Spring 2015

Climbing the Taxonomy Ladder with Help from the Keyword Method

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CLIMBING THE TAXONOMY LADDER WITH HELP FROM THE KEYWORD METHOD

A Masters Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Psychology

By

My Quoc Vu

May 2015

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Psychology

Missouri State University, May 2015

Master of Science

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ABSTRACT

The keyword method is a mnemonic device used to improve memory. The purpose of this study is to examine whether the keyword method can facilitate higher-order learning and whether the interactive image component of the keyword method is necessary. Participants were asked to study 18 psychologists and their concepts. Undergraduates were randomly assigned to one of four conditions: an own best method control group, and three variations of the keyword method. The variations in the keyword method were related to the "interactive image" aspect of that strategy. The dependent measures measured whether the keyword method can facilitate higher order-learning levels as defined by Bloom's taxonomy. Descriptively, all mnemonic conditions outperformed the own best method (control) group on both matching and higher-order learning measures. However, only one statistically significant difference emerged, perhaps due in part to limited sample size. Based on effect sizes, the findings suggest that the traditional keyword method can facilitate higher-order learning. Also, the effect sizes imply that the interactive image component is not necessary in lower level learning such as "remembering" but the interactive image component is necessary for retention in higher levels of learning such as "understanding" and "applying." Descriptively, the keyword method can facilitate higher-order learning, but variations of the interactive component cannot and are less likely to improve memory compared to the keyword method.

KEYWORDS: memory, keyword method, Bloom's taxonomy, higher-order learning, interactive image

This abstract is approved as to form and content

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ACKNOWLEDGEMENTS

I would like to thank my committee chair and advisor, Dr. Russell Carney, for his support during the course of my graduate studies. I would also like to thank the other members of my committee, Dr. Wayne Mitchell and Dr. Erin Buchanan, for their support of my thesis project. Finally, I wish to thank the research assistants who helped with data collection and processing: Kayla Jordan, Spenser Phillips, and Hannah Hickman.

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INTRODUCTION

People rely on their memory for important decisions as well as mundane daily activities. Therefore, it is advantageous to have a good memory. The keyword method, a mnemonic device, can help aid our journey for a better memory. Many studies have supported the keyword method's effectiveness in improving memory (Ott, Butlier, Blake, & Ball, 1973; Atkinson & Raugh, 1975; Carney & Levin, 1998).

Even though there are studies supporting the keyword method's effectiveness, people criticize these mnemonic devices, including the keyword method. Critics say that mnemonic devices can only aid in lower levels of learning, but not in higher levels of learning that is more complicated (Worthen & Hunt, 2011; Siegel & Shaughnessy, 1994). There are many studies that support that the keyword method can facilitate higher-order learning (Pressley & Dennis-Rounds, 1980; Carney & Levin, 2000; Carney & Levin, 2008). However, there is not a study that pinpoints how much higher-order learning the keyword method can facilitate. Therefore, in this current study, I intend to do so via levels defined in Bloom's taxonomy, a classification for learning objectives (Bloom, 1956).

In this current study, I also intend to examine whether the interactive image component in the keyword method is necessary. In Dolean's (2014) study, their findings showed that the interactive component was not necessary. Since there are few studies covering this fairly new idea, I intend to add to this literature by examining the importance of the interactive component in the keyword method. I intend to do so by comparing different groups differing on the interactive image component.

LITERATURE REVIEW

Keyword Method

We are constantly trying to remember things, whether answers on a test or where we put our keys this morning. Memory is an important factor in our daily lives, and people are even willing to pay to improve their memory. Fortunately, there are inexpensive mnemonic strategies that can be used to enhance memory. Since having a good memory is very important, there are many mnemonic devices to help us improve our memory. Some of these mnemonic devices are acronyms (Izura & Playfoot, 2012), method of loci (Yates, 1966), and peg words (Carney & Levin, 2011).

A mnemonic device that has been much researched is the *keyword method*. Unlike the previously mentioned mnemonic devices that help us remember the order of information, the keyword method helps us to remember the association between two pieces of information. To understand how the keyword method works, Levin (1983) explains the technique in terms of the "three R's"- recoding, relating, and retrieving. Take, for example, the Russian word *zvonok,* meaning *bell*. First, the participant "recodes" the unfamiliar word *zvonok* by thinking of an English word that sounds similar to the foreign word. Here, zvonok sounds like the English word, *oak*. Second, an interactive mental image is formed in which the keyword (oak) is interacted with the Russian word's meaning (bell) to "relate" the two. For example, one might "imagine an *oak* growing beneath a giant *bell* jar" (Atkinson & Raugh, 1975, p. 126). The final R stands for "retrieving" the meaning of the unfamiliar word from memory. Retrieval, then,

proceeds as follows: the Russian word, *zvonk* → *oak* → image of an *oak* beneath *bell* jar → the word's meaning, *bell*.

