

Mnemonic Strategies: What Are They? How Can I Use Them? And How Effective Are They?

**Margo A. Mastropieri, Thomas E. Scruggs, Janet Graetz,
Judith Fontana, Victoria Cole, and Andrea Gersen**

George Mason University

Many students with learning disabilities experience difficulties when required to learn school-related information. The demands of learning and remembering vast amounts of new content in domains such as science, social studies, and vocabulary increase greatly as students advance in grade level. The importance associated with learning and remembering school information has also increased as school performance and graduation requirements have become linked to standards on statewide high-stakes tests. This has led to increased concern on the part of many students with learning disabilities; as expressed by one student, “How do they expect me to remember all this stuff?”

Many methods for enhancing memory have existed for years, some going back as far as the time of the Ancient Greeks (see Yates, 1956 and Underwood & Schultz, 1960, for discussions). One strategy that has proven particularly effective for helping students with learning disabilities to learn and remember unfamiliar school-related content is mnemonic strategy instruction (Forness, Kavale, Blum, & Lloyd, 1997; Pressley, Levin, & Delaney, 1981).

Mnemonic (memory-enhancing) strategy instruction helps make unfamiliar information more concrete and familiar by linking new information with prior knowledge using visual and auditory cues. This enhanced familiarity and concreteness helps make information more memorable (Paivio, 1971). The most effective mnemonic strategies use systematic encoding techniques and direct retrieval links to recently learned information (Mastropieri & Scruggs, 1998; 2002). In addition, mnemonic strategies that are especially effective utilize elaborations in which pieces of information are linked together in interactive images, pictures, or verbal phrases. While typically developing students may begin to use types of elaborative mnemonic strategies independently, students with learning disabilities frequently do not (Rohwer, Raines, Eoff, & Wagner, 1977). Fortunately, however, research has demonstrated that when students with learning disabilities are taught using mnemonic strategies, their performance increases significantly (Scruggs & Mastropieri, 2000; 2002).

WHAT ARE MNEMONIC STRATEGIES?

One example of a mnemonic strategy that provides encoding and retrieval features and interactive elaborations is the keyword method. The keyword method works best when newly introduced information is unfamiliar and needs to be linked to already familiar information. When using the keyword strategy, unfamiliar information is first made more concrete by changing the new unfamiliar word into an acoustically similar but concrete word. For example, to learn that the vocabulary word “buncombe” means “empty, insincere speech or talk,” first, think of an acoustically similar, familiar and easily pictured keyword (see Figure 1). In this case, *bun* would be a good keyword because it sounds like buncombe, is concrete, and is easily pictured. Then, think of an interactive picture of a bun and its definition doing something together. In this example, a picture of a person giving an insincere or empty speech with the audience throwing buns at the speaker would be a good example. When asked to retrieve the word buncombe, first, think of the acoustically similar, concrete and familiar keyword, *bun*. Then think back to what was happening in the picture with the bun in it; in this case, it was “an audience throwing buns at a speaker delivering an insincere and empty speech.” Finally, retrieve “insincere speech or empty talk” as the definition of buncombe (Mastropieri, Scruggs, & Fulk, 1990). In this case also, the definition is enhanced with an audience member stating, “This speech is empty, insincere, and contrived!!”

BUNCOMBE (bun)

Buncombe describes talk that is empty, insincere, or merely for effect, like humbug.

