Letrud & Hernes, *Cogent Education* (2018), 5: 1518638
https://doi.org/10.1080/2331186X.2018.1518638

cogent education

TEACHER EDUCATION & DEVELOPMENT | RESEARCH ARTICLE

Excavating the origins of the learning pyramid myths

Kåre Letrud[1]* and Sigbjørn Hernes[2]

Received: 11 May 2018
Accepted: 29 August 2018
First Published: 03 September 2018

*Corresponding author: Kåre Letrud, Centre for Philosophy, Inland Norway University of Applied Sciences, Norway
E-mail: kare.letrud@inn.no

Reviewing editor:
Mark Boylan, Sheffield Hallam University, UK

Additional information is available at the end of the article

Abstract: The family of cognitive models sometimes referred to as the "Learning Pyramid" enjoys a considerable level of authority within several areas of educational studies, despite that nobody knows how they originated or whether they were supported by any empirical evidence. This article investigates the early history of these models. Through comprehensive searches in digital libraries, we have found that versions of the Learning Pyramids have been part of educational debates and practices for more than 160 years. These findings demonstrate that the models did not originate from empirical research. We also argue that the contemporary Learning Pyramids, despite their continued modifications and modernizations, have failed to keep up with the developments of cognitive psychology. The conception of memory implied by the Learning Pyramids deviates significantly from the standard picture of human memory.

Subjects: Learning; Educational Research; Education Studies; History of Education; Philosophy of Education; Theories ofLearning; Teachers & Teacher Education; Theory of Education; Teaching & Learning; Educational Psychology

Keywords: learning pyramid; cone of experience; cone of learning; scientific myth; neuromyth; neuroscience; learning modalities

1. Introduction

Uncorroborated and even refuted claims about educational psychology and educational neuroscience appear repeatedly in educational studies, practices and debates. It is not uncommon among educators to believe that we use only 10 per cent of the brain, and have different learning styles (for these and other learning myths see Geake, 2008; Goswami, 2006; Howard-Jones, 2014; Kirschner & Merriënboer, 2013; Rato, Abreu, & Castro-Caldas, 2013). Some of these myths even reach academic status (Kirschner, 2017). This article addresses a similar myth of learning

ABOUT THE AUTHORS

Kåre Letrud is assistant professor at the Centre for Philosophy, Inland Norway University of Applied Sciences. His research focuses on research ethics and the theory of science. This article is part of a case study for a project on scientific myths.

Sigbjørn Hernes is Chief Librarian at the Lillehammer Library of Inland Norway University of Applied Sciences. His research focuses on the sociology of science and on library and information science, with a special attention to bibliometric use and misuse.

PUBLIC INTEREST STATEMENT

Some ideas about learning and teaching widely cited by educators and educational researchers are either unsubstantiated, or even proven to be plain wrong. We search for the origin of one of these conceptions, the Learning Pyramid, and demonstrate that this is one particularly tenacious myth: It is more than 160 years old. We can definitively conclude that the Learning Pyramid did not originate from research, because the field of learning psychology is at least 20 years younger than the model. By contributing to the debunking of the Learning Pyramid, the paper seeks to limit the academic diffusion of this myth.

psychology that has circulated widely among educators as well as educational researchers: a family of models that ranks the retention effects from various presentation and perception modalities. There are several versions of this notion, and those that go by the name of "Learning Pyramid" are probably among the best known. We shall use this as a blanket term for all these different models.

We shall present the findings from a search for the original source of these models, and demonstrate that primitive versions were published in the early 1850s. We shall also argue that it is unlikely that the Learning Pyramids originated from empirical studies, because they predate by decades the entire field of experimental retention studies. Furthermore, we shall argue that the current Learning Pyramids are ill suited for research as well as for educational practices. The present-day versions of the Learning Pyramids feature more or less the same folk-psychological conceptions of learning and memory as they did in the 1800s. Consequently, they contradict current consensus in psychology concerning the structure and function of memory, and they fail to adopt essential insights into the principles of learning developed by memory studies.