Before the strategy was called the keyword method, there were studies supporting its effectiveness. In Ott, Butler, Blake, and Ball's (1973) study, interactive-image mnemonics (later called keyword method) was used to learn the meanings of German words. The results demonstrated that the mnemonic group remembered almost twice as many German words as the control group.

The name "keyword method" was first coined in Atkinson and Raugh's (1975) study. In their study, participants were assigned to one of two groups (control or keyword method) used to learn Russian vocabulary. The control group was told to use any method they thought was best to remember the Russian vocabulary. In contrast, students in the mnemonic group were directed to apply the keyword method. The participants studied 120 words that were broken down into 40 words per day for three days. Based upon the test results, they found that the keyword method group significantly outperformed the control group, with a mean of 72% words correct in the keyword method group, compared to a mean of 46% correct in the control group.

With the success of Atkinson and Raugh's (1975) study, other researchers became interested in other applications of the keyword method as a beneficial memory aid. The keyword method is very versatile and is not limited to just foreign language acquisition. This was demonstrated when Carney and Levin (1998) used the keyword method to learn different brain structures. Their results demonstrated that the mnemonic keyword method group significantly outperformed the repetition control group (90% vs. 72%) on a matching test over those brain structures.

Even with evidence supporting the effectiveness of the keyword method, the procedure is not free from criticisms. In Siegel and Shaughnessy's (1994) interview, Howard Gardner stated that "…schools are just going through the motions of education… ample evidence that suggests an absence of understanding..." (p. 273). Gardner suggested that our education system is teaching students to just regurgitate verbatim what they have learned without much understanding. Some people think mnemonic devices could be part of the problem. For example, Worthen and Hunt (2011) stated that "From Middle Ages to the early 20th century… mnemonics was sporadically criticized as ineffectual or even detrimental to true understanding and as such deserved no status in serious education" (p. 93).

Bloom's Taxonomy

In the present study, I plan to debunk these criticisms by using the revised version of Benjamin Bloom's taxonomy (Krathwohl, 2002; see Fig. 1) to support the claim that the keyword method can facilitate higher-order learning, which includes *understanding*. Bloom's taxonomy is a classification system of learning objectives in education (Bloom, 1956). The differences from the original and the revised versions of Bloom's taxonomy is that the levels are described using nouns in the original version but the revised version uses verbs. Also, as illustrated in Figure 1, synthesis was moved from the second from the top level in the original version to the top level and renamed creating in the revised version.

Bloom's taxonomy has six levels. Starting at the bottom they are remembering, understanding, applying, analyzing, evaluating, and creating. In the present study, I want

to show that besides facilitating performance at the lowest level (i.e., remembering), the mnemonic keyword method can facilitate performance on test items getting at the next two tiers of the revised version of Bloom's taxonomy: understanding, and applying (Krathwohl, 2002). Questions at the "remembering" level test whether the student can directly recall verbatim the original information. Questions at the "understanding" level test whether the student can explain ideas or concepts in their own words. Questions at the "applying" level test whether the student can use the information in a new way. Furthermore, when higher-order learning is mentioned, it is in reference to any learning that goes beyond merely recalling the original information in the "remembering" level of Bloom's taxonomy.

Higher-Order Learning

There are several studies that suggest that the keyword method can facilitate higher-order learning through the idea of transfer. Transfer is the concept of taking old information and using it to understand new information. This is very similar to the "applying" level in Bloom's taxonomy. Hence, evidence of transfer can be seen as demonstrating higher-order learning. For example, in J. Levin, Shriberg, Miller, McCormick, and B. Levin's (1980) study, a dual-keyword approach was used. Fourth and fifth-grade children were taught to associate U.S. states with their capitals. For example, the keyword used for Maryland was *marry*, and the keyword for its capital, Annapolis, was *apple*. Then, an illustration depicting the two keywords interacting (e.g., of two apples getting married) was provided. Both the control and the keyword method groups had the same amount of time to learn a subset of the U.S. states and their capitals. On the

second day, the participants were given another set of state capitals to learn. This time, the strategies were switched: the control group on the first day used the keyword method and the keyword group became the controls. The thought behind this manipulation was that the keyword method group would continue to use the technique even when not specifically instructed to do so. However, in both sets of state capitals, the keyword method group always outperformed the control group. In a different study involving learning Latin vocabulary, Pressley and Dennis-Rounds (1980) found that 11- and 12-year-olds could not transfer the keyword method from task to task, but that 17- and 18-year-olds could do so without any instruction.