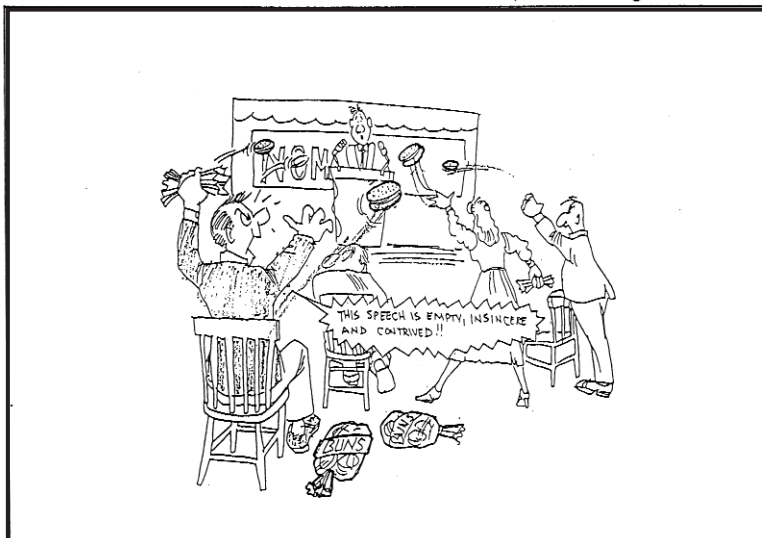


Figure 1 Menmonic Illustration of Buncombe

Mnemonic strategies are versatile and can be used in many different ways to facilitate learning of unfamiliar information. There are combinations of keyword and keyword strategies, pegword strategies (for remembering numbered or ordered information), and combinations of keyword and pegword strategies that have been successfully implemented with students with learning disabilities across a wide range of content areas. The previous example used English vocabulary, but this same type of procedure has been applied to learning unfamiliar social studies content, science content, and foreign language vocabulary. In all instances, the keyword strategy or combinations of the keyword strategies can be used to facilitate the learning of unfamiliar names of people, places, concepts, and events.

HOW CAN I USE MNEMONIC STRATEGIES IN MY TEACHING?

Mnemonic strategies have been developed across a variety of content domains and have proven successful with students with learning disabilities from elementary to high school grade levels. Examples across many of those content areas are now presented.

Social Studies Content Examples

Social studies content contains many unfamiliar names, places, events, and vocabulary for students with learning disabilities (Mastropieri & Scruggs, 1991). Adaptations of the keyword method have been successfully applied to

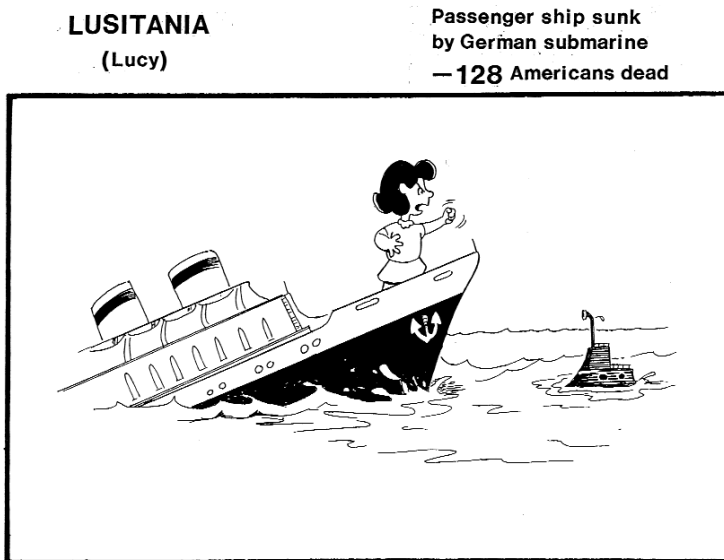


Figure 2 Menmonic Illustration of Lusitania

student learning of all of those social studies areas. For example, when learning information about the causes leading up to U.S. involvement in World War I, students are typically required to know about the sinking of the Lusitania and the Zimmerman incident. Both of these major World War I events can be taught using mnemonic strategies. To learn that the Lusitania was a passenger ship sunk by a German submarine and 128 Americans were killed, apply the same development principles described previously. First, create a keyword for Lusitania; in this case, *Lucy* from Charles Shultz' *Peanuts* cartoon strip would be a good concrete proxy for the Lusitania because it is acoustically similar, very concrete, familiar to students, and easily pictured. The interactive picture could show Lucy standing on the ship that is being sunk by a German submarine with the information about 128 Americans also being killed, as in Figure 2. When asked to retrieve the information about the Lusitania, tell students to think of the keyword that sounds like Lusitania (Lucy) and to remember what else was happening in that picture with Lucy in it to retrieve the information. Since Lucy was standing on a ship being sunk by a German submarine and 128 Americans were killed, students retrieve that the Lusitania was a passenger ship that was sunk by a German submarine and 128 Americans were killed (Mastropieri & Scruggs, 1988).

Figure 3 is an example containing directions appearing with the interactive illustration to help students remember the Zimmerman incident. This mnemonic strategy helps students learn that the Zimmerman incident consisted of

