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ABSTRACT

In three experiments subjects (college and high school students) read passages which described psychological principles and answered either adjunct application or factual questions while reading. Questions were presented either before, after, or both before and after the parts of the passage that answered the questions. Subsequently subjects took a posttest containing new factual and application items. The important result was that subjects given factual prequestions or factual pre- or post-questions did better than subjects given adjunct application questions. This result conflicted with previous findings and theorizing and raised questions about boundary conditions within which previous generalizations apply. (Author/RD)

Adjunct Application Questions Facilitate Later Application, Or Do They?

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Abstract

In three experiments subjects (college and high school students) read passages which described psychological principles and answered either adjunct application or factual questions while reading. Questions were presented either before, after, or both before and after the parts of the passage that answered the questions. Subsequently subjects took a posttest containing new factual and application items. The important result was that subjects given factual pre-questions (Exp. 1) or factual pre- or post-questions (Exp. 3) did better than subjects given adjunct application questions. This result conflicted with previous findings and theorizing and raised questions about boundary conditions within which previous generalizations apply.

Adjunct Application Questions Facilitate Later Application, Or Do They?

Research on the effect of questions on learning from prose has yielded two generalizations that seem to be widely accepted. The first is that it is better to place questions after relevant text than before it. Placing questions prior to relevant text lowers recall of information of material not directly related to the questions. Placing questions after the relevant text enhances recall not directly related to the questions. While this generalization has been questioned (Carver, 1972; Ladas, 1973); a recent review of this literature shows that the data from most studies supports the generalization (Anderson and Biddle, 1975).

The second generalization is that asking students to apply presented concepts and principles while reading enhances their ability to later apply those concepts and principles in new situations. (Watts and Anderson, 1971; Felker and Dapra, 1975). Students asked application questions during learning do better on new application questions than students asked factual questions during learning. The enhancement is limited to the particular concepts and principles about which students were questioned (Moore, 1975).

The standard interpretation of both the question position and question level effects is that these variables produce their effects by influencing the manner in which subjects read and think about the text. It is believed that question position directly influences the aspects of the material to which subjects attend. When the questions come before the passage, subjects selectively attend to only that information in the text which answers the questions, when questions come after the text, the subjects carefully read all the text because they cannot be sure which items of information will be required. The question level effect occurs because the question influences the kind of semantic processing in which subjects engage. With an application question the subject is led to process those aspects of the presented

information that permit later application of the information and thereby forms a representation of the information in memory that facilitates later application.

Given the manner in which position and level are assumed to influence subjects' processing, it seems reasonable to suppose that the two variables would interact. When subjects are given a low level question prior to reading a segment of text it is possible for them to limit their attention to relevant portions of that segment. However if subjects are given a higher level question prior to reading a text, it would not be possible for them to limit their attention to selected portions of the text since answering the higher level question entails comprehending the passage. If the question is an application question for example, there is no specific item of information to which attention may be limited, the subject must read and understand the whole passage. Thus higher level questions presented prior to the passage should not be deterimental to but should facilitate learning from the passage.

This interpretation is supported by a study by Rickards (1976) in which students were given either higher-level or low-level questions before or after reading segments of a passage and were asked to recall the passage. Higher order questions presented prior to the passage enhanced recall of the passage. However, the Rickards study used higher order questions that demanded relatively simple inferences from the students and also used a measure of learning that involved rote recall of the passage. Thus it yielded little information about how question level and position might influence the acquisition of higher-order learning from a passage.

Felker and Dapra (1975) compared comprehension or factual questions presented before or after relevant passages. Comprehension post questions, but not comprehension pre-questions, facilitated later problem-solving involving the presented concepts and principles. This finding is somewhat counter—

intuitive; the comprehension pre-questions should give the subject a set to understand the material just as strongly as does the comprehension post-question. The present experiment was designed to further examine the effects of question position and question level on learning to apply presented concepts and principles.