The idea that the keyword method could facilitate transfer, the ability to generalize one task to another, raises the question as to whether the keyword method can facilitate other types of higher-order learning. For instance, Carney and Levin (2000) examined how information obtained from a close cousin of the keyword method (i.e., the face-name mnemonic) could be used to obtain similar new information in paintings. In Carney and Levin's (2000) study, the participants from the mnemonic group outperformed the controls on being able to transfer the associations from studied paintings and their artists to new, similar paintings (i.e., recognize "new" paintings by the same artist). The success in the ability to transfer and apply given information obtained through a form of the keyword method in this study suggests that the keyword method can promote higher order processes. In a later study, Carney and Levin (2008) had participants learn different phobias using either their own best method or the keyword method. One of their dependent measures required students to make reasoned inferences from definitional information. Students using the mnemonic approach significantly

outperformed the control group on these higher order test items.

More recently, Richmond, Carney, and Levin (2011) conducted a study in which participants learned different neuroscience terms, again comparing a control group to a group using the keyword method. Here again, they demonstrated that students using the keyword method were able to participate in some form of higher-order process in order to correctly answer a set of applied multiple-choice questions in comparison to controls. In addition to the use of multiple-choice questions as higher-order questions, analogies have also been examined.

In a study dealing with learning three-level fish hierarchies via the face-name mnemonic, Carney and Levin (2003) used questions involving analogies to see if participants could identify and apply the classification levels of the fish hierarchies. An example of these analogies would be *Poacher* is to *Agonidae*, as *Lasher* is to _____. Since the nature of the studied material was hierarchical, analogies based on levels were easy to form. In this study, in which the learning task will be psychologists associated with their concepts, the to-be-learned materials may not lend itself towards analogy-type questions as easily as in Carney and Levin's (2003) fish hierarchies study. All of these studies suggest that the keyword method can facilitate higher-order learning and therefore can reach higher levels in Bloom's taxonomy than the first level of "remembering."

Interactive Image

Another element to the current study is that, in addition to having an *own best method* control group and a traditional keyword method group (i.e., *keyword method A*, in which keywords and descriptions of interactive mental images will be provided), there

were two mnemonic conditions in which *separate* pictures representing keywords and concepts will be provided, presented side by side on a computer screen. In *keyword method B*, students will be directed to form their own interactions between each pair. Our third mnemonic condition, *keyword method C*, will be similar to B, except that students will *not* be directed to form interactive images. It should be noted that *keyword method C* is technically not an application of the keyword method, since it leaves out the requirement to form an interactive mental image. This condition reflects the fact that some studies have shown that the most important aspect of the keyword method might not be the interactive quality, but rather the fact that the method involved forming a visual image. Just having a visual image is one of the best indicators of an effective memory technique (Shapiro & Waters, 2005; Beaton, Gruneberg, Hyde, Shufflebottom, & Syke, 2005).

More specifically, in a recent study, Dolean (2014) had 31 Romanian 2nd and 3rd graders learn 46 words in English. The image of the new word (e.g., "chin") and the image of a keyword (e.g., the number five, which is "cinci" in Romanian, and pronounced "chin-ch") were presented. The new word and keyword were divided with a diagonal line and presented on the top and bottom corners on a card. Surprisingly, the results indicated that directions to form interactive images were not required to produce benefits in memory. Dolean (2014) argued that the interactive component of the keyword method was not necessary and also was not practical in classroom settings. There are several reasons why having interacting pictures is not so easily applied in a classroom setting. First, there is a lack of existing interacting pictures online that are necessary to convey the intended lesson. In contrast, it is easy to find individual pictures for side-by-

side presentation. Second, one could hire artists to draw interactive images, but schools may not have the funds needed to obtain them. Third, teachers may have neither the time nor ability to produce the interactive images themselves. Leaving out the interactive quality of the keyword method (as will be tested in group C) would greatly benefit teachers by giving them the ease of using clip art or the many pictures available online.

Purpose and Hypotheses

The purpose of this study is to examine whether the keyword method can facilitate higher-order learning. If the keyword method can facilitate higher-order learning, I want to explore how much it can facilitate as defined by different levels in Bloom's taxonomy. Also, I want to examine whether the interactive image component of the keyword method is necessary.

