THE LEARNING PYRAMID: DOES IT POINT TEACHERS IN THE RIGHT DIRECTION?

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This paper raises serious questions about the reliability of the learning pyramid as a guide to retention among students. The pyramid suggests that certain teaching methods are connected with a corresponding hierarchy of student retention. No specific credible research was uncovered to support the pyramid, which is loosely associated with the theory proposed by the well-respected researcher, Edgar Dale. Dale is credited with creating the Cone of Experience in 1946. The Cone was designed to represent the importance of altering teaching methods in relation to student background knowledge: it suggests a continuum of methods not a hierarchy. While no credible research was uncovered to support the pyramid, clear research on retention was discovered regarding the importance of each of the pyramid levels: each of the methods identified by the pyramid resulted in retention, with none being consistently superior to the others and all being effective in certain contexts. A key conclusion from the literature reviewed rests with the critical importance of the teacher as a knowledgeable decision maker for choosing instructional methods.

The Learning Pyramid (see Figure 2) is an often-cited guide for teachers to use for designing effective instruction. It can be found in books (Sousa, 2001; Danielson, 2002; Drewes & Milligan, 2003), articles in refereed journals (Wood, 2004; Brueckner & MacPherson, 2004; Darmer et al., 2004; DeKanter, 2005) and in teacher resources (Boulmetis, 2003; Hershman & McDonald, 2003). Further, a recent internet search using Google® returned 12,200 hits, of which 452 were from cites with the generic top level domain .org, 313 from .edu, and 30 from .gov. While it appears an intuitive model and an implied comprehensive research summary, the logic of the model, as well as its research base, have been questioned (Thalheimer, 2005). Therefore, it is our intention to examine the following: the source of the general structure of the pyramid, Dale's Cone of Experience; available research on retention from the methods identified by the pyramid; and consider the relationship(s) among the methods.

Dale's Cone of Experience

Edgar Dale was a prominent educator and nationally known scholar regarding the use of media in instruction. He had a laudable career at the Ohio State University and its media center is named in his honor. In 1946 Dale published the first of three editions of his influential text Audio-
**Visual Methods in Teaching.** The purpose of the text was to delineate:

the use of audio-visual materials in teaching—materials that do not depend primarily upon reading to convey their meaning. It is based upon the principle that *all* teaching can be greatly improved by the use of such materials because they can help make the learning experience memorable...this central idea has, of course, certain limits. We do not mean that sensory materials must be introduced into every teaching situation. Nor do we suggest that teachers scrap all procedures that do not involve a variety of audio-visual methods (Dale, 1954, p. 3, italics in original)

The 1946 edition included the debut of his *Cone of Experience* (See Figure 1). The cone was Dale’s attempt to organize various types of experience according to their levels of abstractness, with Direct, Purposeful Experiences being the at least abstract (or most concrete) end of the continuum, and Verbal Symbols, the most
abstract, at the other. However, he notes that there will clearly be overlap among the levels. Before proceeding, we should note that there were modifications to the cone to accommodate emerging technologies (e.g., television was added in 1954) in the three editions of his text (Dale, 1946; 1954; 1969). However, the general construct of the cone, progressing from the concrete to the abstract, remained intact.

Dale describes Direct, Purposeful Experiences as those in which “you have direct participation, with responsibility in the outcome” (1954, p. 42, italics in original). He asserts that our most vivid memories are often the result of direct experiences. As an example, Dale offers performing a laboratory experiment as direct experience. However, he goes on to note that:

Life cannot, of course, be lived exclusively on this direct, concrete, sensory level. Whenever we remember something we have experienced, we have begun to abstract. Even our earliest experiences involve some degree of abstraction. As very young children we learn to talk about the doll or the cat or the man that is not physically present, and thus our direct, concrete experience becomes associated with abstractions. (1954, p. 44, italics in original)

Dale prefaced his presentation of the cone with the reminder that the gap between the least and the most abstract is often quite narrow, noting that even the words of small children, for whom we often advocate concrete learning experiences, are abstractions. In Dale’s words, the cone serves as a “visual metaphor of learning experiences” and that “you will make a dangerous mistake, however, if you regard the bands on the cone as rigid, inflexible divisions” (1954, p.42). Also, he notes that “increasing abstractness does not mean increasing difficulty” (1954, p.42). Finally, in presenting a notion that still applies to schools today, instruction would typically improve if it included opportunities for Direct Experience. To provide balance, however, he goes on to cite Dewey (1916) who reminds us that while direct experiences are important to learning they are also, by their very nature, limiting: learning about a geographic region in sensory stimulating manner (i.e., being there) would indeed be a valuable experience. However, that experience would be very restricted in terms of developing an understanding of geography, its multiple components, and numerous regions (better learned from a map)—although it is likely a good beginning. Clearly, Dale recognized the importance of having a variety of learning experiences and the complementary nature of those experiences.