Method

Subjects: The subjects were 120 undergraduates taking psychology courses at Iowa State University. Both male and female students were included in the sample but records of gender were not kept. Subjects received extra course credit for their participation.

Design: The design can be considered a 2 X 3 between-subject factorial. Either name questions or application questions were inserted in a prose passage. Type of question represented the first factor in the design. The questions were placed either before, after, or both before and after the pages whose content provided answers to the questions. Position of question provided the second factor in the design. After reading the passage subjects took an 80 item posttest on the content of the passage. There were seven different types of questions represented on this posttest. Subjects also completed the Wide Range Vocabulary Test (French, Ekstrom, and Price, 1963). The data for each of the seven types of posttest questions were analyzed using a 2 X 3 analysis of co-variance with vocabulary test score as the co-varying measure.

Materials: The materials for this study consisted of a ten page passage which defined and gave examples of 10 psychological concepts or principles, a set of adjunct questions which were inserted in the passage, and a posttest on the content of the passage. Each page in the passage described a different psychological concept. Each page was written in the same format: the first

paragraph on the page presented an example of the concept, the second paragraph gave a verbal definition of the concept, presented the name of a psychologist associated with the concept, and gave some incidental information about the concept. The third paragraph gave a second example of the concept.

Seven multiple-choice questions were written for each text page. The Name question asked the student to select the name of the psychologist associated with the concept from a list of five alternatives. The distractors were the names of other psychologists used in the passage. Distractor names were randomly chosen with the restriction that each be used equally often over the set of 10 Name questions. Three Application questions were written for each page. Two of these Application questions asked students to select an example of the concept from a set of four alternatives. The examples used as correct alternatives were different from the examples presented on the page. The distractors for these application questions were made up to sound plausibly related to the concept or principle. The distractor contained the elements used in the concept but arranged these elements differently. Sometimes only some of the necessary elements were used in writing a distractor. Since the item stem presented the name of the concept and the alternatives possible examples of the concept, these two Application Questions were called Application-Term-to-Example questions. The third application question presented the students with an example of the concept or principle and asked students to select the name of the concept or principle from a set of four alternatives. The distractors used were the names of the other concepts and principles presented in the text. Distractors were randomly selected with the restriction that they be used equally often as possible over the set of 10 questions. This type of question was labeled an Application-Example-to-Term question. A Factual question asked the student to

recognize a particular fact presented in the passage. These questions were made up by taking a sentence or phrase in the passage which presented incidental information about the concept and making a multiple-choice question out of the sentence or phrase. These questions were pretty much verbatim in the sense described by Anderson (1972). Distractors were written which sounded plausible. A Repeated Example question asked students to recognize one of the two examples presented in the text as an example of presented concept. The format of Repeated Example questions was the same as Application-Term-to-Example questions and distractors were prepared in the same way. A Definition question asked students to recognize the correct definition of the concept as it was presented in the text. All Definition questions were four choice multiple choice questions; distractors again were written to sound plausible. Both the item stem and correct alternative substantially employed the language used in the passage, so the questions were verbatim level questions (Anderson, 1972). These materials were based on materials developed by Watts and Anderson (1971). Five of the descriptions of concepts, their Name questions, their Repeated Example questions, and some of their associated Application-Term-to-Example questions had been written by Watts and Anderson; the remaining descriptions and questions were written specifically for this study.[2] The new materials conformed to the format and style used by Watts and Anderson.

The Name question and one of the Application-Term-to-Example questions were chosen to be used as adjunct questions inserted in the passages. The particular Application-Term-to-Example questions used as an adjunct questions were determined randomly. The materials were prepared in dittoed booklets. The text pages of the booklets were typed single spaced in elite type, each text page described one concept and took about one full single-spaced page (250-300 words). The Application-Term-to-Example and Name questions used as adjunct questions were reproduced one per page on separate sheets. The

materials were assembled into booklets appropriate for the various conditions of the experiment.