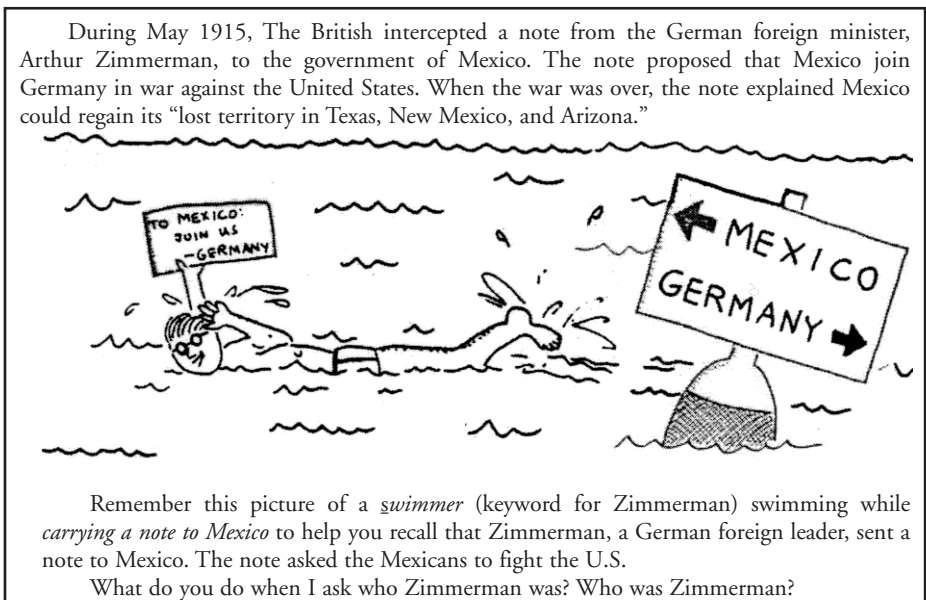


Figure 3 Mnemonic Illustration of the Zimmerman Incident

Germany sending a coded note to Mexico asking it to fight the United States along the Texas-Mexico border. Because that coded note was intercepted by the United States, the incident was another leading cause for U.S. involvement in World War I. In Figure 3, the keyword *swimmer* represents Zimmerman and is shown swimming with a coded note to Mexico from Germany. The note says: "To Mexico: Join us.—Germany." When asked about the Zimmerman incident, students first retrieve the keyword "swimmer." They then think about what was happening in the picture with the swimmer in it. Finally, they retrieve the information about a coded note being sent to Mexico from Germany asking Mexico to fight the United States.

More recently, Fontana (2002) implemented mnemonics strategies to teach vocabulary associated with high school world history classes. Fontana developed and designed mnemonic techniques for key vocabulary identified by the inclusive high school teachers. One example includes teaching the definition of anarchist, meaning people opposed to all government. The keyword *ant* (for anarchist) was shown knocking down a dome similar to the Capitol, which represented government. Regularly assigned teachers implemented the mnemonic instruction in their classes over several weeks, introducing only a few strategies at a time. Teachers presented the mnemonics using overhead projectors while students had small cards containing the interactive pictures for independent practice with the materials.

Keyword-keyword strategies. Keyword strategies are ideally suited to situations where unfamiliar content is to be associated with familiar content as in the previous examples. However, when both pieces of information are unfamiliar to students, two keywords can be combined to develop a single mnemonic strategy. For example, keyword-keyword strategies have been developed to help students learn the names of the states and their capitals (Mastropieri, Scruggs, Bakken, & Brigham, 1992). When both the state and the capital names are unfamiliar or difficult to picture, develop keywords for both and design an interactive illustration containing both keywords doing something together. Students can be taught to retrieve the information by selecting either the state name or the capital name. Since the capital name, Baton Rouge, and its state name, Louisiana, might be unfamiliar to many students with learning disabilities, create two interacting keywords in an interactive illustration. In this case *baton* and *rouge* are good keywords for Baton Rouge and *Louise* and *Anna* are good keywords for Louisiana. Both keywords could be interacting as in the illustration in Figure 4 in which "Louise and Anna," who are wearing rouge, are twirling batons. When asked what is the capital of Louisiana, prompt students to think of the keywords "Louise" and "Anna" (for Louisiana), to think back to what was happening in that picture (they were twirling batons and wearing

Louisiana
(Louise, Anna)

Baton Rouge
(baton, rouge)



Figure 4 Mnemonic Illustration of Baton Rouge as the Capital of Louisiana

rouge), and to retrieve Baton Rouge. When asked in the reverse order (“Baton Rouge is the capital of what state?”), prompt students to first think to the key-word for Baton Rouge (batons and rouge). Then, they should ask themselves what was happening in that picture (Louise and Anna were wearing rouge and twirling batons) and retrieve Louisiana as the state name (Louise and Anna = Louisiana).

Using pegwords. Often, students are required to learn information that is numbered or ordered. In these cases, the use of a pegword strategy can be combined with a keyword strategy to facilitate recall. Pegwords rhyme with numbers and represent numbers that can be placed in interactive illustrations to help facilitate recall. The following are commonly used pegwords:

- One is bun.
- Two is shoe.
- Three is tree.
- Four is door (or floor).
- Five is hive.
- Six is sticks.
- Seven is heaven.
- Eight is gate.