The Learning Pyramid

At some point, Dale’s original cone of experience was transformed into the ubiquitous Learning Pyramid (Figure 2). To be more accurate, we should say Learning Pyramids, given that it has taken on more than one form over the years (it is also common to find the pyramid labeled as Dale’s Cone). The pyramid replaces levels of experience with instructional methods, with lecture occupying the peak of the pyramid, followed by reading, etc.

the lowest level being teaching others, and indicates various levels of retention associated with each method. There are, however, more levels in the cone than are typically found in the pyramid (i.e., there is not a one-to-one correspondence between the levels of the cone and the levels of the pyramid). As noted, there are variations of the pyramid that include a different hierarchy of methods or different methods, as well as different levels of retention ascribed to these methods. For example, the most common pyramid (e.g., Sousa, 2001) identifies lecture at the top of the pyramid and indicates that its corresponding level of retention at five percent, with reading falling below it with a retention level of ten percent. In contrast, the National Training Laboratories, formerly of Bethel Maine and currently

![Diagram of the Learning Pyramid](image)
located in Alexandria Virginia, provides a pyramid that locates reading at the top with a retention level of ten percent, followed by hearing with a retention level of 20 percent.

Additional information regarding the pyramid raises questions of credibility. The National Training Laboratories, in response to an email request from a member of the Academic Computing Department at the College of Charleston in South Carolina, stated the following about the pyramid:

It was developed and used by NTL Institute at our Bethel, Maine campus in the early sixties when we were still part of the National Education Association’s Adult Education Divi-

sion. Yes, we believe it to be accurate - but no, we no longer have - nor can we find - the original research that supports the numbers. We get many inquiries every month about this - and many, many people have searched for the original research and have come up empty handed. We know that in 1954 a similar pyramid with slightly different numbers appeared on p. 43 of a book called Audio-Visual Methods in Teaching, published by the Edgar Dale Dryden Press in New York. Yet the Learning Pyramid as such seems to have been modified and always has been attributed to NTL Institute.

![Pyramid Provided by the National Training Laboratories](image-url)
To summarize the numbers (which sometimes get cited differently) learners retain approximately:
90% of what they learn when they teach someone else/use immediately.
75% of what they learn when they practice what they learned.
50% of what they learn when engaged in a group discussion.
30% of what they learn when they see a demonstration.
20% of what they learn from audio-visual.
10% of what they learn when they’ve learned from reading.
5% of what they learn when they’ve learned from lecture.

(February, 2003)

This same correspondence contained the pyramid shown in Figure 3, indicating different levels of retention for different activities. While this inconsistency may be the result of two separate models or simple typographical errors, the source of the research raises serious questions regarding the credibility of the pyramid. The laboratories’ statement that the pyramid might have “slightly different numbers” than Dale’s original work is unfounded. An examination of all three editions of Dale’s texts reveals that he never uses the word retention to describe the outcome of a particular learning experience and, more importantly, he presents no numbers referring to empirical research. His conclusions were based on theory and personal observations, not on research. Further, he cautioned that there is overlap among the levels and we should not treat them as being discrete. For example, one might encounter visual and verbal symbols when watching television, on a field trip, or observing a demonstration. Thus, these numbers appear to be speculation.