A cover page on the booklet provided general directions for the experiment and specific directions for each condition. The general directions told students to read the material; that the purpose of the study was to investigate how people learned from written materials; to read the text for a subsequent test; and to answer the inserted questions they encountered as they read.

In the Questions Before conditions, the booklets consisted of alternating question and text pages. The appropriate application or name question was inserted in the booklet before the text page. The cover page instructed students to answer the inserted question without turning ahead to the text even if the students had to guess. In the Questions After conditions, the booklets consisted of alternating text and questions pages. The cover page indicated that students were to read the text page, then turn to the question and answer it without turning back to the text page. Again students were told to answer the adjunct questions even if they had to guess. In the Questions Before and After conditions the booklets consisted of 10 sets of question-text-question pages. The appropriate adjunct question was presented before the related text page and repeated after the text page. Instructions on the cover page told students to read the before question but not answer it, to read the text without turning back to the before question or ahead to the after question, and to answer the after question without turning back to the text page. The order of concepts within the booklet was randomized but was the same in all conditions.

A seventy-item posttest consisting of the seven items made up for each of the 10 concepts was prepared. The order of items on the posttest was randomized. The Name and Application-Term-to-Example questions used as

adjunct questions were repeated in this posttest. Students answered this posttest on machine-scorable answer sheets.

Procedure: The subjects were run in large groups in a college classroom. As each subject entered the experimental room he was handed a booklet for one of the experimental conditions. The booklets contained the Wide Range Vocabulary Test, the instructional passage and adjunct questions. The booklets were taken serially from a stack in which booklets for the various conditions had been unsystematically arranged. In this way students were randomly assigned to conditions. Subjects were given 10 minutes to complete the Wide Range Vocabulary Test. At the end of 10 minutes, subjects were told to read the directions on the cover of their booklet and begin working on the passage and adjunct questions. Subjects read through the booklet and answered questions at their own pace. Proctors in the room ensured that students did not turn ahead or back to text pages while answering the adjunct questions. When a subject completed the booklet, he raised his hand and a proctor brought him the 70 item posttest, and removed the passage booklet. When the subject completed this posttest, he again raised his hand. A proctor came, collected the booklet, thanked the subject and dismissed him.

Results

The data were analyzed separately for each of the seven types of posttest scores described above. The analysis and results for each of the posttest types is discussed separately. Table 1 presents the means for each condition for each type of score.

Name Questions: The analysis of covariance revealed a significant effect of type of questions, $F(1,113) = 9.62$, $p < .003$; students who received Name Questions as adjunct questions did better on those same Name Questions when they were repeated on the posttest (Name Adjunct Questions = 4.35, Application

Adjunct Questions = 3.36). There was also a tendency for subjects who received questions after the relevant text pages to recall names better than subjects who received questions either before or both before and after the text pages, $F(2,113) = 2.67$, $p < .072$; After = 4.32, Before = 3.80, Before and After = 3.40.

Repeated Application-Term-to-Example Questions: Neither Type of Question nor Position of Question produced significant variation in the data (both Fs less than one). Table 1 presents the individual cell means.

New Application-Term-to-Example Questions: Only the interaction of Type of Question and Position of Question proved significant, $F(2,113) = 4.31$, $p < .015$, Table 2 presents the cell means. Basically this interaction occurred because the effect of Type of Question changed as a function of Position of Question. When questions came after the relevant pages, Application Questions led to superior performance, when questions came before the relevant pages Name Questions led to superior performance. When questions came both before and after the text page, Name and Application questions led to equivalent performance. However, when tested by simple main effects tests the difference was significant only for the Before Question condition, $F(1,39) = 9.4249$, $p < .01$.

Application-Example-to-Term Questions: Neither Position nor Type of Question produced reliable variation in the data. Table 2 presents the means. In all groups performance on these questions tended to be relatively high.