- Nine is vine (or line).
- Ten is hen.

Pegwords are usually easy for students with learning disabilities to learn and can be mastered by simply practicing the list a few times. Then, substitute a pegword for a number within interactive illustrations with the to-be-associated information, just as in the keyword illustrations. For example, to learn that insects have six legs, first teach the pegword sticks for six, then teach students to think of an insect walking on sticks (or show an interactive illustration of the information). Finally, when asked “How many legs does an insect have?” students are taught to think of “insects” and what was happening in the picture with the insects in it, recall that the insects were walking on sticks, remember that sticks represented six, and respond with the number six. Conversely, when students are asked, “What has six legs?” prompt them to think of the pegword “sticks” for six, to remember what was happening in the picture with the sticks in it (an insect was walking on sticks), and to retrieve “insect.” To help remember that spiders have eight legs, show a picture of a spider spinning a web on a gate (pegword for eight).

Pegwords can also be combined with letter strategies (in this case, acronyms) to remember relevant information. For example, to remember freedoms guaranteed in the First Amendment to the U.S. Constitution, picture a rap singer who “raps about buns.” Bun is the pegword for one, or First, Amendment, and RAPS is an acronym for the freedoms of religion, assembly, press, and speech.

Keyword-pegword strategies. Keywords and pegwords can be combined when learning unfamiliar information with an associated number. Many students are required to learn the order of the U.S. Presidents as part of their social studies requirements. Pegwords can be combined with keywords for learning the order of the U.S. Presidents. For example, to learn that Thomas Jefferson was the third President, use *tree* as the pegword for third President (or President number 3) and *chef* as a good keyword for Jefferson. Think of (or show) a picture of a “chef sitting in a tree” to help remember that Jefferson was President number three. When asked to recall the information, students can be taught to retrieve the information in two different ways. First, when asked to remember who was President number three, tell students to think of the pegword tree (for three) and remember what was happening in the picture with the tree in it. Since a chef was sitting in the tree, recall that “chef” represented Jefferson and therefore Jefferson was the third president of the U.S. When asked to retrieve the information in the reverse order such as “What number president was Jefferson?” think of the keyword for Jefferson (chef) and then think of what was

happening in the picture with the chef in it. Since a chef was sitting in a tree, retrieve that tree represents three and recall that Jefferson was President number three. If all President names are not familiar to students such that a keyword will prompt the President name (e.g., *film* = Fillmore), practice the relevant Presidents' names until they become more familiar.

Science Content Examples

Mnemonic strategies have also been successfully designed and implemented in the science content area (e.g., Scruggs, Mastropieri, Levin, & Gaffney, 1985). The principles for developing and using the strategies are identical to those described in social studies. For example, to learn that the mineral topaz is eight on the Mohs hardness scale, think of the pegword *gate* for "eight" and the keyword *top* for "topaz." Then remember a picture of a top spinning on a gate. When asked to retrieve what number topaz is on the hardness scale, think of the keyword for topaz (top), what was happening in the picture with the top in it (spinning on a gate for eight), and retrieve eight. This mnemonic can be practiced retrieving the information the opposite way. When asked: "What mineral is eight on the hardness scale?", tell students to think of the pegword for eight (gate), think back to the picture with the gate in it and what was happening (top spinning on a gate), and retrieve the answer topaz (keyword for top) as in Figure 5.

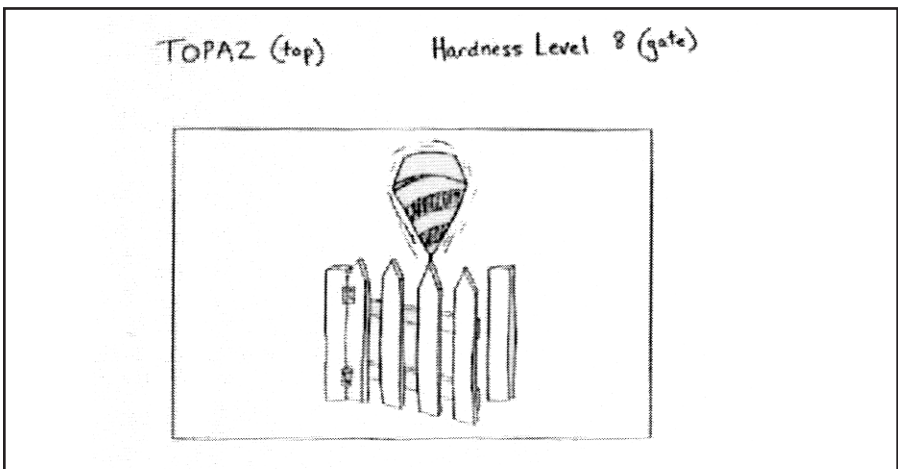


Figure 5 Mnemonic Illustration of The hardnes Level of Topaz

Multiple attributes. Multiple attributes can be combined within one mnemonic illustration to facilitate learning of more than one item. In learning about minerals, students may be required to learn not only the hardness level, but also the color and common use of the mineral. For example, a keyword-