Hypothesis 1: The keyword method can facilitate the bottom three tiers of remembering, understanding, and applying in Bloom's taxonomy.

Hypothesis 2: The interactive image component in the keyword method is not necessary in lower levels of "remembering" in the Bloom's taxonomy. However, the interactive image component will be necessary for retention in higher-order learning levels.

METHOD

Participants

One hundred and sixteen undergraduate students at a Midwestern university participated in this study. Participants were assigned randomly to one of four groups: either an own best method (control) group, or one of three variations of the keyword method: A, B, or C. Participants were recruited in two different ways. Using the SONA System, students taking an introductory psychology class could sign up for the study in order to earn course credit. Also, extra credit was offered in certain upper level psychology classes in exchange for students' participation. Prior approval for this project was obtained from the Missouri State University IRB (February 12, 2015; approval #15-0129).

Procedure

A pilot study of 24 undergraduates at a Midwestern University was used to test the timing of each item and how many psychologist and concept pairs were appropriate. All of the participants studied 18 psychologists and their concepts (see Table 1). The average time that it took a participant to completely finish the study was about 40 minutes. All of the participants went through the same procedures. Depending on which group they were in, participants only differed in memory strategy. The procedures proceeded in this order.

Informed Consent - Participants signed up for specific timeslots and reported to a computer lab to participate in the study. Qualtrics, online survey software, was used in

this study. Consent forms were displayed and acknowledged on the computers before participants could continue on to the study materials. Participation in this study was voluntary and test scores were not associated with the participants' names.

Concepts and their Definitions - The participants were presented with definitions describing each concept (see Table 2). There were 20 definitions (2 of them were practice items). Each concept and definition pair was shown on the computer screen for 15 seconds. Then, they were given a matching test over these definitions. If the participant got a question incorrect, the correct definition/concept pair was shown. Participants were instructed to study the items that they had gotten incorrect.

Your Strategy - As stated earlier, participants were assigned randomly to one of four groups that differed in study strategy: either an own best method group, or one of three variations of the keyword method (see Table 3). In this section, participants were given instructions on how to use their specific strategy. In order to orient them to their strategy, there were 2 practice items, and 2 questions covering those items.

There were 4 groups that differed in memory strategy. *Own Best Method (control) Group* - Individuals in the own best method group were directed to use any method they thought was best to associate the psychologists with their concepts. For an example, see Figure 2. *Group A* - Students in the keyword method A group were provided with a keyword for each unfamiliar psychologist's surname. Then, the keyword was interacted with their concept by a way of a verbally described mental image. For an example, see Figure 3. *Group B* - Those in the keyword method B group were also provided with keywords for psychologists' names. However, instead of being provided with interactive image descriptions, they were given pictures displayed side by side (i.e., a picture

representing the keyword, and a picture representing the concept). There were brief labels on each image explaining what each image is supposed to portray and instructions to combine the two pictures into an interactive mental image. For an example, see Figure 4.

Group C - The Keyword method C was identical to B, except that there were no instructions to devise an interactive mental image. For an example, see Figure 5.

Name Familiarization - In order to get the participant to be familiarized with the materials, the psychologist's name and/or the keyword was presented for 8 seconds each before the actual studying of the psychologist/concept associations. If a participant was in the own best method (control) group, they were shown 20 psychologists' names. If a participant was in one of the three mnemonic conditions (A,B,C), they were shown 20 psychologists' names and their associated keyword.

Review page - As a reminder, the participant will see a brief description of their strategy. They will see one example of what they will see in the actual study section.

Actual Study - The participant will see 18 psychologists with their concepts plus material that is specific to their own group for 20 seconds each.

Filler Task- The participant saw 9 pictures of famous singers. Only 3 pictures of singers were presented on the screen at a time. It was not timed. The participant was asked to list all of the songs sung by the singer in the presented picture. This task was only used to distract the participants from holding the previous information in their short-term memory.

Level 1 "Remembering" Test - The three dependent measures were written to correspond with the three bottom levels of Bloom's taxonomy. First, the participants took an 18-item matching test over psychologists and their associated concepts. This exam

tested how well they "remembered" the 18 associations (Level 1). For an example of a question in this level, see Figure 6.

