

## WEB PAPER

# Edgar Dale's *Pyramid of Learning* in medical education: A literature review

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## Abstract

**Background:** Edgar Dale's *Pyramid of Learning* and percentages of retained learning are cited in educational literature in a range of disciplines. The sources of the Pyramid, however, are misleading.

**Aims:** To examine the evidence supporting the Pyramid and the extent to which it is cited in medical education literature.

**Methods:** A review of literature (1946–2012) based on a search utilising Academic Search Complete, CINAHL, Medline and Google Scholar conducted from September to November 2012.

**Results:** A total of 43 peer-reviewed medical education journal articles and conference papers were found. While some researchers had been misled by their sources, other authors' interpretations of the citations did not align with the content of those citations, had no such citations, had circular references, or consulted questionable sources. There was no agreement on the percentages of learning retention, in spite of many researchers' citing primary texts.

**Discussion and conclusion:** The inappropriate citing of the Pyramid and its associated percentages in medical education literature is widespread and continuous. This citing undermines much of the published work, and impacts on research-based medical education literature. While the area of learning/teaching strategies and amount of retention from each is an area for future research, any reference to the Pyramid should be avoided.

## Introduction

In education and training books, conference papers and peer-reviewed journal articles, it is widely cited that students remember 10% of what they hear, 20% of what they read, and these percentages of retention increase in multiples of 10 until they describe the retention rates of students involved in activities such as problem-based learning (Northwood et al. 2003; Wood 2004; Woods 2006; Yeh et al. 2011), computer-based training and simulation (Barnes 2001; Buehler et al. 2001; Chen et al. 2007; Krain & Lantis 2006) case-based learning (Golich et al. 2000) and other constructivist activities (Harker 2008; Khan et al. 2012; Pinto et al. 2012).

The academic fields in which these percentages impact upon educational methodology range across a broad spectrum, and include education in astronomy (Chen et al. 2007), biochemistry (Campbell 1993), chemistry (Lagowski 1990), general education (Martinez & Jagannathan 2010; Pinto et al. 2012), engineering (Northwood et al. 2003), international politics (Golich et al. 2000; Krain & Lantis 2006), library science (Buehler et al. 2001; Harker 2008), management (Joss 2001; Elouarat et al. 2011), physics (Yeh et al. 2011; Khan et al. 2012), poultry science (Barnes 2001) and veterinary science (Bernardo 2003).

The percentages from these conference and journal articles are also supported in documents from well-respected, non-academic sources such as the WHO (PAHO 1997), UNESCO (Obanya 2010), the World Bank (n.d.), the European Virtual Campus for Biomedical Engineering (Kybartaitė et al. 2007),

## Practice points

- The *Pyramid of Learning* and associated percentages attributed to Edgar Dale and the NTL have no valid basis.
- They are cited widely in medical education literature.
- Researchers have been misled, have made crucial errors, and there is no agreement on the percentages of learning retention.
- Continued citing of the *Pyramid of Learning* in medical education research should be avoided.

the University of Newcastle Upon Tyne (2004) and even State sponsored newsletters (Iowa Department on Aging 2009).

When citing the research on which these percentages are based, authors sometimes cite secondary sources (Lagowski 1990; Golich et al. 2000; Buehler et al. 2001; Joss 2001; Obanya 2010; Pinto et al. 2012) or no sources at all (PAHO 1997; Barnes 2001; Iowa Department on Aging 2009; Martinez & Jagannathan 2010).

The two most common primary sources of the research are the National Training Laboratories (NTL) for Applied Behavioral Science's *Pyramid of Learning* (Kybartaitė et al. 2007; World Bank n.d.), and Edgar Dale's *Cone of Learning* or *Pyramid of Learning* (Campbell 1993; Bernardo 2003; Northwood et al. 2003; Krain & Lantis 2006; Woods 2006; Chen et al. 2007; Harker 2008; Elouarat et al. 2011; Yeh et al. 2011; Khan et al. 2012; Pinto et al. 2012). Occasionally, the

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Socony-Vacuum Oil Company's research is also cited (Golich et al. 2000).

With the apparent credibility of these percentages firmly established, there appears nothing to be questioned. A cursory glance at these percentages, however, should surely trigger an alarm: human behaviour can seldom, if ever, be classified into neat percentages in multiples of 5 or 10. As educators, we should be prompted to ask questions like: "Are these percentages valid across all disciplines? Across all demographic groupings? Without variation? For all time?"

With these questions appearing to undermine the validity of the *Pyramid of Learning*, it is crucial to examine the evidence supporting the Pyramid, and the obvious starting point is the research detailed in the primary sources of the Pyramid. A closer investigation of the primary sources of the Pyramid leads to some troubling findings. Indeed, an article by Lalley and Miller (2007), indicates that the sources of these percentages should be questioned. These will be explored in the next section.