pegword strategy can be combined as described above, but the keyword can also be colored in the actual mineral color to represent the mineral's color. In addition, the common use can be represented in an interactive fashion with the other pictorial elements. For example, wolframite is four on the hardness scale, black in color, and is a source of tungsten for filaments used in making light bulbs. All of these pieces of information can be depicted in an interactive illustration of a "black wolf standing on a floor surrounded by light bulbs" in which *black* represents the color of wolframite, *wolf* is the keyword for wolframite, *floor* is the pegword for four, or the hardness level, and the *light bulbs* represent a common use of the mineral. Research has indicated that learning is greatly facilitated for students with learning disabilities when combinations of facts are integrated within one illustration (e.g., Scruggs, Mastropieri, Levin, & Gaffney, 1985).

Chemistry content. More recently, we have been designing and implementing mnemonic strategies to help facilitate the learning and memory of complex chemistry content in inclusive high school classes. The same principles are implemented, but the content level appears more complex than that for which some of the earlier mnemonics were developed (see Mastropieri & Scruggs, 2000, for additional details). Some of the information in chemistry requires learning the names and accomplishments of important people such as Mendeleev. To learn that Mendeleev was the Russian who developed the first periodic table in 1871, students were taught the keyword *men dealing* for Mendeleev and shown a picture of "men dealing cards from the periodic table" to represent that Mendeleev developed the first periodic table of elements. Instructional steps remained similar to those described previously. When asked to retrieve who Mendeleev was, students were taught to think of the keyword (men dealing) and what was happening in that picture. Once they retrieved "men dealing cards from the periodic table" they were able to remember that Mendeleev was the Russian who developed the first periodic table.

Chemistry content is cumulative in nature and tends to be more abstract and complex. Students are required to learn a great deal of information about the periodic table, including the attributes associated with the general organization of the periodic table. They must know that on the periodic table, periods go across in rows and groups go up and down in columns. Mnemonics that teach those facts could include learning that (a) *periods end sentences that go left to right* to help remember that periods on the periodic table go left to right and (b) things *grow up* to help remember that groups (*grows*) go up and down in columns. These mnemonics can be pictured on a smaller periodic table to help reinforce the information. In our

research, additional pieces of information were continually embedded within the periodic table whenever teachers identified critical content that needed to be mastered by students. Additional characteristics about the periodic table included that (a) mass and electron affinity increase across periods; (b) size decreases across the periods; (c) reactivity and atomic radius increase across groups; (d) electron negativity decreases across groups; and (e) halogens and earth metals are examples of groups.

Peer tutoring with mnemonics in chemistry. Once students have learned the steps in mnemonic strategy instruction, they can practice those strategies independently with peers. Tutors can serve to promote recall of important terms as well as related information and meaningful verbal elaborations on the conceptual foundations of that information. The tutoring chemistry materials contain questions about the important content, mnemonic illustrations, and questions for peer tutors to ask their partners for follow-up and for related information about and elaborations on the specific content (Mastropieri & Scruggs, 2002). For these materials, we used commercially available clip art to develop mnemonic illustrations and found them to be very useful.

In our recent research, students have worked with partners as tutoring buddies in high school inclusive chemistry classes practicing abstract chemistry content together (Mastropieri & Scruggs, 2002). Reciprocal tutoring or tutoring in which students reverse roles and serve as both tutor and tutee was implemented. The tutoring materials contained new information and related information about a chemistry concept. Elaborative questions were included in the materials to help link additional information required for all students. Materials were designed so that if the initial information were known, the mnemonic strategy could be skipped, and just the associated related information could be practiced. However, for use when necessary, the mnemonic strategy was embedded in the materials for students who required extra assistance in mastering the main information. To learn that a mole represents atomic weight in grams, a strategy was developed as in Figure 6. Figure 6 displays the materials tutors would see and contains tutoring directions. For example, the first thing tutors would say is, "What is a mole?" If partners answered correctly, tutors skipped down the page and asked, "What else is important about moles?" After that question had been practiced, tutors asked, "What is an example of a mole?"