Level 2 "Understanding" Test - This was followed by a 9-item matching test that assessed how well they "understood" the material (Level 2). Each item in this test had two parts. At first, the participants saw a definition of the concept that was worded differently from the definition that was given at the beginning of the study. The participant then took that reworded definition and matched it to the corresponding concept. Then, the concept was to be matched to a psychologist. For an example of a question in this level, see Figure 7.

Level 3 "Applying" Test - The last test that the participants took was a 9-item multiple-choice test that assessed how well they could "apply" their knowledge (Level 3). These questions were all scenario-type questions that put the concepts in an applied setting. The answer choices were the psychologists' names. In order to get the correct answer, the participant had to correctly identify the name of the concept from the described situation, and then connect the concept to the psychologist's name. The 9 concepts examined in this test were different from the 9 concepts examined in the previous test. For an example of a question in this level, see Figure 8.

Questionnaire - The questionnaire asked questions such as "Did you have trouble learning the memory strategy?", "How many of these psychologist/concept pairs did you already know before?", and "If you were in the Own Best Method group, what technique did you use to remember the associations?" The questionnaire also asked demographic questions such as their student status (eg., freshman) and whether their major was psychology.

RESULTS

A One-Way between subjects ANOVA was used to compare three dependent variables (3 different levels) differing only on memory strategy. There were four groups that differed in memory strategy (own best method (control), A, B, C). Even though there were 116 students that participated in this study, there were 27 missing cases in level 1, 27 missing cases in level 2, and 3 missing cases in level 3. Since there were numerous tests involved in this study, the missing cases could be attributed to participants being discouraged and not try their best. Due to small sample sizes and not being able to objectively identify the participants that not tried their best on this study, none of the original data was removed by the researcher.

Out of the three levels, only level 1 ($F(3, 73) = 3.36$, $p = .02$, $\eta_p^2 = .12$) was statistically significant. Level 2 ($F(3, 73) = 1.41$, $p = .25$, $\eta_p^2 = .06$) and level 3 ($F(3, 73) = 1.57$, $p = .20$, $\eta_p^2 = .06$) was not significant. A Tukey *post hoc* test was used to compare the differences between groups. Descriptively, on level 1, all three mnemonic conditions of group A (80%), B (77%), and C (72%) outperformed the own best method (control) group (56%). However, only group A significantly outperformed the control group ($p = .03$, $d = .99$) on level 1. These means are shown in Table 4.

Hypothesis 1

Based on a large effect size between group A and the control group in level 1 ($p = .03$, $d = .99$), medium effect size in level 2 ($p = .35$, $d = .61$), and medium effect size in level 3 ($p = .16$, $d = .75$), it suggests that the traditional application of the keyword

method (group A) was able to facilitate high-order learning (i.e., on questions that measured "understanding" and "applying"). For a table of effect sizes (Cohen's *d*), see table 5.

Hypothesis 2

Even though it was not statistically significant, there were medium effect sizes between the control group and group B ($p = .07$, $d = .77$), and between the control group and group C ($p = .20$, $d = .54$). This finding seems to imply that not only is the traditional keyword method (group A) a helpful memory aid, but a self-generated interaction (group B), and even no interaction at all (group C) might be helpful in "remembering" information.

Group B ($p = .07$, $d = .77$) and Group C ($p = .21$, $d = .54$) had medium effect sizes between the control group in level 1. However, group B versus control had small effect sizes in level 2 ($p = .80$, $d = .27$) and level 3 ($p = .47$, $d = .44$). Group C versus control also had small effect sizes in level 2 ($p = .99$, $d = .05$) and level 3($p = .75$, $d = .29$). In level 2, group A versus the group C had a medium effect size ($p = .29$, $d = .62$). Group A had the traditional keyword method in which the interaction of images were present, and group C had images that were not interacted. Therefore, group A may be able to facilitate higher-order learning, while group B and group C may not be able to facilitate higher-order learning. These findings suggest that the interactive image component is not necessary in lower learning of "remembering" as in level 1, but it is necessary in higher-order learning such as "understanding" in level 2, and "applying" in level 3.

DISCUSSION

Descriptively, overall, group A performed the best, group B scored 2nd best, group C scored third best, and the best method (control) group performed the worst. These results were expected because group A is the typical version of the keyword method. In Group A, a verbal description of interaction of the keyword and target word was provided. Group B should perform the second best because the participants were instructed to interact the pictures, but the interaction was not explicitly provided as in group A. Group C was expected to be the third best because there were no instructions to interact the pictures, and therefore the interactive image aspect was absent.