According to the Learning Pyramid models, one supposedly remembers very little from hearing or attending lectures. Reading is near equally inefficient, whereas seeing something, for instance, a film or a demonstration, results in a higher degree of retention. Furthermore, talking and participating in discussions, having direct experiences, practising, and teaching others are extremely efficient. The models often neatly quantify the effects on retention of these ways of learning in increments of five or 10 per cent, for instance 10%, 20%, 30%, 50%, 75%, or 90%. Apart from such general similarities, there is neither a consensus about the number and nature of the modalities nor their levels of efficiency, as exemplified by the following three recent quotations:

> … research suggests that that [*sic*] learning does not occur in isolation but by teams working together to solve problems … and that on average, students retain 10% of what they read and 30% of what they see; whereas students retain 50% of group interaction and 90% of what they act on … (Rogers, 2011, p. 609)

> According to Hansen … students retain 25% of what they listen to, 45% of what they listen to and see, and 70% when they manipulate, control and modify experiments, putting into practice what they are learning. (Bravo, van Joolingen, & de Jong, 2006, p. 769)

> The benefits of more holistic pedagogical approaches are demonstrated in social science teaching in the finding that "students retain 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say, and 90% of what they do and say together"… (Johnson, 2016, p. 319)

The models' lack of uniformity impedes efforts at criticizing them as a unitary phenomenon. Indeed, owing to the extensive variations between these models, their affinities and common ancestry were exposed only some years ago (Januszewski & Betrus, 2002; Molenda, 2004; Subramony, 2003). Searches for the alleged studies behind the Learning Pyramids have turned out empty-handed (e.g. Holbert, 2009; Lalley & Miller, 2007; Molenda, 2004; Subramony, 2003; Thalheimer, 2006). Lalley and Miller's (2007) search revealed no studies supporting some of the more common varieties of the Learning Pyramids' ranking of learning efficiency:

> 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. (Lalley & Miller, 2007, p. 76)

Nevertheless, the models have accrued a veneer of authority within medical and engineering educational research, however unwarranted (Holbert, 2009; Masters, 2013). Furthermore, we recently demonstrated that versions of these retention models have been propagated within several other areas of subject-didactic research and educational technology, in at least 418

peer-reviewed articles, as well as in 11 encyclopaedia articles, all published between 1990 and 2013. In comparison, merely 15 articles (including one encyclopaedic article) questioned or criticized the validity of some version of the learning pyramid (Letrud & Hernes, 2016). The distribution of these conceptions by academic journals is problematic in an epistemological perspective. However, the repeated academic publication of the Learning Pyramids might have wider consequences. When peer-reviewed journals and encyclopaedias uphold these models, they imbue them with a scientific legitimacy and authority that transcends academic educational debates. This might augment the current spreading and recognition of these models in professional, public, and political deliberations within such diverse areas of education as curriculum, didactics, and even school architecture, for example (Letrud & Hernes, 2016).

More rigorous knowledge about the early history of the Learning Pyramids shall hopefully contribute to the effort of busting and vitiating these myths, and impede their widespread dispersion and acceptance. There are several gaps in the early history of these models. We know neither how and when they originated nor who produced them. All the same, the lack of information about any original research has not deterred the spreading of these ideas. We are aware that shouldering the burden of proof for the nonexistence of research corroborating the Learning Pyramids is a precarious project. One might argue that the inability to secure proof for its nonexistence may be read as evidence for the existence of this research, despite the evident fallaciousness of the inference. We must stress, then, that those who distribute these models have the responsibility of supplying adequate evidence.

2. Method

In 1967, D.G. Treichler published a version of the Learning Pyramid models in the magazine *Film and audio-visual communication* that went on to become an oft-cited source. Treichler, an affiliate with Mobil Oil Company (later ExxonMobil), claimed that "people generally remember":

> 10% of what they read
> 20% of what they hear
> 30% of what they see
> 50% of what they hear & see
> 70% of what they say
> 90% of what they say as they do a thing (Treichler, 1967, p. 15)

Treichler asserted that these numbers came from studies, but he did not say where they could be found. There have been some attempts at unveiling the source of the model and its original form. Dr Michael Molenda traced the origin of the model to a Paul John Phillips at the University of Texas, who asserted that these numbers were supported by research performed at the US Army's Ordnance School in Aberdeen, Maryland, in the early 1940s. However, searches for documentation supporting Phillips' claim came up empty handed (Molenda, 2004). Dr James E. Stice (2009) questioned this report, and argued that the model originated sometime between 1934 and 1955. Stice also noted that it seemed more closely associated with ExxonMobil. The basis for this claim is a handout he received at a workshop in the early 1970s, featuring a near identical model marked "Socony-Vacuum Oil Company", which was in fact the name used by ExxonMobil in the period 1934–1955. It was renamed "Socony Mobil Oil" in 1955 and "Mobil Oil Company" in 1966, which is the company Treichler was affiliated with in 1967 (Stice, 2009). Quite recently, Subramony, Molenda, Betrus, and Thalheimer (2014) reported findings of claims resembling those made by Treichler, published in 1913, 1914, 1920, and 1922. This documented that the models did exist in various forms in the early 1900s. However, the information shed no light on the models' origin, nor did it point in the direction of any corroborating research. The findings revealed no association with the US Army or the oil industry, and they offered no clues regarding the age or origins of the data.