In addition to these inconsistencies from publication to publication, the pyramid and its comparison of instructional methods and respective levels of retention raise a number of empirical issues. There is an implied assumption that these methods have been compared to one another in a systematic manner employing sound research methodologies. At a minimum, these empirical issues would include:

- That each of the methods, employed as an experimental treatment, was of the same duration (e.g., a student’s reading session would last as long as an individual teaching or discussion session).
- That each of the methods would have been conducted or supervised by the same teacher or that multiple teachers would have been matched in terms of education, teaching experience and subject area (e.g., the lecture being given by the same teacher as the one leading the discussion). Further, the teacher(s) should have been well versed in both content and method.
- That the content to be learned with each method would be the same, regardless of the method being employed.
- That the outcome measure(s), or dependent variable(s), was one measuring retention, the ability to recall or do something after a time delay (e.g., days, weeks or months), rather one that is completed immediately after treatment.
To conduct research in this manner with seven equivalent treatment groups would be a daunting task indeed, and if such issues were not addressed the assumptions regarding the relative effectiveness of the methods are erroneous. This alone makes us skeptical that such research was done. Further, inconsistencies in referencing, as well as variation in purported percentages, heighten our skepticism. Finally, although Sousa (2001) reports that retention was measured after a 24-hour period (for which Sousa provides no reference), many who promote the value of the pyramid make no mention of the time between learning and measured retention.

Beyond these inconsistencies, we are concerned with the overlap among the approaches. Isn’t reading typically done before one engages in an academic discussion? Are there many, if any, instances where one is ready to teach about something before learning about it? Isn’t prior knowledge of the content necessary to understand what is observed during a demonstration? Aren’t most audiovisual presentations preceded by an introduction, or an orienting lecture, and then followed by a discussion. In sum, the instructional design process would be far more complicated and thoughtful than simply relying on the pyramid.

Thus, it is our thesis that isolating the various methods is nearly impossible in the process of good teaching: a balanced combination, based on content, teacher background knowledge, resources, and student characteristics, is likely to be most effective. Further, we wish to go beyond questioning the validity of the learning period to examine the research on retention for the various methods identified. In the next section we will present some of the research results for these methods. However, we will not attempt to arrange these results in any type of a hierarchy, identifying one as better than another, as is done in the pyramid. To do this would be highly speculative based on the research methodology issues raised earlier.

Teaching Methods and Retention

The research presented here is not intended to be a comprehensive literature review for each method, as that would go beyond the scope and purpose of this discussion. Instead we wish to determine if the identified methods do result in retention of what was learned after some period of time. In some instances we will also report effects on learning to provide a more well-rounded discussion. There were two main challenges in examining this literature. First, many empirical studies focus on learning but do not examine retention, so available data are limited in some cases. Second, it is difficult to determine percentage of retention from a given treatment because percentage of retention is not typically reported; and, for us to calculate it, the researchers must have reported pretest and retention scores, as well as the total number of items on the retention test. This was also not typical. Further, as will be seen, the length of treatment and the delays between treatment and retention vary from study to study which makes attributing retention percentages to one method relative to others impracticable. Therefore, we will not attempt to ascribe percentages to given methods.
Lecture or Direct Instruction

Direct instruction is a highly structured teaching plan often associated with Hunter’s Mastery Teaching model (1985). It emphasizes teacher direction and student teacher interaction. Here, the teacher provides explicit experiences to assist student attainment of lesson objectives (Eby, Herrell, & Jordan, 2006). Direct instruction is the most researched teaching strategy and the one strategy, more than others, that has improved student achievement (Kim & Axelrod, 2005; Stein, Carnine, & Dixon, 1998). Clearly, direct instruction relies on some form of teacher lecture. According to the assertions of the learning pyramid, lecture/direct instruction would be least likely strategy to produce retention.

However, direct instruction is a useful teaching strategy for students throughout the grades, students with exceptionalities (Eby et al., 2006; Rosenshine, 1976; Adams & Engelmann, 1996), and children from low socio-economic backgrounds who typically come to school with less background knowledge than those from more affluent backgrounds (Kim & Axelrod, 2005). Further, direct instruction has been shown to have a significant affect on retention (Randler & Bogner, 2002).

Reading

It is not new to assert that a primary mission of schools is to increase student reading comprehension. Further, a substantial number of studies have been devoted to analyzing the impact various learning to read strategies might have on increasing the chances students will remember what they have read. For example, in a study by White (2005) fifteen grade two regular education teachers agreed to follow a structured set of lesson plans throughout a school year. These teachers explicitly aimed at increasing student capacity to use analogies to help gain meaning of unknown words through understanding of known words. Results showed significant positive relationship between the number of lessons the students participated in and students’ gains on standardized tests in reading comprehension. Results supported the use of specific comprehension strategy interventions as a means of improving student understanding of text.