Based on large and medium effect sizes between the control group and group A in all three levels, it suggests that the traditional keyword method (group A) may be able to facilitate higher-order learning. If this were true, it would be a convincing argument to implement the keyword method in educational settings because it can not only help students "remember," but also help them "understand" and "apply" the information that they have learned.

Descriptively, the performances of the mnemonic groups (A, B, and C) were not very different. All of the mnemonic groups consisted of an image of the keyword whether it was verbally described or provided. The only differing condition between the mnemonic groups is how the images were interacted. Since the interactive component is the only difference between the mnemonic groups, it could suggest that the interactive image component in the keyword method might not be as an important component for retention as we once thought.

Interestingly, there was a medium effect size between the control group and group C in level 1. Consistent with Dolean's (2014) findings, it suggests that the interaction requirement of the keyword method may not be necessary. If this finding were true, it would be very beneficial in educational settings. Teachers could easily place two pictures side by side to convey the intended association instead of digging through the scarce resource of existing interacting pictures.

However, alternative forms of the keyword method such as a self-generated interaction (group B) and no interaction at all (group C) were not successful in achieving large or medium effect sizes in levels 2 and 3. These results show that the variations may be helpful memory aids at the lower "remembering" level, but are not successful in facilitating higher-order learning at the "understanding" and "applying" levels.

In level 2, the means for all of the groups were descriptively higher than level 1 and level 3. This could be due to previous practice in the matching test with the concept's definitions at the very beginning. Due to a small sample size, there could also be outliers that are making that level descriptively higher than the rest. Future research should replicate this study with larger sample sizes. Due to small sample sizes, there was only one statistically significant difference (between control group and group A in level 1), and therefore conclusions were based primarily on means and effect sizes. Another limitation to this study was the numerous tests that might have discouraged the participants from performing to their full potential. Since duration of the tests was not accurately recorded, there was no objective way of removing participants who did not try their best on this study.

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Table 1 Psychologists and Their Concepts

Psychologist	**Concept**
Adler, Alfred*	Inferiority Complex*
Ainsworth, Mary*	Attachment Theory*
Asch, Solomon	Conformity
Batson, Daniel	Empathy-Altruism Hypothesis
Ebbinghaus, Hermann	Forgetting Curve
Festinger, Leon	Cognitive Dissonance
Gibson, Eleanor	Visual Cliff
Gilovich, Thomas	Spotlight Effect
Kohlberg, Lawrence	Stages of Moral Development
Kubler-Ross, Elizabeth	Stages of Grief
Lewicki, Pawel	Reward Theory of Attraction
Miller, George	Seven plus or minus two
Schwarz, Bennett	Tip-of-the-Tongue Phenomenon
Seligman, Martin	Learned helplessness
Sperry, Roger	Split-brain research
Steele, Claude	Stereotype Threat
Thaler, Richard	The Nudge Theory
Thorndike, Edward	Halo Effect
Wolpe, Joseph	Systematic Desensitization
Zajonc, Robert	Mere Exposure Effect

Note. The items that have asterisks by them served as practice items and was not included in the final tests.

Table 2 Concepts and Their Definitions

Concept	Definitions
Inferiority Complex	Feeling like you're not good enough
Attachment Theory	A child needs to develop a good relationship with a caregiver for them to have a successful social and emotional development in the future.
Conformity	Group pressure can change your opinion
Empathy-Altruism Hypothesis	Feeling empathic for a person in need motivates helping, even though it does not benefit yourself
Forgetting Curve	Information is lost over time
Cognitive Dissonance	Mental stress from having beliefs that conflict with your actions
Visual Cliff	Used to measure perceptual differences in infants
Spotlight Effect	People overestimate the amount of attention that is focused on them
Stages of Moral Development	Your judgments as to what's right and what's wrong throughout your life
Stages of Grief	Describe the experience when facing their own death
Reward Theory of Attraction	People are attracted to those who remind them of someone who makes them feel good
Seven plus or minus two	The average amount a person can hold in their working memory
Tip-of-the-Tongue Phenomenon	You can't entirely name an item, but you can vaguely remember it
Learned helplessness	Repeated failure with a task leads one to give up and not try
Split-brain research	The left and right hemispheres of the brain have different functions
Stereotype Threat	The potential of confirming a negative existing view about themselves
The Nudge Theory	Indirect and non-forced suggestions can influence others
Halo Effect	Your overall impression of a person affects your judgment on specific traits of them
Systematic Desensitization	Gradual exposure can help overcome fears
Mere Exposure Effect	Seeing the same thing a lot makes you start to like it more

Table 3 Components of the Four Conditions

Condition	Keyword present	Verbal description of interaction	Two pictures side-by-side	Instructions to interact pictures
Own Best Method	No	No	No	No
Keyword Method A	Yes	Yes	No	No
Keyword Method B	Yes	No	Yes	Yes
Keyword Method C	Yes	No	Yes	No

Note. Keyword Method C is not technically the "keyword method" since if leaves out the interactive image component.