Ideally, the tracking down of the origins of a scientific idea involves following references that directly leads to the original publication, or indirectly, where each reference constitutes a stepping-stone. Unfortunately, the lack of known references to earlier sources hinders any further attempts at tracking the origins of the Learning Pyramids. However, the last decade or so has seen the digitalization of thousands of books that are normally only accessible at a few libraries or archives. This has made it possible to throw a wider net in the search for the origins of the retention chart, and it has proved to be more efficient than a laborious and time-consuming search for references.

We searched primarily Google Books (books.google.com) and HathiTrust (hathitrust.org). We limited the search period up to 31 December 1940, and produced a large number of search-strings from Treichler's chart by inflecting the personal pronouns' number and gender, conjugating verbs, and by adding different types of scales, including different standards of spelling, like "per cent" and "percent" (Table 1). The most efficient search-strings turned out to be variations of the phrase *"of what we hear" AND "of what we see"*.

Because there is a plethora of general statements concerning retention, identifying findings as being early versions of the Learning Pyramids presented some problems. It was important to differentiate between occurrences of the model, on the one hand, and similar but unrelated claims, on the other. At the same time, it was also vital to avoid rigidity in order to allow the recognition of new variants of the model. The Learning Pyramids are constantly changing, and we could only assume that this would also be the case with the early instances of the models. We could not presume specific enumerations of these effects, nor even that they were quantified. The findings needed to be models ranking learning and perception modalities and their corresponding effect on retention, and the categories of these models had to be adequately similar to the familiar and common versions. We established the following criteria for this study: The finding would have to be a claim about at least three modalities and their comparative effect on retention, or two if these effects were also quantified in ways similar to current versions. In every case, at least two of these modalities had to be contained in Treichler's list. This would ensure that there were adequate similarities to establish a kinship and sufficient leeway for unforeseen varieties. We obtained facsimiles of all the publications in order to verify the findings.

3. Results

The oldest confirmed findings of the model were published in 1852, 1859, 1862, 1871, 1898, and 1901. Albeit not quantified, all of these authors ranked the retention from different learning modalities in ways consistent with Treichler's version of the chart. The oldest finding that quantified these effects was published in 1906 (Roads). We found 63 models published between 1906 and 1940, in conference proceedings, bulletins, books, magazines, newspapers, and academic journals. The earliest finding was published in "The British controversialist and impartial inquirer" in 1852 by an author writing under the signature "C.W., Jun":

> It has been truly and eloquently remarked that what we read, often fails to produce a lasting impression upon the mind; what we hear of, finds no permanent abiding place in the memory; but that which we see become engraven upon the recollection, it survives all the vicissitudes and changes we may encounter, its image its ever at our call, and not unfrequently accompanies its possessor down to the last hours of his earthly sojourn. (C.W., Jun, 1852, p. 130)

Reading, hearing, and seeing are all categories from Treichler's retention chart and their relative effect on retention seems to be consistent with his version. Seeing is more effective than reading or hearing. Although there admittedly is no explicit ranking of these last two modalities, the author listed them in the same sequence as Treichler did, possibly suggesting a similar hierarchy of efficiency.

Table 1. Construction of search-strings

Scale	("of what")	Subject	Modalities		
Percent		I	See/-s	Saw	Have seen
Per cent		You	Hear/-s	Heard	Have heard
Tenth/-s		He	Say/-s	Said	Have said
Ninth/-s		She	Write/-s	Wrote	Have written
Eighth/-s		We	Read/-s	Read	Have read
Seventh/-s		They	Do/-es	Did	Have done
Sixth/-s			See/-s and hear/-s	Saw and heard	Have seen and heard
Fifth/-s			Hear/-s and see/-s	Heard and saw	Have heard and seen
Fourth/-s					
Quart/-s					
Third/-s					
Half					
Tithe					

We find a hierarchy of modalities quantified for the first time in 1906 by Reverend Charles Roads. However, whereas the earlier models all address the persistence of memories, Roads' versions focus on the amount of information retained. Here Roads discusses the pedagogical usefulness of having large illustrations from the Bible on the wall of the Sunday school's main room:

> This would afford that most valuable expression by the student by both word and act. "We remember one tenth of what we hear, five tenths of what we see, seven tenths of what we say, nine tenths of what we do". (Roads, 1906, p. 583)

Interestingly, Roads repeats the retention model at the end of his article. This time the model appears to be modified according to his personal experiences:

> Whether it is true of all adults may be doubted, but in children, probably the impression made through the eyes is ten times greater than that which is made through the ears. The child remembers one tenth of what he hears, but he retains five tenths if he also sees it and seven tenths if he then expresses it, nine tenths if he can get it by his own action. (Roads, 1906, p. 584)

Roads here applies the numbers to children only. Furthermore, the categories in the first version appear to be discrete, rendering the effect of each learning mode individually, whereas several of the categories in the second version are additive, suggesting that multimodality increases the effect on retention.