#### The sources of the Pyramid and the percentages

The first possible primary source of these percentages, the NTL, does not have any research data, published or unpublished, supporting its Pyramid. According to email correspondence from the NTL (Raymond 2012), its *Pyramid of Learning* is based upon its own research, although it has never been able to locate this research and has not been able to provide details of this research. Nevertheless, the NTL explains that "the Learning Pyramid as such seems to have been modified and has long been attributed to NTL. The NTL Learning Pyramid, sometimes with slightly different percentages, appears as [Figure 1]." (Raymond 2012)

This is not reassuring. Given the impact of the Pyramid and the percentages on education and their wide application in educational literature, they would surely have been based upon a large research project, and it is disconcerting to think that there is no documentation at all detailing the research or

even the names of the researchers. (There is also no explanation for why this two-dimensional figure is referred to as a pyramid, rather than a triangle, but that does not appear to be significant in any of the literature consulted).

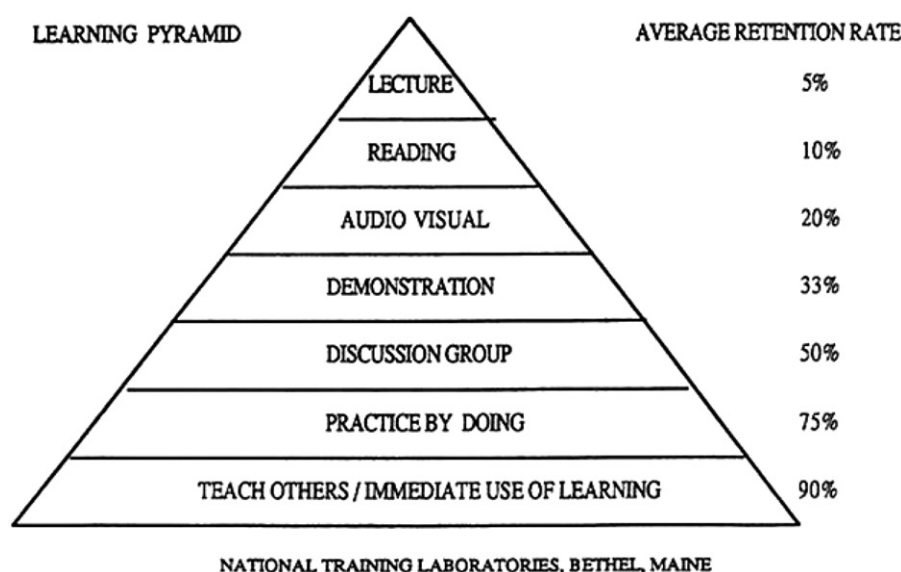
The NTL further acknowledges that Edgar Dale produced "a similar pyramid with slightly different numbers" in his 1954 text *Audio-Visual Methods in Teaching* (Raymond 2012). According to the NTL, "The following [Figure 2] is the pyramid attributed to Edgar Dale's *Audio-Visual Methods in Teaching*." (Raymond 2012).

When we look at this second possible primary source, however, we see something different. In his text *Audiovisual methods in teaching* (Dale 1946, 1954, 1969), Edgar Dale presents a "Cone of Experience" (Figure 3), and not a *Pyramid of Learning*. (Through the different editions of his text, there were some updates, such as the inclusion of television.)

Most importantly, unlike the *Pyramid of Learning* attributed to Dale by the NTL, Dale's Cone of Experience has no numbers or percentages, and no suggestion of retention of information from any input source or activity of any type, or for any length of time.

Dale's Cone of Experience is merely a classification diagram. It "classifies various types of instructional materials according to the relative degree of concreteness that each can provide." (Dale 1969). Dale presents his Cone of Experience as "only a model," a "visual analogy," comparing it to the analogy of the computer for understanding the functioning of the brain. It stems from his overall perception of learning, similar to, he notes, modes of learning discussed earlier by Jerome Bruner. It is not based on empirical evidence of any kind, and Dale makes no such claims.

In addition, unlike the *Pyramid of Learning* commonly cited, there is no suggestion that the experience at the base is superior to the experience at the apex. On the contrary, in Dale's discussion, if there is an implied desired direction of movement, it tends towards the abstraction at the apex, although not all learning happens like that.



**Figure 1.** The NTL *Learning Pyramid*, "sometimes with slightly different percentages, appears as [this figure]" (Raymond, 2012).

## PEOPLE GENERALLY REMEMBER

An important learning principle, supported by extensive research, is that people learn best when they are actively involved in the learning process. The "lower down the cone" you go, the more you learn and retain.