If students were incorrect on the initial response, tutors presented the mnemonic strategy to help facilitate the learning. In this case, tutors said, "Think of the word 'mole' (mole the animal for mole in chemistry). Now think of this picture of a 'mole on a scale looking at his weight in grams' to

What is a mole?

Your weight in grams is . . .



Atomic weight in grams of an element or compound

If your partner is correct, go to →

If your partner doesn't know the answer, review the strategy.

STRATEGY: Think of the word "mole." Then, think of this picture of a mole on a scale looking at his weight in grams, to help you remember that a mole is the atomic weight in grams of an element.

Then ask: *What is the strategy to remember mole?*

Then ask again: *What is a mole?*

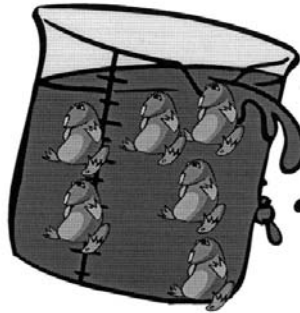
→ *Then ask: What else is important about moles?* [Answers include: The mole serves as a bridge between the invisible world of atoms and the macroscopic world of materials and objects]

Then ask: *What is an example of a mole?* [Answers include: O (oxygen) is atomic weight 16, so 1 mole O = 16 grams O]

Figure 6 Mnemonic Illustration of a Mole

help you remember that a mole is the atomic weight in grams of an element.” Tutoring materials contained a mnemonic interactive picture that was shown to tutees. Following the mnemonic strategy practice, tutors proceeded to the next questions on the related information: “What else is

What is Molarity?



Concentration of a solute in a solution; moles per liter.

If your partner is correct, go to →

If your partner doesn't know the answer, review the strategy.

STRATEGY: Think of the word “moles” for mole, and remember the picture of a number of moles in solution, to remember molarity is the concentration of a solute in a solution, in moles per liter.

Then ask: *What is the strategy to remember molarity?*

Then ask again: What does molarity mean?

→ Then ask:

What else is important about molarity?

[Answers include: molarity is a ratio, moles of solute divided by liters of solution]

Figure 7 Mnemonic Illustration of a Molarity

important about moles?” and “What is an example of a mole?” Correct answers were also included on the tutoring materials and tutors continuously provided corrective feedback. Once students had completed practicing a set of about four to five strategies, students reversed roles so that each acted as a tutor and a tutee.

Figure 7 contains a follow-up example of the chemistry materials. In this case, notice that the question “What is molarity?” was asked and that the same mnemonic illustration of a “mole” was used in representing the answer. In this case, several smaller moles are shown in the solution to indicate that molarity is “moles per liter or the concentration of a solute in a solution.” Again, the related information questions followed the mnemonic strategy and included, “What else is important about molarity?”

During tutoring sessions, students had recording sheets to document the date they practiced each strategy and whether or not they had mastered the content. Initially, all students in our 10th grade chemistry classes checked off they had mastered the content they practiced on day 1. However, when the teacher noticed the students’ responses, she said, “Since I see check marks indicating you have learned all the information, it means we are ready for a quiz, right?” Immediately following the teacher’s comment, students erased the check marks in the mastered column of their checklists and indicated that they still needed practice learning the information in the materials. This situation demonstrates the need for careful teacher monitoring during tutoring sessions when students are using materials more independently. We have seen that students may have the tendency to say they have learned the information prematurely.

Independent Student Generation of Mnemonic Strategies

Students can also be taught to generate their own mnemonic strategies independently (King-Sears, Mercer, & Sindelar, 1992). Initially, teachers can model the way to develop effective mnemonic strategies. Steps such as the following can be beneficial for creating mnemonic strategies:

- Identify important information.
- Generate a keyword for the unfamiliar word.
- Generate (imagine or draw or use clip art) a picture in which the keyword is interacting with the answer.
- Practice using the strategy until the information is learned (see also Fulk, 1994; Fulk, Scruggs, & Mastropieri, 1992).

King-Sears, Mercer, and Sindelar (1992) introduced the IT-FITS strategy to promote independent mnemonic strategy use with students with learning disabilities. Their strategy consisted of the following steps:

- Identify the term.
- Tell the definition of the term.
- Find a keyword.
- Imagine the definition doing something with the keyword.
- Think about the definition doing something with the keyword.
- Study what you have imagined until you know the definition.