Table 4
Mean Percent Correct and Standard Deviation by Condition on 3 Different Level Tests

	Own Best Method (n = 21)	A (n = 19)	B (n = 18)	C (n = 19)
Level 1 Matching Test				
18 Psychologists	56.2%	79.7%	76.9%	72.4%
(*SD*)	(29.02)	(16.37)	(24.50)	(30.57)
Level 2 Matching Test				
9 Definitions	72.0%	86.3%	79.9%	70.5%
(*SD*)	(29.16)	(16.70)	(28.72)	(31.70)
Level 3 MC Test				
9 Scenarios	57.7%	76.6%	71.0%	66.7%
(*SD*)	(29.11)	(20.25)	(30.99)	(32.29)

Table 5 Cohen's *d* Effect Sizes

Level 1 "Remembering"			
	A	B	C
Control	- .99	- .77	- .54
A		.14	.30
B			.16
Level 2 "Understanding"			
	A	B	C
Control	- .61	- .27	.05
A		.27	.62
B			.31
Level 3 "Applying"			
	A	B	C
Control	- .75	- .44	- .29
A		.21	.37
B			.14

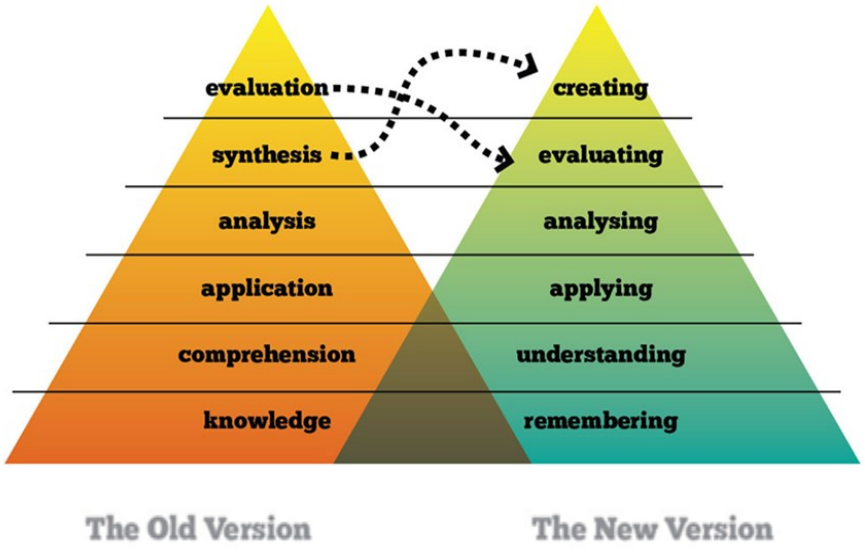


Figure 1. Bloom's Taxonomy: Original and revised versions (Krathwohl, 2002)

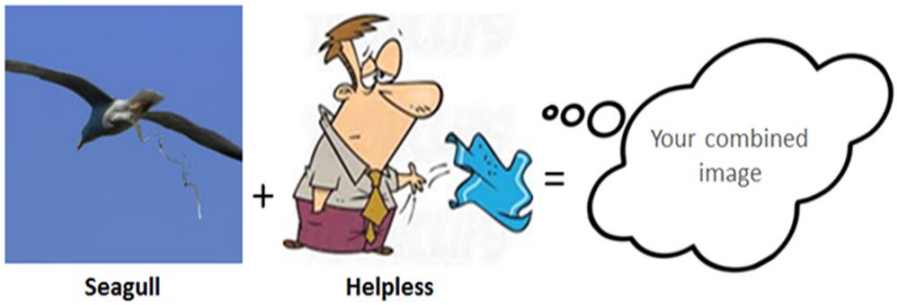
Seligman = Learned Helplessness

Figure 2. Own best method group example

Seligman (*seagull*) = Learned Helplessness

Imagine seagulls (*Seligman*) pooping on a man so much that he feels helpless and does not try to clean it.