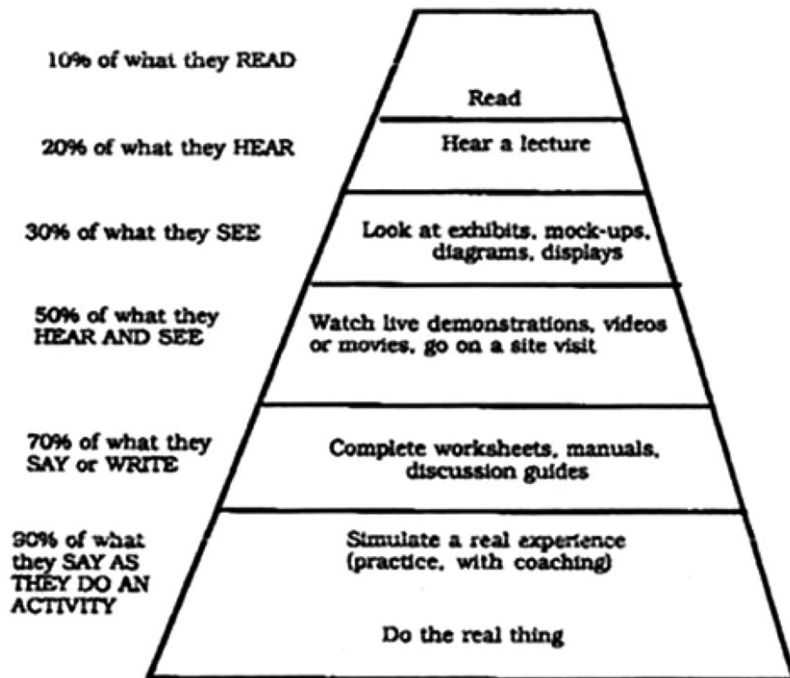


Figure 2. The Pyramid of Learning attributed by the NTL to Edgar Dale from his *Audio-Visual Methods in Teaching*.

While Dale describes the value of the “direct, firsthand experiences that make up the foundation of our learning,” he also makes it clear that “human life cannot, of course, be lived exclusively on the direct, concrete, sensory level,” and frequently learning tends towards higher levels of abstraction. The Cone “classifies instructional messages only in terms of greater or lesser concreteness or abstractness,” and it is not an “exact rank order of learning processes.” The teacher and learner must be able to move through all levels.

In short (apart from contradicting common-sense), these percentages are questionable because the NTL has never been able to produce any evidence or research supporting their *Pyramid of Learning* (and so it is doubtful that any such research occurred), and Edgar Dale never created a *Cone of Learning* or a *Pyramid of Learning* (with or without percentages). It appears, then, that the pyramid structure and the percentages are based on nothing substantial.

### The problem for medical education

The need for strong education research and theory to underpin medical education is well-recognised (Pauli et al. 2000; Collins 2006; Gibbs et al. 2011). It follows, moreover, that medical

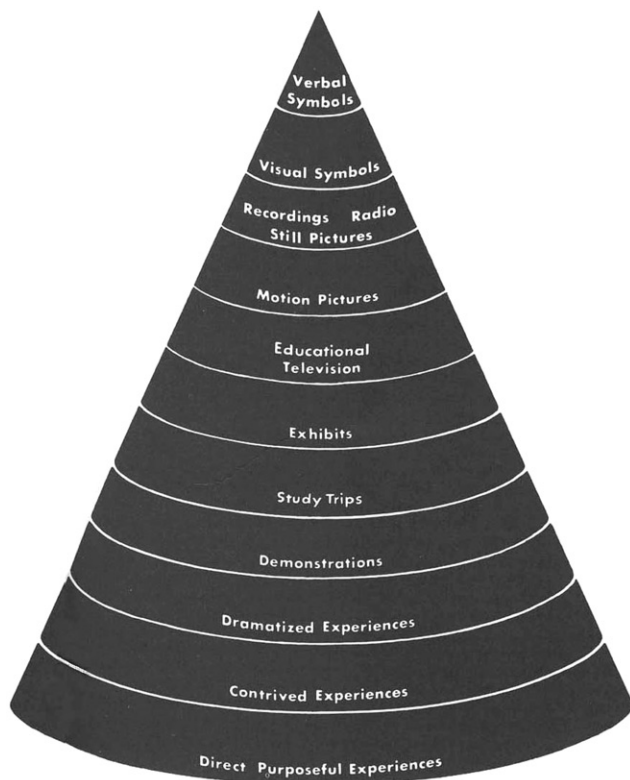
education practice must be based on true research, and not on suppositions and invalid assumptions. Just as the other academic fields cited above have used the *Pyramid of Learning* to influence their arguments regarding educational practices, so there is the possibility that medical education practice has done, and will do, the same.

This paper surveys the medical education literature, in order to assess the extent to which the Pyramid has been cited, the medical disciplines that are affected, the sources of the Pyramid, and the retention percentages quoted.

## Methods

A documented search was conducted on the following databases: Academic Search Complete, CINAHL and Medline. Google Scholar was searched in order to find other widely available documents that reference the Pyramid. In addition, where authors cited the source of their data, these references were followed until they reached either a non-medical source or a primary text (e.g. the NTL site or one of Edgar Dale’s texts).