Between 1906 and 1940, we find that the list of learning modalities and retention was an oft-published and widespread conception, as seen in Table 2. The terms "least", "less", "more", and "most" are not consistently used by these authors, but indicate the relative strength of the impression made on the mind, and the durability associated with the different modalities. As Table 2 shows, the authors generally agreed on the ranking of these modalities. On the other hand, the findings demonstrate comprehensive variations. There was no consensus on what constituted a complete list of modalities and levels of retention effect, subjects, or whether the effects were discrete or additive. We found no consistent use of percentages, nor of numerators and denominators in the fractions. Interestingly, the peculiarly neat numbers with increments of 10% propagated by Treichler's list in 1967, as well as by the modern Learning Pyramids, seem to originate from conversions of tenth fractions that are frequent among the findings: 1/10 = 10%, 3/10 = 30%, and so on.

4. Discussion

The task of unearthing the origins of the Learning Pyramids is not completed. Even if the findings conclusively date the model to the 1850s, the challenge of tracing the model back to its beginning still stands. The model is probably considerably older, given that is referred to as a true and eloquent remark in 1852 (C.W., Jun., p. 130), and as "a well known fact" in 1859 ("On the art of spelling", p. 245). However, predating the model further is now of less importance, because the earliest findings amply refute the existence of original empirical studies. We know that the empirical study of retention is a relatively recent area of research. It initially emerged in the 1870s and 1880s, pioneered by, among others, Wilhelm Wundt, and the first publication of experimental work on retention is generally considered to be Ebbinghaus' *Über das Gedächtnis: Untersuchungen zur experimentellen Psychologie* (*On memory: investigations in experimental psychology*) in 1885 (Mandler, 2007). In his study, Ebbinghaus primarily focused on the effect of repetitions on retention, and not on the effects of learning or perception modalities (Ebbinghaus, 1964 [1885]). As far as we know, Münsterberg and Bigham published the earliest systematic study of the effect of stimulus attributes on retention (1894) more than forty years after the earliest known publication of this conception.

The likelihood that the field of experimental psychology empirically verified the hierarchy and numbers of the retention models decades after being published in the mid-1800s and early 1900s

Table 2. Publications featuring the learning pyramid models pre-1940

Publication	Subject	Hear	Read	Write	See	See, hear	Say/ express	Say, hear	See, hear, express	Touch	Do	Do, say	See, do	See, hear, do
C.W., Jun. (1852, p. 130)	"We"	Less	Less		More									
On the art of spelling (1859, p. 245)	"We"	Least			Less	More								Most?
Forgetfulness and how to cure it (1862, p. 725)	"We"	Less	Less		More									
Cheever (1871, p. 210)	"We"	Least			Less		More?				Most			
Stubblefield (1898, p. 335)	"We"	Least			More	Most								
Teaching hints for intermediate classes (1901, p. 730)	"We"	Least			Least	More								
Roads (1906, p. 583)	"We"	1/10			5/10		7/10				9/10			
Roads (1906, p. 584)	"The child"	1/10				5/10			7/10		9/10?			
Haskell (1913, p. 638)	"We"	2/10			5/10					7/10	9/10			
Wayland (1914, p. 162)	"We"	1/10			5/10						9/10			
The annual meeting of Western Forestry and Conservation Association (1915, p. 29)	"People"	2/10			1/10		5/10	3/10			7/10	9/10		
Allen (1915, p. 255)	"We"	2/10			1/10	3/10	5/10				7/10	9/10		
Fowler (1915, p. 345)	"We"	Least	More			Most								
The graded lessons (1915, p. 597)	"We"	1/10			3/10	5/10								
Hincks (1915, p. 25)	"We"	2/10			5/10									
Robertson (1915, p. 4)	"We"	1/10		5/10	7/10						9/10			
Thomas (1915, pp. 72–73)	"We"	1/10			3/10	5/10	7/10				9/10			
Western Forestry and Conservation Association—Second session (1915, p. 61)	"We"	2/10			1/10	3/10	5/10				7/10	9/10		
Bring the children to the fair (1916, p. 1)	"We"	1/10			7/10		3/10				5/10			

(*Continued*)

cogent education

Table 2. (*Continued*)