Figure 3. Group A example



Seligman *(seagull)* = Learned helplessness

Figure 4. Group B example

Seligman *(Seagull)* = Learned Helplessness

Figure 5. Group C example

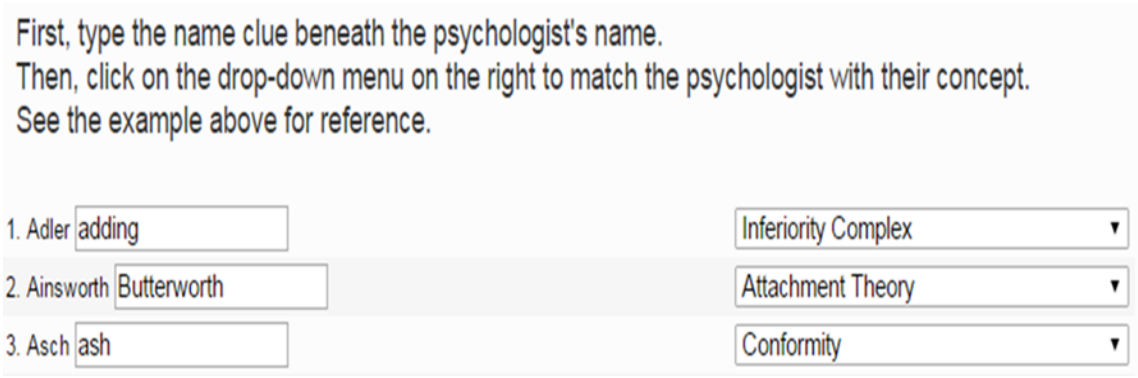


Figure 6. Example of level 1 question

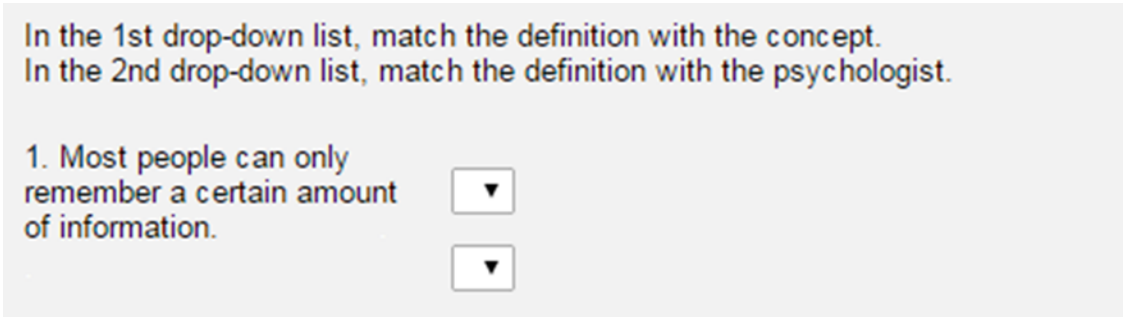


Figure 7. Example of level 2 question

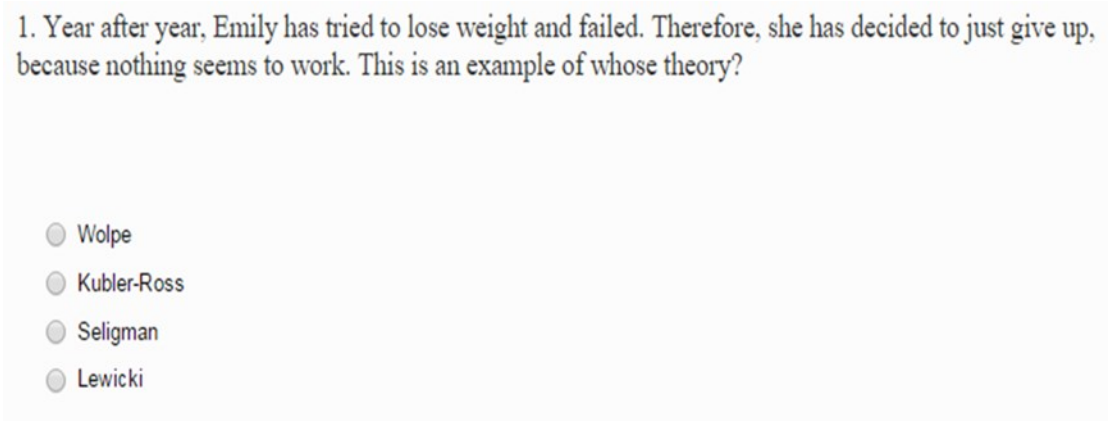


Figure 8. Example level 3 question