Because the *Pyramid of Learning* might be displayed in a variety of ways (including without an actual pyramid), and



**Figure 3.** Edgar Dale's *Cone of Experience*, as presented in *Audiovisual methods in teaching*, 3rd ed. p 107 (Dale, 1969) (earlier versions of the Cone did not include television).

might be referenced from a range of sources, the search terms were broad. The search phrase was: “(“medical” OR “medicine”) AND (“% of what they read” OR “Learning Pyramid” OR “*Pyramid of Learning*” OR “Dale’s Cone” OR “Dale Cone” OR “Cone of Learning” OR “Learning Cone” OR “Cone of Experience”))”. The precise syntax of the phrase was adjusted to suit the requirements of the specific databases.

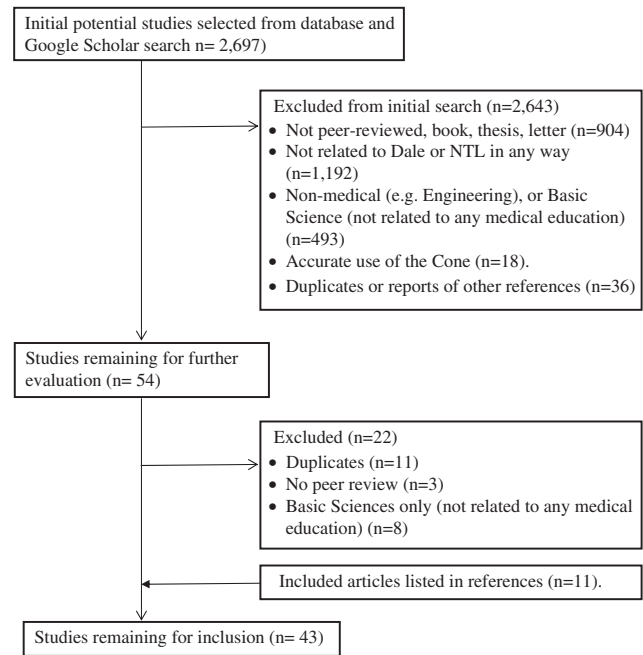
To be included, the source had to be in English and from a journal or conference with some evidence of peer-review, published from 1946 to 2012. The start year of 1946 was chosen because that was the first publication date of Dale's *Audiovisual methods in teaching* (Dale 1946). Other documents, such as books, letters to the editor, Masters and PhD theses were excluded. The search was conducted from September to November, 2012.

## Results

### Overall

The initial result returned a total of 2697 references. An initial sorting process reduced this number to 54 articles, further refinement to 32 articles and further searching for articles listed in references increased this number to 43 (Figure 4).

This search could find only one article that questioned the origin and applicability of the Pyramid. Gallagher et al. (2012) noted that the “authority and origins of the [Learning Retention Pyramid] are disputed in some quarters,” and cite Lalley and Miller (2007). Nevertheless, Gallagher et al. still used the



**Figure 4.** Article selection process.

percentages in the Pyramid to stimulate discussion in their workshop. All the other articles appear to accept the percentages unquestioningly.

### Articles and their sources

Table 1 gives a summary of the articles found. This table indicates the medical education discipline that forms the context of the article, the source to whom the percentages are attributed, and the citations to the references from which the percentages were obtained. In some cases, no specific attribution has been made (e.g. Afandi et al. refer merely to the “Learning Pyramid Theory”, and Arthurs merely quotes the percentages).

In addition to Dale's primary text (Dale 1946, 1954, 1969), there are three references to a replication of his Pyramid in an edited text. In these references, this text has been given different bibliographic information, including as a chapter (or section) by Dale in a book edited by Wiman and Meierhenry (Avers & Wharton 1991; Oldaker 1992), or attributed directly to Wiman and Meierhenry as authors (Weinrich et al. 1994). Upon inspecting the text, one finds a chapter by Donald Stewart (1969) in which he elaborates on Dale's Cone of Experience and supplies a diagram of his own interpretation (Figure 5). In his diagram, however, one can see that he retains the principles of Dale's classification, and makes no suggestion of learning retention through different modes of instruction. There is no indication that Edgar Dale contributed any material to this text.

### The percentages

All of the authors, apart from Hazlett (2009), quote percentages. Hazlett states that “Teaching modalities that require students to be actively involved in learning new knowledge

**Table 1.** List of references, the medical discipline, the person to whom the Pyramid and/or percentages are attributed, and the cited source of the information.