Additionally, Van Keer and Verhaegje (2005) also investigated specific strategy interventions in their study of second and fifth graders. However, in their study they included two types of strategy practice: teacher directed whole class practice and peer assisted practice. Results for both grade level groups indicated significant achievement gains for both groups. In turn, their findings supported a persistent line of reading comprehension research (McGill-Franzen & Allington, 1999; Pressley & Allington, 1999; Snow, Burns, & Griffin, 1999) that indicated that comprehension strategy practice is related to improved reading comprehension. The mission and research initiatives have taken on a new sense of urgency with the myriad of high-stakes tests relying on a student’s ability to read and interpret information in each of the content areas. In fact, test taking is increasingly being thought of as a new reading genre.
Audio-Visual materials represent the most ill-defined teaching methodology. In some ways, they might not be considered a method of instruction but tools that can be incorporated when using the methods discussed here. Their many forms can include videos, sound, pictures, and graphs. They can be used individually or presented in various combinations. They can also be presented using a variety of media. A thorough examination of each of these is beyond the scope and purpose of this article. Further, preliminary literature searches identified few, if any, empirical research that addressed retention. However, we will examine some research that seems germane to this discussion.

Increasing attention has been given to the usefulness of a visual experience to enhance learning. A corresponding response to that interest has been the implementation of graphic organizers in lessons. A graphic organizer is a visual representation of facts and concepts and the relationship between and among them (Eby et al., 2006).

Kim et al. (2004) provide a synthesis of research on the effect of graphic organizers on the reading comprehension of students classified as learning disabled across grade levels. These researchers examined twenty one studies and determined all but two yielded overall beneficial outcomes of graphic organizer use and student achievement. They reported significant effect sizes with mean posttest scores ranging from 48 to 83% correct on posttests and follow-up. Although they did not find significant results related to transfer, the researchers concluded that the use of a visual enhanced student understanding of what was read.

In research on other forms of visual instruction, Van Hell, Bosman and Bartelings (2003) studied the use of visual materials by children with spelling problems. They found that "visual dictation" using cue cards improved their spelling when it was measured one month after instruction. In a study that used actual video, Hodges, Chua, and Franks (2003), found that students who saw videotaped feedback of their performances while learning motor movements had better retention following a four to seven day delay than those who did not receive feedback. Also, when video feedback was provided during computer assisted instruction, it resulted in superior retention when compared to textual feedback (Lalley, 1998).

As technology continues to evolve, teachers will have many options for including audio-visual materials in instruction. These will include the use of computer technology to allow students to engage in simulations, a form of discovery learning, which has shown some initial promise (Shaffer, Squire, Halverson, & Gee, 2005). A similar but more immersive and interactive environment is virtual reality which is predicted to come to the classroom within the next ten years. The integration of such technologies is sure to present challenges while also offering great promise for both teachers and students.

**Demonstration**

Demonstration typically involves an expert (i.e., teacher) performing a learning task while students observe. The intent is to model the correct behavior in an attempt to minimize ambiguity in instruc-
tion, and therefore, limit the potential for student errors and misconceptions. It is thought to be particularly useful when poor understanding of the task to be performed can lead to students experiencing physical harm (e.g., in industrial technology courses) or where costly learning materials (e.g., dissection specimens) may be wasted. Research on this method is relatively sparse, which may be directly related to the safety and cost issues raised, where research on teaching without demonstration would be neither practical nor informative. However, there has been some research on using demonstration in more traditional content areas. One such study was conducted by Polhemus, Dambe, Moorad, and Dambe (1985) that examined students learning about the concept of length and how it is not dependent upon context (e.g., spatial orientation). Students who were provided with demonstrations using manipulatives showed significant pretest (2.6) to retention test (12.2) gains after a seven week delay following instruction. However, these were essentially identical to the gains made by students who took turns observing each other doing similar demonstrations and those who had their own set of manipulatives to learn with following teacher demonstrations. All groups had greater change from pretest to retention than the control group that received no instruction (2.6 on the pretest and 2.1 on the retention test). Similarly, in a study by Pigford (1974) in which preservice teachers were given instruction about the metric system, equivalent gains were made from pretest to retention by doing hands-on learning in a laboratory and those receiving lecture/demonstration. This raises yet another issue regarding overlap and integration of the methods identified by the pyramid: in the classroom, similar to the Pigford study, lecture and demonstration are likely interwoven. This would make determining the isolated effectiveness of the methods impractical and, more importantly, would risk making experimental treatments artificial. Thus, teachers would be well advised to provide students with demonstrations when warranted by safety concerns, effective use of materials, and/or need for clarity.