Factual and Definition Questions: For neither of these variables were Position and Type of Question significantly related to performance. Table 1 presents the mean cell values.

Discussion

The results of the present study were quite surprising. The hypothesis that higher order questions would facilitate performance on a later application test regardless of question position was not supported. Instead the effect of Type of Adjunct Question was moderated by position of the question. When the questions came after the relevant text application questions tended to facilitate performance on a later test of new applications. Thus performance on the new Application-Term-to-Example questions was good in both the After and Before-and-After Application Question Groups. This result weakly replicates the finding by Watts and Anderson (1971). Performance in the before conditions is what is puzzling. When questions came before the relevant text, name questions led to superior performance. Thus performance was high in the Before and Before and After Name question groups. This latter result conflicts with the results of Felker and Dapra (1975). In their study both before factual and before comprehension questions failed to facilitate performance.

One possible explanation of the present results may be based on interference notions. Students in the before application condition read a complex question containing four alternatives written to sound related to the concept or principle. Without having knowledge of the presented concept or principle, they would have no means of differentiating the real example of the concept from the distractors. These subjects would have to read and remember the four possible examples in order to relate them to the subsequently presented text. Interference between the wrong examples presented in the distractors and the information presented on the text page could account for the poor performance of the Before Application question group on the posttest.

The problem with this argument is that it does not explain the superior performance of the Before Name question conditions. While it is true that subjects in these latter conditions would not have had a confusing set of

examples to deal with and thus would not suffer interference, it is not clear why subjects given Name Questions before the text would do better than subjects given Name questions after the text. The differential performance of the groups given name questions before or after the text that is the most puzzling result of the present study. A theoretical model that would handle this finding is not readily apparent.

A second puzzling finding is that students given application questions while reading do not do any better on those questions when they were repeated on the posttest. This finding conflicts with Watts and Anderson (1971) and also to other studies which show that students do well on repeated questions (Anderson and Biddle, 1975).

The nature of the procedures used in the present study may be related to the differences in the present findings. Subjects read 10 passages and then took a long posttest. The average time to complete the experiment was approximately 1.5 hours and some students took up to two hours. It was clear that many students were bored and answering questions perfunctorily at the end of the interval. While it is not clear what effect this low motivation would have, it is possible that the differences in results between studies may be due to differences in motivation between the groups. Accordingly Experiments 2 and 3 were done in an attempt to eliminate problems with the length of the materials.

Experiment 2

With some minor changes in procedure, Experiment 2 was a replication of Experiment 1. Two variables were again manipulated, Type of Adjunct Question and Position of Adjunct Question. The basic purpose of Experiment 2 was to determine if the results of Experiment 1 would replicate in a study that used shorter passages than Experiment 1.

Method

Subjects: The subjects were 155 male and female students taking undergraduate psychology courses at Iowa State University. The students received course

credit for their participation.

Materials: The booklets used in Experiment 1 were divided into two parts. One part contained the first five text pages and associated questions and the second part contained remaining text pages and questions. Cover sheets appropriate for the condition were added to the second part booklets. Thus the materials used in Experiment 2 were identical to those used in Experiment 1 except that subjects read about only 5 concepts instead of 10. The booklets containing the first 5 text pages and questions were labeled Form 1; the booklets containing the second 5 text pages and questions were labeled Form 2.

Separate posttests, containing the seven types of questions used in Experiment 1 but limiting those questions to those concepts discussed in a particular form, were prepared. The Form 1 posttest contained the questions appropriate for the Form 1 booklet; the Form 2 posttest was appropriate for the Form 2 booklet. The questions used in Experiment 2 were identical to the questions used in Experiment 1. The order of posttest questions within forms in Experiment 2 was randomly determined.

In addition to the 35 multiple choice questions, the posttest contained 10 short answer questions. These short answer questions contained 5 application questions in which students were given an example of a concept or principle and asked to supply the concept name, and 5 repeated example questions in which students were given an example of a concept that had been used in the text and were asked to write the concept name. The examples used in the short answer repeated example questions were different from those used in the multiple choice repeated example questions.