Publication	Subject	Hear	Read	Write	See	See, hear	Say/ express	Say, hear	See, hear, express	Touch	Do	Do, say	See, do	See, hear, do
Illustrations pay (1917, p. 5)	"The average man"	1/10			3/10	5/10								
Johnson (1917, p. 94)	"We"	1/10			5/10						9/10			
Calkins (1918a, pp. 22–23)	"We"	10%	15%		20%									
Calkins (1918b, p. 117)	"We"	10%	15%		20%									
Cronk (1918, p. 368)	"We"	3/10									9/10			
Day's issues treated by agency officers (1918, p. 9)	"We"	1/10			3/10	5/10								
General discussion on advertising (1918, p. 4)	"We"	3/10			1/10	5/10								
Iden (1918, p. 268)	"We"	1/10			3/10		5/10				7/10			
Kendall and Stryker (1918, p. 78)	"We"	1/10			5/10						9/10			
Packard (1918, p. 118)	"A child"	1/10			3/10						7/10			
Quelling the Restless Club (1918, p. 496)	"We"	1/10			3/10	5/10								
Richards (1918, p. 2)	"We"		1/10		3/10						9/10			
Robertson (1918, pp. 45–46)	"We"	1/10		5/10	7/10						9/10			
Baldwin (1919, p. 56)	"Children"	1/10			3/10	5/10								
Cooper (1919, p. 134)	"We"	1/10			5/10						9/10			
Every Child Loves to Dress Up (1919, p. 247)	"The spectator"	3/10			8/10						9/10			
Illustrations pay (1919, p. 18)	"The average man"	1/10			3/10	5/10								
Orr (1919, p. 275)	"We"	1/10									9/10			

(*Continued*)

cogent education

Table 2. (*Continued*)

Publication	Subject	Hear	Read	Write	See	See, hear	Say/ express	Say, hear	See, hear, express	Touch	Do	Do, say	See, do	See, hear, do
Saunders (1919, p. 1)	"We"	1/10			3/10									
Beard (1920, p. 33)	"We"	2/10			5/10									
Conat (1920, p. 14)	"We"	1/10			5/10									
Iden (1920, p. 382)	"We"	1/10			3/10		5/10				7/10			
Smith (1920, p. 8)	"Students"	1/10	1/10								9/10			
Willard and Case (1920, p. 82)	"A general farm audience"	1/10			3/10	5/10	7/10				9/10			
Iden (1921, p. 266)	"We"	1/10			3/10		5/10				9/10			
Podhaski (1921, p. 214)	"An Individual"	1/5			3/5									
Smith (1921, p. 73)	"People"	1/10	1/10		3/10	5/10	7/10				9/10			
Stevens (1921, p. 754)	"We"	5%			50%									
Tunmore (1921, p. 31)	"A man"	1/10			3/10	5/10	7/10				9/10			
Burritt (1922, p. 55)	"We"	1/8	1/8		3/8						7/8			
Cassell (1922, pp. 24, 14)	"We"	1/10			3/10						9/10			
Scherr (1922, p. 6)	"We"	1/10			3/10						9/10			
Stevenson (1922, p. 147)	"The average man"	1/10			3/10	5/10								
Ticilos (1922, p. 18)	"The average individual"	1/5			3/5	4/5								
Bricker and Rochester (1923a p. 242)	"Students"	3/10 1/10			5/10									
Bricker and Rochester (1923b, pp. 221–222)	"Students"	1/10 3/10			5/10									

(*Continued*)

cogent education

Table 2. (*Continued*)

Publication	Subject	Hear	Read	Write	See	See, hear	Say/ express	Say, hear	See, hear, express	Touch	Do	Do, say	See, do	See, hear, do
Moody (1923, p. 11)	"Children"	1/10			3/10						6/10			
Parke (1923, p. 387)	"We"	3/8			5/8						7/8			
Stevenson (1923, p. 177)	"The average man"	1/10			3/10	5/10								
Art in our college (1924, p. 1)	"We"	1/10			5/10						9/10			
Cronk (1925, pp. 281–283)	"We"	less			more						9/10			
What should be done? (1926, p. 116)	"A boy"	1/10					5/10				7/10			
Doing and remembering (1928, p. 16)	"A general audience"	1/10			3/10	5/10	7/10				9/10			
Doing means remembering (1928, p. 133)	"A general audience"	1/10			3/10		5/10				9/10			
Dixon (1928, p. 5)	"A general farm Audience"	1/10			3/10	5/10	7/10				9/10			
Students learn most by doing (1928, p. 1)	"A general audience"	1/10			3/10	5/10	7/10				9/10			
Graeber (1930, p. 7)	"We"	1/10				2/5					9/10			
Goode (1932, p. 429)	"The ordinary citizen"	1/10			3/10	5/10								
Mead and Orth (1934, p. 8)	"We"	1/10			One half						9/10			
Wood (1936, p. 258)	"We", "children"	Less			More						Most			
Canfield (1940, p. 353)	"The average man"	1/10			3/10	5/10								

cogent education

is minuscule. In 1912, V.A.C. Henmon published a review of retention studies focussing on the effects of presentation modalities of auditory, visual, and motoric presentations (e.g. articulating and writing). These categories are to some extent comparable to the modalities seeing, hearing, saying, writing, and (perhaps) doing. Henmon reviewed 29 studies on retention published between 1894 and 1910, all focusing on the relation between presentation modality and retention. He found that the findings were inconclusive as to whether visual presentations gave higher retention than auditory. Rather:

> . . . Meumann . . . states that a single method of presentation for all cases can not be declared to be most advantageous. The value of a method of presentation varies with the nature of the material, the type of imagery of the learner and the procedure in presentation. (Henmon, 1912, p. 80)

Addressing the effect of multimodality, Henmon determined that the reported findings were indecisive. Münsterberg and Bigham reported "significant superiority in the combined method" (Henmon, 1912, p. 81). Quantz on the other hand found no advantage in the combined method, considering it a possible hindrance of retention (Henmon, 1912, p. 81). Instead, the studies repeatedly found that the types of material (images, nonsense syllables, numbers) influenced retention, in accordance with Meumann's above remark. Consulting the publications in Henmon's review leaves the impression of early retention studies as a precocious field, despite the radical new effort of measuring and quantifying higher mental processes. The results reported by these often meticulous and laborious studies are much more refined, qualified and detailed than those reported in the Learning Pyramids, contemporary versions included. In fact, it seems that the association of the Learning Pyramids with research emerged several decades after the publication of the earliest models. A column in the insurance-agent magazines *Field Notes* and *The Insurance Field* points in the direction of "the Carnegie Bureau of Scientific Research" ("Illustrations pay", 1917; p. 5; "Illustrations pay", p. 28, 1919; respectively). We have not been able to verify the existence of this institution. Some years later, the model was attributed to "The Carnegie Institute of Technology" (Stevenson, 1922; p.147; 1923; p. 177). This institute, now part of Carnegie Mellon University, was not established until 1912 ("CIT: More than 100 years", n.d.).

Another insurance-sales magazine related the numbers to a "Munsterberg", who "after tests, said that we remember one-tenth of what we hear, three tenths of what we see and five tenths of what we both see and hear" ("Day's issues", 1918, p. 9). This probably refers to the German psychologist Hugo Münsterberg (1863–1916), and he is possibly the same person who is referred to in a dental journal a few years later. The rates of retention reported, however, are not the same:

> Years ago when Professor Munsterberger [*sic*] of Harvard was teaching psychology he gave 298 students a memory test. He found that by reading to them they retained one-tenth of what they heard; by lecturing they retained three-tenths of what they heard; by picturing it to them they retained five-tenths of what they saw. (Bricker & Rochester, 1923b, pp. 221–222)

Other authors (Iden, 1918, 1920, 1921; Packard, 1918) attributed similar numbers to US psychologist G. Stanley Hall, for example:

> G. Stanley Hall, says that one-tenth of what a child hears becomes a permanent part of that child, as well as does three-tenths of what he says, and seven-tenths of what he does. (Packard, 1918, p.118)

We suspect the authors attached the names Münsterberg and Hall in order to add authority the retention claims, as both were major figures in the new field of experimental psychology. This presumably corresponds to the more recent practice of ascribing this kind of claims to US psychologist William Glasser (e.g. Ascough, 2002; Diachun, Dumbrell, Byrne, & Esbaugh, 2006).

The successes of early experimental psychology may have inspired the various attempts at quantifying the models, and we also suspect that they have motivated the shift of focus from amount of time to the amount of information retained. But these early studies do not corroborate them in any way.

A set of learning modalities similar to those distributed by Treichler (1967) were at some point fused with a misreading of Edgar Dale's Cone of experience as a hierarchy of learning modalities (Molenda, 2004; Subramony, 2003), and these early categories were supplemented and partly replaced with categories of presentation modalities like "audiovisual", "demonstrations", and "discussion groups". The resulting hybrid models mix separate and composite perception modalities, and complex presentation modalities (e.g. "audiovisual"; "exhibit"; "demonstrations"). Later versions also include learning strategies (e.g. "practice"; "immediate use"; "teach others").

5. Contemporary retention research and the learning pyramids

Today, more than 160 years after the first known publication of a proto-Learning Pyramid, books, proceedings, peer-reviewed articles, and encyclopaedias continue to distribute the progeny of these early models (Holbert, 2009; Letrud & Hernes, 2016; Masters, 2013). We must admit that theoretically, there may be studies published between 1912 and today that to a degree offer support to some version of the Learning Pyramids. However, the extensive and fruitless searches performed for this research leaves us confident that these studies are non-existent.

