comparison with multiple-choice questions. Similarly, Anderson and Biddle (1975, as cited in Daraghmah, 1997) stated that essay questions could improve

students‘ achievement if they are written at high levels of learning (UG), whereas multiple-choice questions can improve students‘ achievement if they are written at low levels of learning (RI, RG). According to Jacoby (1991), essay tests rely more on the intentional, recollective component than multiple-choice tests, and that this deeper engagement of recollection results in better retention.

The findings of this study are in contrast with the results of the study conducted by Nungester and Duchastel (1982) and Bridgman and Lewis (1994), who concluded that students who received multiple-choice questions performed better than those who received essay questions on the post-test that measured retention**.** The results in a study conducted by Perkins (1984) showed that objective items produced better results than did essay ones on a comprehension level of learning. In addition, Bridgman and Rock (1993) showed that essay items were not measuring anything beyond what is measured by the multiple-choice version of these items, which means that the two question types (essay vs. multiple-choice) have the similar effect on the student’s achievement.

The findings of this study will be of great importance for language teachers on how to use tests and levels of learning effectively for teaching, testing, and enhancing learners' immediate and delayed retention. They can benefit from this study in designing their tests by considering types of tests, levels of learning, and the instructional objectives. In addition, the results of this study can be useful for the students who are interested in questions and tests as a learning strategy.

To summarize, since testing consumes such a large amount of teacher and student time in schools, it is important to learn as much as possible about the effects of tests on learning. It is important to maximize every aspect of the learning and evaluation process. As the results of this study suggest, practitioners should consider the importance of tests on students' retention. Different types of tests are used not only to test students‘ achievement, but also to improve retention if different learning levels are considered appropriately.

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Appendices

Appendix A

Common cold

Colds are by far the most common illness in the world. Ninety percent of the population will have at least one cold per year. The classic symptoms of common cold begin 1-4 days after contact with the virus and usually last 5-7 days and often include runny nose, difficulty breathing through your nose, swelling of your sinuses, sneezing, sore throat, cough, and headache. Fever usually occurs with the flu. They are contagious diseases which are spread through contact. The common cold is spread mostly by hand-to-hand contact, For example, a person with a cold blows or touches his or her nose and then touches someone else who then becomes infected with the virus.

Additionally, the cold virus can live on objects such as pens, books, and coffee cups for several hours and can be acquired from such objects. Children have about 6 to 10 colds a year. One important reason why colds are so common in children is because they are often in close contact with each other in daycare centers at schools.

More than 200 different viruses are known to cause the symptoms of the common colds, especially rhinoviruses. Approximately 10 to 15 percent of adult colds are caused by viruses also responsible for other, more severe illnesses and the causes of 30 to 50 percent of adult colds, presumed to be viral,

remain unidentified.

The flu is similar, and sometimes has the same symptoms as a cold, but is often much more severe and lasts longer and is created by many viruses.

Unfortunately, modern medicine has not yet developed any good ways to kill these viruses once they have invaded the body but it can be prevented by injecting the patient with vaccine which is a liquid injected into the arm. Vitamin C hasn't been proven to be of any benefit but taking a daily dose of vitamin C (1gm or 3 gm) is useful but using it more may be harmful. Too much vitamin C can cause severe diarrhea, a particular danger for elderly people and small children. Antibiotics only work against bacteria, which are very different from viruses. So there is no "cure" for a cold. The best way to handle colds is simply to prevent them from occurring, and if that fails, to treat the unpleasant symptoms. Prevention is mainly a matter of hygiene. There are several ways you can keep yourself from getting a cold or passing one on to others such as:

1) Because cold germs on your hands can easily enter through your eyes and nose, keep your
hands away from those areas of your body
2) If possible, avoid being close to people who have colds.
3) If you have a cold, avoid being close to people and touching them.
4) If you sneeze or cough, cover your nose or mouth
5) Wash your hands frequently.
6) Refusing to rest can result in worse symptoms, delayed recognition
7) Drink at least two quarts of clear liquids per day.

Appendix B

Multiple-Choice Test: Remember an Instance Level (RI)

General Instructions

1- Write your name on the booklet.
2- You have 20 minutes to read the passage once.

3- You have 10 minutes to answer the post questions.
4- The total time allowed for the passage and the questions is limited to 30 minutes.

Circle the most appropriate answer for each of the following questions.