Cooperative Learning and Discussion Groups

Research support for cooperative learning and achievement has been outlined in Johnson, Johnson and Stanne's (2000) meta analysis. Their data indicate higher levels of student achievement with cooperative learning as a teaching strategy as compared to competitive and individualistic approaches. The cooperative learning methods included studies comparing Johnson and Johnson’s Learning Together, Slavin’s (1997) Students-Teams-Achievement-Division (STAD) and the Team Assisted Individualization method to individualistic methods. According to the data from the meta analysis, each provided higher achievement than competitive and individualistic methods.

Widespread agreement with the Johnson, et al. meta analysis can be found in the literature (Eby et al., 2006; Mayer, 2002; Ornstein & Lasley, 2004). In a study of middle-class students, Yager, Johnson, Johnson, & Snider (1986) compared cooperative learning with group processing (5 minutes of reflection and discussion at the
end of each session), cooperative learning without planned group processing, and individualistic learning where students used learning materials and only sought assistance from the teacher (essentially a discovery method). Prior to instruction, students in the sample were compared and identified as high, middle or low ability. Retention scores, regardless of ability level, showed that cooperative learning with group processing was more effective than cooperative learning without group processing and individualistic instruction, and that cooperative learning without group processing was more effective than individualistic learning.

Discussion Groups are intended to stimulate student thinking and articulation of ideas related to a topic (Jacobsen, Eggen, & Kauchak, 2005). The teacher’s role is to set the conditions in the classroom to increase the chances students will participate in the discussion. The teacher can serve as leader, equal participant, or as a monitor who doesn’t directly participate but acts to keep the group on task.

Research on the impact of discussion is often associated with descriptive studies of strategies teachers believe have the most likelihood of creating an atmosphere to produce student involvement in a discussion (Wilén, 2004). Three studies were found dealing with retention and discussion. In two of these (Drane, Smith, Light, Pinto, & Swarat, 2005; Morgan, Whorton, & Gunsalus, 2000), subjects were college students and a combination of lecture and discussion was compared to students who experienced lecture only or cooperative learning only. The results indicated a slight short-term retention benefit for students in favor of lecture discussion but no long-term benefit. In the third study, Riesenmy, Mitchell, Hudgins & Ebel (1991) fourth- and fifth graders were taught critical thinking and problem-solving skills using the discussion method. They retained these skills after four and eight weeks while a control group that received no instruction did not.

**Practice by Doing**

One of the most highly advocated types of practice by doing is Discovery Learning. It is thought to be effective because it encourages students to work like a professional in the field (e.g., a scientist). Students work on their own or in groups to discover principles and relationships in a given content area to develop a personal understanding of concepts and relationships that are more meaningful and better understood than if they were simply told about them. It can be open-ended, such as taking students on a field trip to an aquarium to learn about marine life, or, can be structured (i.e., guided) in a way that is intended to help students meet specific objectives. As early as 1960, Jerome Bruner advocated the use of discovery learning in math and the physical sciences, as well as in social sciences.

Ivins (1985) found that eighth-grade science students retained more information when concepts were introduced in a laboratory context followed by lecture/reading, than when introduced through lecture/reading and followed up by laboratory exercises. It should be noted, based on Ivins’ description of the procedure, that this is not so much a matter of comparing methods as it a comparison of
sequencing. Further, Ivins describes the laboratory activities as “guided discovery”.

Research has, at times, shown that discovery learning, when compared to direct instruction, results in superior learning. Hilllocks’ (1984) meta-analysis of teaching composition found two main approaches. He compared “presentational”, lecture and teacher-led discussion to “environmental”, which was guided discovery with structured activities. It was found that environmental resulted in superior learning. However, retention was not examined.