(King-Sears et al., 1992, p. 27)

Although students with learning disabilities have been taught to successfully generate mnemonic strategies independently, research findings indicate that they learn more content in shorter instructional time periods when mnemonic strategies are developed and presented by teachers (see Scruggs & Mastropieri, 1992, for an example). This does not imply that teachers should not encourage students to develop strategies independently. However, it does imply that teachers should think carefully about the allocated time for specified subject areas and content-to-be-covered and make good instructional decisions regarding strategy instruction based on that information. In other words, if there is sufficient time for students to learn to develop and generate their own strategies, encourage them to do so. However, if little instructional time is available and strategies are already developed, teach students using the previously developed strategies. Remember, once mnemonic materials are developed, they can be used again and again.

Final Tips For Developing and Using Mnemonic Strategies

When developing mnemonic strategies, it is important to prioritize the content to be learned and select the key pieces of information that need to be associated before developing strategies. Think of the following as a guideline for development and instruction:

- First, prioritize content to be learned. Select only the most important content to be learned. Rely on your district curriculum guides and state level standards of learning.
- Second, select content to be learned that is unfamiliar to the target students. Make lists of the unfamiliar content and the to-be-associated information.

*QUESTION
INFORMATION*

- Buncombe
- Lusitania
- Molarity

TO-BE-ASSOCIATED

empty or insincere speech
passenger ship sunk by a
German submarine
concentration of a solute in
a solution

- Third, create keywords that are acoustically similar, familiar, and concrete to target students. Remember to brainstorm strategies, and remember also that you get better at creating keywords with practice!
- Fourth, create interactive illustrations of the keywords and the to-be-remembered information. The illustrations can be drawn by hand (they don't have to be "artistic," just recognizable), created with cut-outs from magazines, or drawn by an artistic student. Remember also that clip art can help with the development of almost any picture. Clip art with thousands of illustrations is available commercially or can be found on the internet for free by using a search engine and typing in "clip art" and the name of the picture you need.
- Fifth, introduce the materials to your students. Provide ample opportunities for students to practice using the strategies. Monitor their strategy usage, as practicing one time will probably be insufficient. Mnemonics are usually very effective, but like any learning task, they must be practiced until they are mastered.
- Finally, teach the students how to use the strategy independently. When presenting new information, say to students, "This information is important to remember, so what is a good strategy we can use to remember it?" Encourage students to practice learning and retrieving the information using the strategies.

HOW EFFECTIVE ARE THEY?

Mnemonic strategy instruction for students with learning disabilities and other mild disabilities has been studied experimentally for almost 20 years. Forness et al. (1997) reported that research using mnemonic strategies had one of the largest effect sizes (1.62) in all of special education intervention research. An effect size of such a magnitude indicates that students who are taught using mnemonics perform significantly and substantially better than their peer counterparts who are being taught using other instructional procedures. Scruggs and Mastropieri (2001) recently reported on the numerous experimental studies as well as the classroom applications that have been conducted by teachers of students with and without learning disabilities. Again, the findings corroborate those reported by Forness et al. Across literally dozens of studies involving more than one thousand students, students taught mnemonically remembered nearly twice as much information as students taught by other means. Moreover, they noted that numerous teacher applications in classrooms have been implemented with

parallel positive findings. One recent example conducted by Heather Uberti demonstrated the powerful effects of using the strategies within inclusive third grade classrooms in which students with and without disabilities benefited from instruction of vocabulary with mnemonic strategies (Uberti, Scruggs, & Mastropieri, in press). Similar findings were reported by Jennifer Sweda when she reported on the use of mnemonic strategies in fourth grade inclusive social studies classes (Mastropieri, Sweda, & Scruggs, 2000). In both of these applications, mnemonic strategies helped improve the performance of students with learning disabilities to the level of the normally-achieving students. In a recent high school application, Terrell (2002) reported that students learning vocabulary for the SAT, across six units of instruction, remembered 49% of vocabulary words using traditional instruction, but remembered 92% all words learned mnemonically. In all of these and other applications, both teachers and students report positive comments regarding instruction using mnemonic strategies.

Converging research evidence indicates that mnemonics are very effective for meeting one critically important aspect of school learning—memory for academic content. It has also been seen that teachers can be successful at developing and implementing these strategies, and that both teachers and students appreciate their value. In response to the student who asked, “How do they expect me to remember all this stuff?” we can answer, “With organization, practice, and mnemonic strategies!”