Design: The design is essentially similar to Experiment 1. There were 2 substantive factors, Type of Adjunct Question (Name or Application) and Position of Adjunct Question (Before, After, or Both Before and After the relevant text page). In addition since the booklet and posttest forms were not equated for difficulty Test Form was included as a blocking factor to eliminate variance

associated with form. The design can be represented as a 2(Form) x 3 (Position) x 2(Question Type) factorial with all factors between subjects.

Procedure: The procedure for Experiment 2 was essentially like Experiment 1. As subjects proceded through their booklets they recorded the elapsed time by writing a number written on the front board of the room on a time record sheet as they completed each booklet page. One of the proctors incremented the number every 10 seconds.

Results and Discussion

As in Experiment 1 separate analyses of variance were conducted for each of the seven types of posttest questions and for the short answer questions. The results can be summarized quickly; across all seven analyses, the only sources of variance proving significant were the main effect of form (in 6 analyses) and two interactions involving form. None of these interactions were interesting. Table 2 presents the means. These results suggest that neither Type of Adjunct Question or Position of Adjunct Question strongly influence the nature of learning from prose material which purport to teach psychological concepts and principles.

Experiment 3

Experiment 3 was also a replication of Experiment 1 and Experiment 2. The major differences were that high school students were used as subjects and that the materials were reduced to 3 concepts per passage.

Method

Subjects: The subjects were 87 male and female students attending Ames High School in Ames, Iowa.[3] The students varied from sophomores to seniors and included both high and average ability students. The subjects participated during their normal class periods.

Materials: Since the study had to be completed in the normal 50 minutes class period at Ames High, the material were shortened to 3 concepts per booklet. This was done by removing the last two concept text pages and associated questions from the Form 1 and 2 booklets used in Experiment 2.

Since subjects received only 3 concepts, it did not seem appropriate to include all seven types of items on the posttest. Doing so would have led to there being only three questions for each item type and we felt that such a three item test would be so unreliable as to produce results that would be difficult to interpret. Since it is performance on New Application Questions that is of greatest educational interest, we prepared a posttest that contained 9 new Application Term to Example questions (3 for each presented concept) and also included the 3 Factual and 3 Definition questions used in Experiments 1 and 2. In addition the relevant short answer questions used in Experiment 2 were included. We used the latter questions simply to get some data on simple factual learning of the passages.

Design: The design of Experiment 3 was identical to that of Experiment 2.

Procedure: The subjects were run in their normal classrooms. When subjects entered the room, the classroom teacher explained the purpose of the visit and introduced the experiment. The experimenter then described the study in general terms, then with the help of proctors passed out the experimental booklets. Booklets were distributed in an unsystematic order. From this point forward the procedure was identical to Experiment 2.

Results

There were 5 dependent measures analyzed: Short Answer Application Questions, Short Answer Repeated Example Questions, Multiple Choice Application Term-To-Example Questions, Multiple Choice Factual Questions, Multiple Choice Definition Questions. Separate 2 (Form) X 3 (Position) X 2 (Question Type) ANOVAs were performed for each measure. Table 3 presents the results for each measure. The analyses are discussed separately for each dependent measure below.

Short Answer Application Questions: The only significant source of variance was Question Position, $F(2,60) = 3.823$, $p < .05$, Questions After = 2.21, Question Before = 1.97, Questions Before and After = 1.59.

Short Answer Repeated Example Questions: None of the sources of variance proved significant.

Application-Term-to-Example Questions: Only question Type significantly influenced the data; subjects who received name questions performed reliably better than subjects who received application questions F (2,75) = 5.004, $p < .05$; Name Questions = 4.67, Application Questions = 3.77.

Factual Questions: No sources of variance proved significant.