In a study that did examine retention, Bay et al. (1992) found that discovery was more effective than direct instruction with learning disabled and non-learning disabled science students. Students worked in triads in a one-to-two ratio, respectively. Using the same learning materials to teach about displacement of water, a discovery group worked with materials to complete well-structured and specific goals, while the direct instruction group observed the teacher demonstrate concepts and then completed worksheets to practice the concepts. Retention was tested two weeks following treatment. Regarding the effectiveness of the discovery method, they conclude “whereas direct instruction is successful, particularly for basic skill instruction in reading and mathematics, such teaching may be less beneficial for science” (p. 567).

Thus, it may be the case that discovery learning is not appropriate for all circumstances. Recall that in the Pigford (1974) study cited earlier, the same retention results were achieved through hands-on laboratory learning as were achieved through lecture/demonstration. Also, Randles and Bogner (2002) found significant increases from pretest to retention after a six-week delay for both direct instruction and discovery but found no differences in retention between the two groups.

Given that discovery can be an effective method but not always more effective than others, Bruner (1960) reminds us that discovery would be too time-consuming for all teaching and that one determinant of its effectiveness is the teacher’s familiarity with the content being taught. Thus, teachers must consider their own content knowledge, and their students’ prior knowledge and abilities, to choose when discovery exercises will be effective.

Teaching Others

The most common form of students teaching others is Peer Tutoring. In terms of the effect of teaching on retention, peer tutoring research (e.g., Fasko, 1994) often provides little insight because it often focuses on its impact on students being tutored (tutee) and not the impact on the tutor. However, in good teaching practice, peer tutoring should only be done when it is in the best interest of the tutor because it provides opportunities to overlearn the material and engage in higher levels of thinking, and/or develop certain social skills. If the method only helps the tutee, an alternate method should be employed. While research has demonstrated that peer tutoring improves achievement, it often involves reciprocal peer tutoring (Heller & Fantuzzo, 1993; Rekrut, 1994) where students take turns being the tutor, so determining the effects of teaching versus being taught is not possible, but there is some research that has examined its affect on
the tutor. Using a story telling strategy as the content to be learned, Rekruit (1994) found that students who were tutors did show superior retention following one month delay when compared to students who did not tutor. However, it is paramount to note that both groups of students were given training on the strategy, so tutoring was not the initial learning experience for the tutors. Instead, it was an opportunity to overlearn the strategy by teaching it.

Summary

The research reviewed here demonstrates that use of each of the methods identified by the pyramid resulted in retention, with none being consistently superior to the others and all being effective in certain contexts. A paramount concern, given conventional wisdom and the research cited, is the effectiveness and importance of reading and direct instruction, which in many ways are undermined by their positions on the pyramid. Reading is not only an effective teaching/learning method, it is also the main foundation for becoming a “life-long learner”. Its fundamental importance was noted early on by Dale who in 1946 stated he “would give much more attention to effective reading in all curricula” (p. 6). Further, direct instruction has been shown to be effective, especially for children from low socio-economic backgrounds.

It is widely accepted that teachers should facilitate active learning in their classrooms. According to Stinson and Miller (1996), “there has been a paradigm shift expressed as moving from being the ‘Sage on the Stage’ to serving as the ‘Guide on the Side’” and teachers will need to have the following skills: active listening, coaching, mentoring, and facilitation. We suggest, based on the literature reviewed, that a capable teacher needs to be both “sage” and “guide”, and all things in between. Thus, the skills identified can be ascribed to no particular teaching method, instead they are skills that will make teachers effective when using most any of the methods discussed here.

If we were to draw any conclusion based on the pyramid, it would be that the methods be thought of as on a continuum as opposed to in a hierarchy. Therefore, the less prior knowledge students have the more likely it is that effective methods would be found toward the direct instruction end of the continuum, and as students’ knowledge increased, they would be more capable of learning with methods involving discussion and teaching. However, because learning is an ongoing process, this will not preclude that further learning will take place with more direct methods. Thus, even the most experienced learners, such as successful heart surgeons, could learn from a more experienced learner, a surgeon with a new technique, and the best initial methods would likely be lecture/demonstration which would lead to practice by doing, and possibly teaching others. Not surprisingly, this returns us to the assertions of Dale (1946) and Dewey (1916) that for successful learning experiences, students need to experience a variety of instructional methods and that direct instruction needs to be accompanied by methods that further student understanding and recognize why what they are learning is useful.
References