REFERENCES

- Fontana, J.L. (2002) *Dissertation in progress*. George Mason University, Fairfax, VA
- Forness, S.R., Kavale, K.A., Blum, B.M., & Lloyd, J. (1997). Mega-analysis of meta-analyses: What works in special education and related services. *Teaching Exceptional Children, 29*(6), 4–9.
- Fulk, B.J.M. (1994). Mnemonic keyword strategy training for students with learning disabilities. *Learning Disabilities Research & Practice, 9*, 179–185.
- Fulk, B.J.M., Mastropieri, M.A., & Scruggs, T.E. (1992). Mnemonic generalization training with learning disabled adolescents. *Learning Disabilities Research & Practice, 7*, 2–10.
- King-Sears, M. E., Mercer, C.D., & Sindelar, P. (1992). Toward independence with keyword mnemonics: A strategy for science vocabulary instruction. *Remedial and Special Education, 13*, 22–33.
- Mastropieri, M.A., & Scruggs, T.E. (1988). Increasing the content area learning of learning disabled students: Research implementation. *Learning Disabilities Research, 4*, 17–25.
- Mastropieri, M.A., & Scruggs, T.E. (1989). Constructing more meaningful relationships: Mnemonic instruction for special populations. *Educational Psychology Review, 1*, 83–111.
- Mastropieri, M.A., & Scruggs, T.E. (1991). *Teaching students ways to remember: Strategies*

- for learning mnemonically. Cambridge, MA: Brookline Books.
- Mastropieri, M.A., & Scruggs, T.E. (1998). Constructing more meaningful relationships in the classroom: Mnemonic research into practice. *Learning Disabilities Research & Practice, 13*, 138–145.
- Mastropieri, M.A., & Scruggs, T.E. (2000). *The inclusive classroom: Strategies for effective instruction*. Columbus, OH: Prentice-Hall/Merrill.
- Mastropieri, M. A., Scruggs, T. E., & Fulk, B. J. M. (1990). Teaching abstract vocabulary with the keyword method: Effects on recall and comprehension. *Journal of Learning Disabilities, 23*, 92–96.
- Mastropieri, M. A., Scruggs, T. E. & Levin, J. R. (1985). Maximizing what exceptional students can learn: A review of research on the keyword method and related mnemonic techniques. *Remedial and Special Education, 6* (2), 39–45.
- Mastropieri, M. A., Scruggs, T. E., Bakken, J. P., & Brigham, F. J. (1992). A complex mnemonic strategy for teaching states and capitals: Comparing forward and backward associations. *Learning Disabilities Research and Practice, 7*, 96–103.
- Mastropieri, M.A., Sweda, J., & Scruggs, T.E. (2000). Teacher use of mnemonic strategy instruction. *Learning Disabilities Research & Practice, 15*, 69–74.
- Paivio, A. (1971). *Imagery and verbal processes*. New York, Holt, Rinehart & Winston.
- Pressley, M., Levin, J.R., & Delaney (1981). The mnemonic keyword method. *Review of Educational Research, 51*, 1–30.
- Rohwer, W.D., Raines, J.M., Eoff, J., & Wagner, M. (1977). The development of elaborative propensity in adolescence. *Journal of Experimental Child Psychology, 23*, 472–492.
- Scruggs, T.E., & Mastropieri, M.A. (2002) Teaching Tutorial: Mnemonics instruction. Division for Learning Disabilities Website: <http://www.TeachingLD.org>.
- Scruggs, T.E., & Mastropieri, M.A. (2000). The effectiveness of mnemonic instruction for students with learning and behavior problems: An update and research synthesis. *Journal of Behavioral Education, 10*, 163–173.
- Scruggs, T.E., & Mastropieri, M.A. (1992). Classroom applications of mnemonic instruction: Acquisition, maintenance, and generalization. *Exceptional Children, 58*, 219–229.
- Scruggs, T.E., Mastropieri, M.A., & Levin, J.R. (1987). Implications of mnemonic strategy research for theories of learning disabilities. In H.L. Swanson (Ed.), *Memory and learning disabilities: Advances in learning and behavior disabilities* (pp. 225–244). Greenwich, CT: JAI Press.
- Scruggs, T. E., Mastropieri, M. A., Levin, J. R., & Gaffney, J. S. (1985). Facilitating the acquisition of science facts in learning disabled students. *American Educational Research Journal, 22*, 575–586.
- Terrell, M.C. (2002). *Mnemonic strategy vocabulary instruction with learning disabled high school students*. Unpublished master's project, George Mason University, Fairfax, VA.
- Uberti, H.Z., Scruggs, T.E., & Mastropieri, M.A. (in press). Mnemonic instruction in inclusive classrooms: A classroom application. *Teaching Exceptional Children*.
- Underwood, B.J., & Schultz, (1960). *Meaningfulness and verbal learning*. Chicago: Lippincott.
- Yates, F. (1956). *The art of memory*. Chicago: University of Chicago Press.

Copyright of Insights on Learning Disabilities is the property of Learning Disabilities Worldwide and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.