References	Discipline	Attrib. to	Citing
Afandi et al. (2009)	Bioethics	"Learning Pyramid Theory"	Lalley and Miller (2007)
Akaike et al. (2012)	Simulation/clinical skills	Dale	Sprawls (2008)
Arthurs (2007)	Nursing	None	Bowman (1997); Nilson (2003)
Avers and Wharton (1991)	Geriatric rehabilitation	Dale	Dale 1969[b]
Baykan and Naçar (2007)	Physiology	None	University of Newcastle Upon Tyne (2004)
Boctor (2013) <sup>2</sup>	Nursing	Dale	Kennedy (2006)
Brueckner and MacPherson (2004)	Dental gross anatomy	"The learning pyramid"	Eyler and Giles (1999)
Croley and Rothenberg (2007)	Critical care	Dale	Dale (1969)
Dark and Perret (2007)	General healthcare	None	Chandler and Sweller (1991)
Darmer et al. (2004)	Nursing	NTL	Lowery (n.d.)
Dickerson (2003)	Nursing	None	Jackson (1993)
Gallagher et al. (2012)	Cross-discipline	NTL	World Bank (n.d.)
Garden (2009)	Obstetrics and gynaecology	NTL	NTL
Gordon (1996)	Medical communication skills	None	None
Hazlett (2009)	Cross-discipline	NTL	Lowery (n.d.)
Jalali and Wood (2012)	Anatomy	Dale	Dale (1954)
Jarvis et al. (2009)	Pharmacy (medication disposal)	Industrial Audio Visual Association	Pakes (1995); Montero (1998)
Karabulut and Cetinkaya (2011)	Patient education	"In the literature"	Ergin (1995) <sup>3</sup>
Katsuragi (2005)	Dentistry	Brummer [sic]	Brummer (n.d.) <sup>4</sup>
Kennedy (2006)	Patient education	Dale	Dale (1969)
Keulers and Spauwen (2003)	Patient education	None	Murphy (1998)
Krishna et al. (2006)	Patient education	"the theory of learning and retention"	Dale (1969)
Kumar et al. (2009)	Cross-discipline	None	None
Lott (2006)	Nursing	None	Dickerson (2003)
Lou (2012)	Chemistry	NTL	Dale (1969) and NTL
Manning (1983)	Nursing	None	Medearis (1974)
Mitchell (2007)	Patient education	None	Rief (1993)
Murphy (1998)	Patient education	None	None
Okolie et al. (2007)	Nursing and radiography	TB Dale	Dale (2000) <sup>5</sup>
Okuda et al. (2009)	Simulation	None	Croley and Rothenberg (2007)
Oldaker (1992)	Patient education	Dale	Dale (1969) <sup>6</sup>
Pei (2003)	Pharmacy	None	Lagowski (1990) <sup>7</sup>
Rao and Kate (2012)	Surgery	Bruner	Friel (2009)
Sarikcioglu et al. (2011)	Physiology	Dale	Arthurs (2007)
Shah et al. (2012)	Cross-discipline	None	Bonwell and Eison (1991)
Shenoy et al. (2012)	Cross-discipline	None	University of Newcastle Upon Tyne (2004)
Sprawls (2008)	Medical physics	Dale	None
Sujatha et al. (2011)	Clinical skills	"Learning Pyramid"	None
Thomas and Baker (2008)	Nursing	NTL	NTL
Videla (2010)	Cross-discipline	"Learning Pyramid"	Unknown <sup>8</sup>
Weinrich et al. (1994)	Patient education	None	Wiman and Meierhenry (1969) <sup>9</sup>
Wood (2004)	Biochemistry	NTL	NTL
Zeraati et al. (2008)	Cross-discipline	None	University of Newcastle Upon Tyne (2004)

<sup>1</sup>This is a citation to a non-existent reference: Merrill CE. 1969. Dale E. Cone of experience. In: Wiman C, editor. Educational media. See discussion below for further information about this reference.

<sup>2</sup>This article was in press and available electronically at the time of the search. This reference has been updated to reflect its current citation details.

<sup>3</sup>This reference is given as: Ergin Ö. "Instructional Technolog [sic] and Communication." Tegem Publication Ankara, 1995, p 102. The existence of this text cannot be verified.

<sup>4</sup>This reference is given as: "Brummer [sic] JS. Learning pyramid. The process of learning. Bethel, Maine: National Training Laboratories." It appears to be a conflation of Bruner's *The Process of Education* and the NTL's Pyramid.

<sup>5</sup>Reference given as: Dale TB. 2000. Teaching materials. *Am J Educ* 38(9):63–69. But, in 2000, the *American Journal of Education* published volume 108. Volume 38 (as *The School Review*), was published in 1930. Volume 38 (9) runs from pp 641 to 720.

<sup>6</sup>This citation is also to the non-existent section in Wiman and Meierhenry (1969).

<sup>7</sup>Cited as Lagowski (1990) Retention rates for student learning. *J Chem Educ* 67:811. There is no such paper. There is a 1990 editorial by Lagowski (1990) entitled "Teaching is more than Lecturing" in the *J Chem Educ* 67(10):811. That editorial quotes the percentages, citing its source as a 1987 article from *Eng Educ* by Stice (1987).

<sup>8</sup>The reference was to "Learning Pyramid; 2004," with a URL: [www.coe.uncc.edu/maps/wspowerpoint/w2pp/sld004.htm](http://www.coe.uncc.edu/maps/wspowerpoint/w2pp/sld004.htm) but this URL no longer exists.

<sup>9</sup>Reference in the citation given as Wiman and Meierhenry as authors.

and skills have been shown to be ten to sixteen times more effective [than passive activities]."