1-How long does the common cold last?
a. 1-4 b. 5-7
c. 3-5 d. 4-7
2- Scientists have found ..... kinds of viruses that cause cold.
a. 150 b. 100
c. over 200 d. less than 200
3- About ……. percent of viruses are responsible for both colds and other illnesses.
a. 30-50 b.10-20
c. 30-40 d. 10-15
4-Which disease of the following has the same symptoms to the cold?
a. Influenza b. Fever
c. Cancer d. Heart disease
5- Colds are caused by a ……..
a. germ b. bacterium
c. fungus d. virus

Multiple-Choice Test: Remember a Generality Level (RG)

General Instructions
1- Write your name on the booklet.
2- You have 20 minutes to read the passage once.
3- You have 10 minutes to answer the post questions.
4- The total time allowed for the passage and the questions is

limited to 30 minutes.

Answer the following questions by writing your answer in the specified spaces.

1- How long does the common cold last?

_____

2- How many kinds of viruses that cause colds have scientists found?

_____

3- What percent of viruses are responsible for both colds and other illnesses?

_____

4- Which disease has similar symptoms to the common cold?

_____.

5- What are causes of a cold, a virus or a bacterium?

_____.

Multiple-Choice Test: Use a Generality Level (UG)

General Instructions

1- Write your name on the booklet.
2- You have 20 minutes to read the passage once.
3- You have 10 minutes to answer the post questions.
4- The total time allowed for the passage and the questions is limited to 30 minutes.

Circle the most appropriate answer for each of the following questions:

1- The major symptoms of colds are
a. headache, sleepiness and coughing.
b. sneezing, headache and coughing.
c. sneezing, yawning and headache.
d. nausea, coughing and fever.

2- A vaccine is a
a. liquid which is injected into the arm.
b. tablet taken by mouth to cure a disease.
c. disease which spreads by touch.
d. disease developed by injection.

3- The major difference between cold and influenza is
a. sleepiness.
b. tiredness.
c. fever.
d. eating.

4- Two ways to avoid caching colds are to avoid
a. getting chilled and being wet in summer.
b. touching people and shaking hands with others.
c. eating ice-cream and drinking lemonade.
d. watching television and smoking cigarettes.

5 - A contagious disease is a disease which:
a . does not have treatment.
b . spreads by touch.
c . affects only pregnant women.
d . causes death.

Essay Test: Remember an Instance Level (RI)

General Instructions
1- Write your name on the booklet.
2- You have 20 minutes to read the passage once.
3- You have 10 minutes to answer the post questions.

4- The total time allowed for the passage and the questions is limited to 30 minutes.

Answer the following questions by writing your answer in the specified spaces:

1. Name three symptoms of the common cold.
   a. _____.
   b. _____.
   c. _____.

2- What is a vaccine? Define it in your own words within one line.
_____.

3- What is the major difference between cold and influenza?
_____.

4- What should you do to avoid catching cold? Mention two ways.
_____.
_____.

5- What is a contagious disease? Define it in your own words within one line
_____.

Essay Test: Remember a Generality Level (RG)

General Instructions
1- Write your name on the booklet.
2- You have 20 minutes to read the passage once.
3- You have 10 minutes to answer the post questions.
4- The total time allowed for the passage and the questions is limited to 30 minutes.

Circle the most appropriate answer for each of the following questions:

1- You cannot take a vaccine to prevent cold, but you can take it to prevent ……..
a. headache b. stomach ache
c. cholera d. blood pressure

2- Medicine can be given to patients in different compositions such as an injection.
Another common way of taking medicine is ……..
a. tablets b. smelling air
c. drinking water d. tasting sugar

3- People believe that you can shake hands with some one who has a headache because a headache ……
a. affects only old people b. affect only young people
c. is a contagious disease d. is not contagious

4- A skin infection is a……..
a. disease b. medicine
c. symptom of a disease d. fever

5- Medicines cannot cure John from influenza forever because influenza is caused by …….
a. many kinds of viruses b. one kind of virus
c. many kinds of bacteria d. one kind of bacteria

Essay Test: Use a Generality Level (UG)

General Instructions
1- Write your name on the booklet.
2- You have 20 minutes to read the passage once.

3- You have 10 minutes to answer the post questions.
4- The total time allowed for the passage and the questions is limited to 30 minutes.

Answer the following questions by writing your answer in the specified spaces.

1-You cannot take a vaccine for once to prevent a cold. Can you take it to prevent cholera ? Yes ..... . No .....Why ?
_____.

2- Medicines can be given to patients in different compositions like injections. Name another way of taking medicines that is commonly used by people.
_____.

3- Do you think that you should or should not shake hands with some one that has a headache ? Yes ..... . No ..... .Why ?
_____.

4- Do you think a skin infection is a disease or a symptom of a disease? Explain your answer within two lines.
_____
_____

5- John has influenza and he is taking a medicine. Do you think this medicine can cure him forever ? Yes .... . No.....Why ?
_____
_____