Definition Questions: No sources of variance proved significant.

General Discussion Experiments 1-3

The results of Experiments 1-3 are consistent neither with previous results nor among themselves. Previous results had suggested that giving students higher level questions while reading increases the students ability to use the information in the passages they are reading. For example Watts and Anderson (1971) had found that students given application questions while studying were later more likely to be able to apply the presented concepts when given new examples. Similarly Felker and Dapra (1975) had found that students given comprehension questions while reading were later more able to solve problems by using the presented concepts and principles. The results of the present studies raise serious questions about the generality of those findings.

In the present three experiments subjects were presented with either low level factual questions or higher level application questions while reading a passage. Considering only new application questions, in the first experiment only the subjects getting factual questions before the relevant text performed significantly better than the subjects in the other groups. In Experiment 2 no significant differences in the subjects ability to apply the presented concepts were found. In Experiment 3 subjects given either name or application

questions before the relevant portions of the passage were better able to apply the presented concepts.

These results are difficult to understand and interpret. The effect of type of question had been interpreted as a level of processing effect. It was believed that subjects given a higher level question processed the presented information to a deeper semantic level than subjects given a low level question. A deeper level of processing leads to a representation in memory that permits application of the concept. The present results raise questions about this interpretation and suggest that the relationship between question level and depth of processing may be moderated by other variables.

One possible such variable is question difficulty. It makes sense that an adjunct question will not have a beneficial effect on processing and later application unless the subject is able to carry out the processing necessary to answer the adjunct question. If the subject is unable to carry out the necessary processing, it is unlikely that a higher order question will facilitate performance. Higher-order questions are often more difficult than lower order factual questions, this proved true in the Watts and Anderson (1971) study and the present experiments. (Felker and Dapra do not report performance on the adjunct questions.) Unfortunately, performance on the adjunct application questions appeared to be worse in the present studies than in the Watts and Anderson study. In the present Experiment performance on those questions ranged from 54% in Experiment 2 to 43% in Experiment 3 (the data were not available in Experiment 1). In Watts and Anderson performance on the adjunct application questions was about 70%. It may be that there is a floor above which performance must rise if adjunct application questions are to have a facilitative effect. In Watts and Anderson, performance may have been above the floor; in the present experiments it may have been below the floor.

One mechanism that might produce such a floor is the effect of the adjunct questions on student anxiety. When subjects find the adjunct questions difficult, their anxiety level may be raised to a high level. It is known that high levels of anxiety usually reduce performance on complex tasks (Anderson and Faust, 1973). Since the new application questions on the posttest represent fairly complex tasks the performance of subjects on these items may have been reduced by the anxiety aroused by the difficult adjunct questions. If subjects find the adjunct questions challenging, but not overly difficult, as in the Watts and Anderson study, a moderate level of anxiety may have been aroused. Moderate levels of anxiety facilitate performance on complex tasks. Obviously this explanation is speculative, but it does suggest that the relationships of anxiety to types of adjunct questions should be investigated in future research.

A second possible explanation for the divergent results in the Watts and Anderson and the present results might have been based upon the time subjects took to read the passages. If the typical reading time varied substantially between the studies, then the differences could be attributed to that variable. Unfortunately while there were differences in reading rate between Watts and Anderson and the present studies, these differences were not consistent across experiments 2 and 3. In Watts and Anderson reading time averaged about 2.1 minutes per passage; in Experiment 2 the mean was about 1.8 minutes per passage, while in Experiment 3 it was about 5.0 minutes per passage.