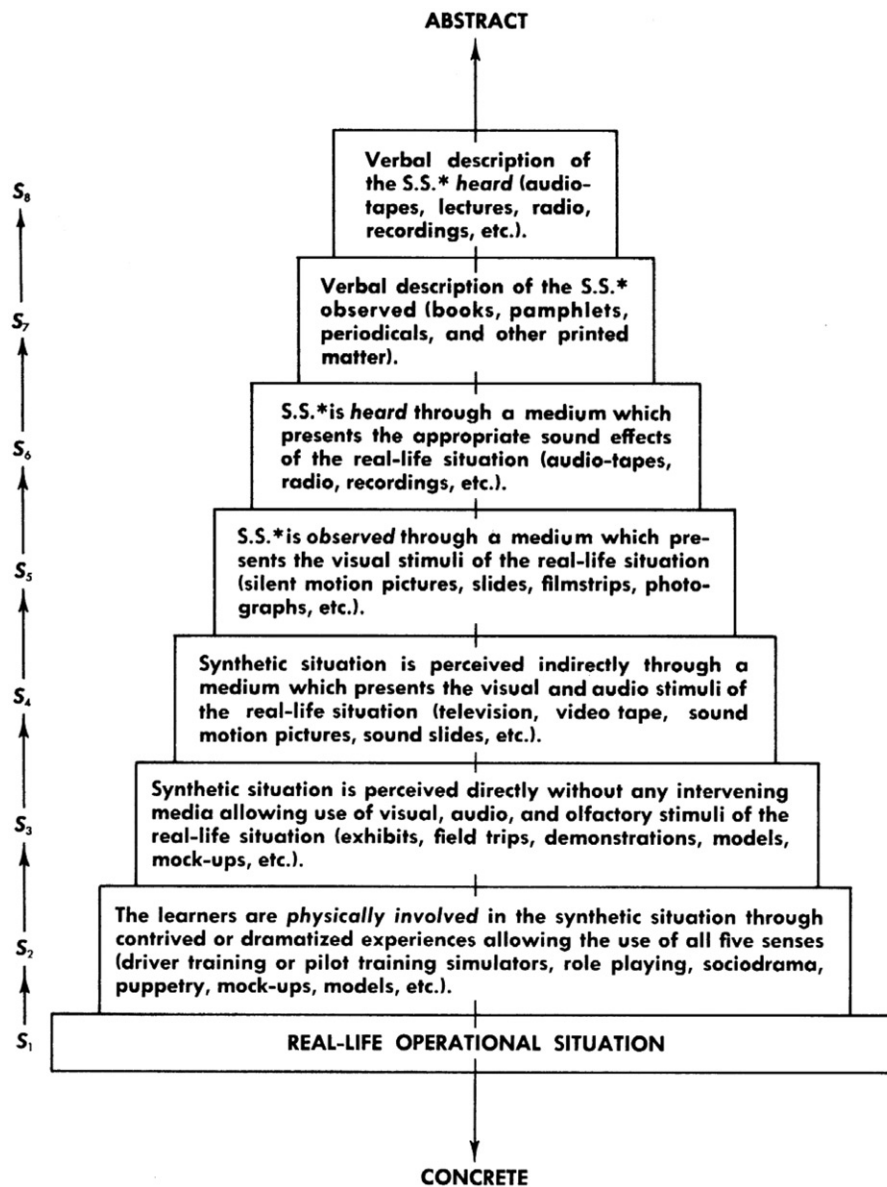
The percentages, as given by the researchers, are given in Table 2.

When one looks at the percentages, one finds a general pattern leading from a lower percentage of retention through hearing and reading to a greater percentage of retention through active learning and teaching. When one inspects the

percentages in more detail, however, inconsistencies emerge, and it appears that there is no agreement on what percentage of information is retained through the different activities.

## Discussion

This literature review has examined articles that deal with medical education and make reference to Edgar Dale's or the



**Figure 5.** Stewart's Simulation through Use of Instructional Media (Stewart, 1969), p 161, "Based in part on Edgar Dale's 'Cone of Experience'".

NTL's *Pyramid of Learning* and/or the percentages of learning retention associated with the Pyramid. It has found that the Pyramid is cited in a wide range of journals, and within the context of a wide range of medical disciplines. The fact that a sizable proportion of the articles was published in 2012 indicates that the Pyramid and its percentages are still currently being cited in medical education literature. Further, the error is being reinforced in new articles and books dealing with medical education (Frith 2013; Risavi et al. 2013; Sewell 2013).

#### Poor referencing

It is apparent that some authors are citing respectable secondary sources in good faith. While citing secondary sources is seldom advisable, it does not necessarily indicate an unacceptable academic practice. Similarly, several authors have cited the NTL diagram as a primary source, and,

therefore, cannot be blamed for errors that may exist in that Pyramid.

In many other cases, however, there is a pattern of poor referencing, and this serves to undermine the research and also contributes to the contradictory percentages. These are not minor typographical errors or misplaced punctuation errors (for which students are routinely berated), but evidence of something deeper. The word "fraud" is probably too strong, but the evidence does point to something academically unsatisfactory.