But, some might argue, even if the Learning Pyramids are unsubstantiated as theoretical models, surely they may serve a practical function? We believe that they would be a poor choice for heuristic models. We shall argue that the conception of memory assumed by the Learning Pyramids fails to accommodate basic insights into the structure and function of memory advanced in the last decades by cognitive psychology. Instead, the Learning Pyramids' accounts of human memory are simplistic and inadequate. Despite the numerous transformations and diversifications of the Learning Pyramids from the 1800s up until today, these models have retained more or less the same folk-psychological conception of learning and memory as they featured in their early days: According to the Learning Pyramids, memory is a passive depository directly accessible for storage via a set of perception modalities. The amount of material retained, and duration, is primarily, if not exclusively, an outcome of modes of perception and modes of presentation. We shall make our argument after a short rendition of some key features of memory.

The standard picture of human memory is in large part based on Atkinson and Shiffrin's Modal Model of Memory. This model has been "a prominent guiding framework for research" since the seventies (Healy & McNamara, 1996, p. 143). The standard picture distinguishes three types of memory stores: sensory-, working- (sometimes referred to as "short-term"), and long-term memory. We base the following presentation of the standard picture on three common psychology textbooks: Baron (1992); Holt et al. (2015); Smith et al. (2003). Together these publications illustrate the level and longevity of the consensus on memory:

The sensory memory stores the totality of the immediate information captured by the sensory apparatus. It handles all perceptual modalities, but most prominently we process visual and auditory information through iconic and echoic memory. This information is transient; however, we are able to transfer these memories to our working memory for operation by directing attention to some of the information in the sensory memory. We can code this information into the working memory with a visual code, a phonological code, alternatively with a semantic code: as mental pictures, sounds, or by some meaningful associations, respectively. "Mental pictures" comprises both text as well as images (Baron, 1992; Holt et al., 2015; Smith et al., 2003). UK psychologist Alan Baddeley has suggested the addition of an episodic buffer that allows integration and manipulation of memories from both working and long-term memory (Holt et al., 2015)

The capacity of the working memory is limited. We are generally able to hold seven units of information (e.g. names, phone numbers, items on a shopping list), give or take two, and only for a few seconds (Baron, 1992; Smith et al., 2003). Later research suggests that the number of units is even lower (Holt et al., 2015). In order to preserve these fleeing moments of life and learning, we must transfer them into our declarative or nondeclarative long-term memories (Baron, 1992; Holt et al., 2015; Smith et al., 2003).

When we are primed, conditioned, or learn skills, whether they are motoric, cognitive or perceptual, we store this knowledge in the nondeclarative (or "procedural") memory. The performance, like riding a bike or reciting the alphabet, does not require conscious retrieval. Whereas personal experiences, facts and concepts are primarily stored in the declarative memory, and retrieving this information does require a conscious effort (Baron, 1992; Holt et al., 2015; Smith et al., 2003).

Unlike sensory memory and working memory, information retained by long-term declarative memory is not structured according to modality. Whether we receive information verbally, by images, or in writing, this is rarely the format in which these memories are stored. Rather, we preserve the general gist of meaning of what we read, hear and see, and rarely verbatim or eidetic. Declarative memory comprises semantic memory and episodic memory. Semantic memory concerns facts and concepts, like the year of the French Revolution. Episodic memory is autobiographical, and we code the information in relation to ourselves (Baron, 1992; Holt et al., 2015; Smith et al., 2003), for example a memory of a slightly disappointing visit to the remains of the Bastille.

Preserving semantic knowledge is primarily a question of making meaningful connections through elaborative rehearsal. Encoding several connections in the new information makes it part of our web of knowledge and thereby better integrated and more accessible (Baron, 1992; Holt et al., 2015; Smith et al., 2003). An elaborated and increased understanding of the Storming of the Bastille during the French Revolution creates several associations and connections in the material, and thereby multiple retrieval routes and increased accessibility of the particularities, causes, and significance, of this event.

Admittedly, the above rendition of the standard picture of human memory is merely a compendiary presentation of the structure and workings of our memory. However, the standard picture arguably represents the consensus of cognitive psychology, and has so for decades even though some issues are under debate. The Learning Pyramids' conception of memory deviates from this standard picture in significant ways. First, according to the Learning Pyramids the transferral of verbal information to declarative long-term memory is a straightforward mechanic allocation of information independent of a process of encoding, equivalent to a tape recorder that more or less accurately stores the information transferred to it. Whereas, in the standard picture, encoding semantic memories into the declarative memory involves construction of information networks.