Watts and Anderson (1971) had failed to find any significant differences in average reading time per passage. There were differences in the present study. In Experiment 2 there was a tendency for subjects given adjunct application questions to take longer to read the passages, Name Questions = 1.75 min.; Application Questions = 1.93 min., $F(1,144) = 2.900$, $p < .09$. This tendency was confirmed in Experiment 3, $F(1,75) = 7.866$, $p < .01$. Name

Questions = 5.3 min.; Application Question = 6.7 min. Position of Question also had an effect on reading time in Experiment 3, $F(2,75) = 3.214$, $p < .05$, Questions Before = 5.15 min., Questions After = 6.75 min., Questions Before and After = 6.10 min. These results are consistent with the anxiety interpretation offered above. If the subjects in the present study found the application questions more difficult and thus were more anxious (relative to the subjects who were given Name Questions) than Watts and Anderson's subjects, it makes sense that the present application question subjects would spend more time completing the task, than had Watts and Anderson's subjects.

A final possibility is more speculative, but is still consistent with available data. Watts and Anderson's data were collected in 1970; the present data in 1976. Data from a variety of sources such as the Educational Testing Service and National Assessment of Educational Progress have indicated a decline in reading abilities over the last several years. It may be that this decline in reading ability has influenced the present results. Differences in reading ability can be at least partially understood as due to differences in the strategies subjects use comprehending material they read. It may be that the strategies that subjects habitually use while reading have changed in such a way as to change the way in which questions influence their performance. One way to assess this possibility would be to obtain extensive descriptions of the reading abilities of a group of students and then use these students as subjects in a study of question level effects.

The major import of the present results is that they suggest that the effects of question level are more complex than had previously been supposed. Previous theoretical models are not adequate to account for the present results. Both new models and more research will be necessary to produce such an adequate account.

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Footnotes

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Table 1

Mean Recall of Each Item Type for Each Condition in Experiment 1

Condition:	Type of Posttest Question						
Question Type and Position	Name	Factual	Definition	New Application Term-to-Example	New Application Example-to-Term	Repeated Example	Repeated Application
Application-QA	3.8	5.3	6.7	6.1	7.1	8.4	5.4
Application-QB	3.3	5.6	5.6	5.6	7.1	7.8	4.6
Application-QBA	2.9	5.7	6.0	6.3	6.7	7.4	4.8
Name-QA	4.9	5.9	6.1	5.8	7.2	8.1	4.8
Name-QB	4.3	6.7	6.7	7.1	7.8	8.9	5.2
Name-QBA	3.9	5.9	6.1	6.1	7.4	7.9	4.9

QA=question after, QB=questions before, QBA=questions before and after

Table 2

Mean Recall of Each Item Type for each Condition in Experiment 2

Condition:	Type of Posttest Question							
Question Type and Position	Short Answer	Name	Factual	Definition	New Application Term-to-Example	New Application Example-to-Term	Repeated Example	Repeated Application
Application-QA	6.3	3.0	3.0	3.3	3.0	4.1	4.3	2.7
Application-QB	6.5	3.0	2.9	3.1	3.1	3.9	4.0	2.4
Application-QBA	5.4	2.7	2.6	3.2	3.1	3.8	4.1	2.6
Name-QA	6.4	2.9	3.1	3.0	3.4	3.7	4.2	2.4
Name-QB	5.0	3.4	2.4	2.7	2.9	3.4	4.2	2.6
Name-QBA	6.0	3.4	2.9	3.0	3.1	3.4	4.0	2.3

QA=questions after, QB=questions before, QBA=questions before and after

Table 3

Mean Recall of Each Item Type for Each Condition in Experiment 3

Condition:	Type of Posttest Question				
Question Type and Position	Short Answer Application	Short Answer Repeated Example	Factual	Definition	New Application Term-to-Example
Application-QA	2.3	1.7	1.9	1.8	3.5
Application-QB	1.9	1.5	1.8	1.8	4.2
Application-QBA	1.3	1.3	2.0	1.6	3.6
Name-QA	2.1	1.7	1.8	1.7	4.9
Name-QB	2.0	2.0	1.5	1.6	4.7
Name-QBA	1.9	1.8	1.8	1.4	4.3

QA= questions after, QB=questions before, QBA=questions before and after