In this respect, the rather large number of authors claiming to be citing Edgar Dale's percentages and Pyramid directly from his text indicates that it is unlikely that they consulted the original text that they are citing; if they had, they might have seen that Dale does not have a *Pyramid of Learning*, and has no percentages referring to retention of information by students.

**Table 2.** Percentages of information retention given by the authors.

Activity: References	Read	Hear/ lecture	See/audio visual	Dem.	Say/Disc. group	See and hear	Do	Say	Say, hear, see and do	Teaching others
Afandi et al. (2009)					50					
Akaike et al. (2012)									90 <sup>1</sup>	
Arthurs (2007)		10–20	20–50 <sup>2</sup>		80				90	
Avers and Wharton (1991)	5–10	10–20	30–50					70 <sup>3</sup>	90	
Baykan and Naçar (2007)	20	30	40		50		60		90	
Boctor (2013)	10	20	30						90	
Brueckner and MacPherson (2004)	10	5			50					90
Croley and Rothenberg (2007)	10	20	30			50		70	90	
Dark and Perret (2007)	10	20							90	
Darmer et al. (2004) <sup>4</sup>	10	5	20	30	50		75			90
Dickerson (2003)	5–15 <sup>5</sup>		10–20				40–50			
Gallagher et al. (2012) <sup>6</sup>	5									90
Garden (2009)	10	5	20	30	50		75			80
Gordon (1996)		25	45				70			
Jalali and Wood (2012) <sup>7</sup>	10								90	
Jarvis et al. (2009)	10	20	30			50				
Karabulut and Cetinkaya (2011)	10	20	30			50				
Katsuragi (2005)		5								
Kennedy (2006)	10	20		30					90	
Keulers and Spauwen (2003) <sup>8</sup>	40	20							80	
Krishna et al. (2006)				50 <sup>9</sup>					90	
Kumar et al. (2009)	20	30	40		50		60			
Lott (2006) <sup>10</sup>	5	15	10–20				40–50			
Lou (2012)	10		20	30	50		75			90
Manning (1983)	10	20	30			50		80	90	
Mitchell (2007)	10	20	30		70	50			90	
Murphy (1998)	40	20							80 <sup>11</sup>	
Okuda et al. (2009) <sup>12</sup>	10						90			
Oldaker (1992)	5–10	10–20				30–50		70 <sup>13</sup>	90	
Okolie et al. (2007)	10	20	30		70	50			90	
Pei (2003)	10	50							90	
Rao and Kate (2012)	5		20		50				75 <sup>14</sup>	
Sarikcioglu et al. (2011) <sup>15</sup>		10–20								
Shah et al. (2012)	20	30	40		50		60		90	
Shenoy et al. (2012)	20	30	40		50		60		90	
Sprawls (2008)	10	20	30			50		70 <sup>16</sup>	90	
Sujatha et al. (2011)				30					90	
Thomas and Baker (2008)	10	5	20	30	50		75			90
Videla (2010)		5 <sup>17</sup>								
Weinrich et al. (1994)	10	20	30		50			70 <sup>18</sup>	90	
Wood (2004)	10	5	20	30	50		75			90
Zeraati et al. (2008)	20	30	40		50		60		90	

<sup>1</sup>“Active Learning”<sup>2</sup>“Adding visual material to a presentation such as pictures or graphics almost doubles student recall. With lecture and visuals, faculty can increase retention to approximately 50%”.<sup>3</sup>Say and Write.<sup>4</sup>This is given as a “rough guide”.<sup>5</sup>Read or hear.<sup>6</sup>Citing (Lalley & Miller, 2007), the authors note that “the authority and origins of the [Learning Retention Pyramid] are disputed in some quarters.”<sup>7</sup>After two weeks.<sup>8</sup>Citing Murphy.<sup>9</sup>According to Edgar Dale’s Cone of Learning, passive methods of learning lead to a maximum of 50% content retention whereas interactive learning methods provide up to 90% retention of the content.”<sup>10</sup>Citing Dickerson.<sup>11</sup>“Up to 80% of what they receive through interactive multimedia programs.”<sup>12</sup>Citing Croley & Rothenberg.<sup>13</sup>“Verbalize and write.”<sup>14</sup>Specifically, Problem-Based Learning (PBL).<sup>15</sup>Citing Arthurs.<sup>16</sup>“Say and Write”.<sup>17</sup>“According to the learning pyramid the average rate of retention is 5% if the class is only theoretical.”<sup>18</sup>“Say or Write”.

In addition, where some authors have cited secondary sources (e.g. Pei 2003 citing Lagowski 1990), it is unlikely that the authors had consulted the text, as it does not exist. This problem does not appear to be confined to medical education, however, as a search on Google Scholar reveals that Lagowski’s

non-existent article has been cited by six other articles. References to other non-existent texts, such as those by “Brummer” and TB Dale are also academically unacceptable.

In cases where the secondary sources do exist, many are questionable as texts supporting arguments in an academic

paper. For example, Rao and Kate (2012) give Bruner as the source of the Pyramid, citing a report by "Friel" (Friel 2009) at the University of Glasgow. At the time of writing the report, Niamh Friel was a "Level 4 Psychology Student" (Friel 2009) at the University of Glasgow. Friel's source of the Pyramid is a single untitled web page showing the learning pyramid, citing Jerome S. Bruner's *Process of Learning* as its source (<http://homepages.gold.ac.uk/polovina/learnpyramid/index.html>). This page is a single de-contextualised page labelled as "Learning Pyramid" on a website maintained by Dr. Simon Polovina at: <http://homepages.gold.ac.uk/polovina/>. Similarly, the University of Newcastle Upon Tyne document referenced by some researchers (Baykan & Naçar 2007; Zeraati et al. 2008; Shenoy et al. 2012) is a general university student study guide, giving no citations relating to the source of its percentages.

In some cases (e.g. Gordon 1996; Murphy 1998; Kumar et al. 2009), the percentages are given without any reference or citation, and the implication is that they are self-evidently correct. These texts then become a source of data for other texts (e.g. Keulers & Spauwen 2003).

#### Implication for medical education

As noted by several medical education researchers (Harden et al. 1999; Petersen 1999; Harden & Lilley 2000; Hart & Harden 2000), a fundamental weakness in medical education research has been the reluctance of many educators to apply the same standards and expectations of quality to educational research that they would expect in clinical research. For more than a decade, however, we have had the benefit of best evidence medical education (BEME) (Harden et al. 1999; Harden & Lilley 2000; Hart & Harden 2000). While difficulties of medical education measurement have long been recognised (Harden et al. 1969, 1999), it is possible to have some measure of quality of medical education evidence.

Harden et al.'s (1999) discussion of the quality of evidence supports the idea that Edgar Dale's Cone of Experience still has value as a classification system, as it is based on his professional experience and observation. A move to a point at which we apply percentages of learning retention, however, assumes measurement, and we should ask the pertinent question that we would ask of any medical research: "how was this measurement performed?"

The researchers cited in this study appear to have failed in asking that question. In their defence, while many have consulted literature as recommended in BEME principles (Harden et al. 1999), their chief errors appear to have been too trusting of secondary texts, not critically appraising them (Hart & Harden 2000), and not "establishing the reliability of the data" (Hart & Harden 2000). If medical education is to be theory- and research-based (Pauli et al. 2000; Collins 2006; Gibbs et al. 2011), then it is imperative that medical education researchers confirm their evidence and the reliability of their sources.

Until the *Pyramid of Learning* or its percentages can be verified as grounded in research, there is a need for medical education researchers to be wary of using the information associated with them. There is also a need, as noted by Azer

et al. (2012), for peer-reviewers of medical education journals to ensure that references are accurately reported.

From this study, it is obvious from the background that, whether citing the NTL or Edgar Dale, the *Pyramid of Learning* has no substance. Citing either of these would seriously damage a research paper and may impact on a researcher's reputation.

This does, however, mean that there is an opportunity for medical education researchers to begin anew, and develop a model of learning retention.

#### Implication for the NTL

Although beyond the scope of this paper, until the NTL can show the evidence for its Pyramid, it should publicly acknowledge that there is no evidence for it. At the very least, it should stop referring to Edgar Dale's non-existent *Pyramid of Learning* in its correspondence with researchers.

#### Limitations

The search terms limited the subject to medicine, as the purpose was to ensure that papers dealing with the basic sciences would be included only if they were being taught in the context of a medical degree. It is likely that a less restrictive subject area would have found more basic sciences' papers, and perhaps papers in other specialties. Little material purpose would have been served by this, however, as the only difference would have been to indicate that the problem is more wide-spread than this paper indicates.

## Conclusion

This paper has reviewed the concept of the *Pyramid of Learning* and its related percentages of knowledge retention as raised in medical education literature.

As a background, the paper has demonstrated that the Pyramid is based on no credible evidence, and that the primary sources either have no research to substantiate their claims (NTL) or have never produced such a Pyramid or percentages (Edgar Dale).

In spite of this, the paper has found that the Pyramid is widely cited across a range of medical disciplines, and shows no indication of losing prominence. Further, the citing of secondary resources is deeply flawed and is frequently a circular process of agreement that has more in common with the Emperor's new clothes than scientific discourse.

Even amongst these citations, there is no agreement on the percentages of learning retention. While there is a general pattern, they are mostly arbitrarily spread across the learning activities.

The *Pyramid of Learning*, with its percentages, is discredited, and should not be accepted in medical education literature.

## Acknowledgments

I am indebted to Suad Al-Busaidi at Sultan Qaboos University Medical Library, and Said Alghenaimi at the Oman Nursing Institute for assistance in searching for some of the references.



I would also like to thank the anonymous reviewers of a previous version of this paper.

**Declaration of interest:** The author reports no conflicts of interest. The author alone is responsible for the content and writing of the article.

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