Second, the stress placed on perception modalities and presentation modalities by several categories in the Learning Pyramids contradicts the way the semantic declarative memory is structured. Although modalities like seeing and hearing are significant to some degree in relation to working memory, they play a minor role in the encoding, long-term storage and retrieval of the information.

Third, although the most effective learning strategies in several Learning Pyramids, like "practice" and "immediate use", are indeed recognizable as forms of encoding, they render primarily the effect of repetition. Admittedly, repetition is a well-tried method of transferring information to long-term memory, like drilling the alphabet, or the ten-time table. However, these are primarily strategies for encoding information into the non-declarative memory. Without addressing the essential educational issue of deep processing, i.e. the elaboration and incorporation of new information into a meaningful whole, we question whether the Learning Pyramids will be able to

meet the needs of educators and educational researchers for a substantial catalogue of didactic strategies, even if they were adequately corroborated.

It seems paradoxical that the Learning Pyramids are often cited in seemingly constructivist approaches to learning, as arguments for student activation. The model itself describes a one-way street of communication, of information passing from teacher to students, rather than the students' internal construction of knowledge. It stresses repetition as a means of encoding, rather than contextualization of information into a meaningful network, and knowledge as a fixed entity. In short, the Learning Pyramids appear to corroborate a realist position in educational philosophy.

6. Conclusion

The Learning Pyramid models were published at least as early as the 1850s, and the hierarchy of learning modalities originated as no more than a conjecture. Despite their lack of evidence, the Learning Pyramids have been part of educational debates and practices since the 1850s, and have since grown from a mere saying, or a commonsensical idea, into a family of quasi-scientific models. Today, several areas of educational studies consider these models authoritative. However, despite the plasticity and many varieties of the Learning Pyramids, they have failed to implement advances made by cognitive psychology, and ignored contradicting evidence. Consequently, they ought to be rejected both as theoretical and heuristic models.

The Learning Pyramids' message of activity-based learning probably seems just as fresh and modern to educationists today as they must have done in the mid-1800s, and we speculate that they have served as quick and easy ways of contending one's preference for varieties of activity and experience-based learning all these years. However, despite their progressive and constructivist appearance, the Learning Pyramids are first and foremost traditional realist learning models, ranking the efficiency of modes of information transferral.

Acknowledgements
We owe thanks to Rosemary Knutsen at the Library of Inland Norway University of Applied Sciences (now retired) for her vital assistance in retrieving copies of several hard-to-find sources, to Gjert Langfeldt who helpfully commented an earlier draft, and to Anstein Gregersen, Knut Olav Skarsaune, Terje Ødegaard, Ronny Selbæk Myhre, Stefan Sütterlin, and Steven Connolley, for valuable feedback and proofreading.

Funding
The authors received no direct funding for this research.

Author details
Kåre Letrud[1]
E-mail: kare.letrud@inn.no
ORCID ID: http://orcid.org/0000-0002-5434-8227
Sigbjørn Hernes[2]
E-mail: sigbjorn.hernes@inn.no
ORCID ID: http://orcid.org/0000-0002-1091-1903
[1] Centre for philosophy, Inland Norway University of Applied Sciences, PObox 400, 2814, Elverum, Norway.
[2] Library, Inland Norway University of Applied Sciences, PObox 400, 2814 Elverum, Norway.

Citation information
Cite this article as: Excavating the origins of the learning pyramid myths, Kåre Letrud & Sigbjørn Hernes, *Cogent Education* (2018), 5: 1518638.

References

Allen, E. T. (1915). Sentiment making and forest protection. *Canadian Forestry Journal*, *11*(11), 252–256.
The annual meeting of Western Forestry and Conservation Association. (1915). *The Timberman*, *17* (1), 24–33.
Art in our college. (1924). *Columbia Union Visitor*, *29*(40), 1.
Ascough, R. S. (2002). Designing for online distance education: Putting pedagogy before technology. *Teaching Theology and Religion*, *5*(1), 17–29. doi:10.1111/1467-9647.00114
Baldwin, J. L. (1919). *The junior worker and work*. New York, NY: The Abingdon Press.
Baron, R. A. (1992). *Psychology* (2 ed.). Boston, MA.: Allyn and Bacon.
Beard, F. (1920). *Pictures in religious education*. New York, NY: George H. Doran Company.
Bravo, C., van Joolingen, W. R., & de Jong, T. (2006). Modeling and simulation in inquiry learning: Checking solutions and giving intelligent advice. *Simulation*, *82*, 769–784. doi:10.1177/0037549706074190
Bricker, F. A., & Rochester, D. D. S. (1923a). The rising tide of preventive dentistry through education. *Dominion Dental Journal*, *35*(7), 233–255.
Bricker, F. A., & Rochester, D. D. S. (1923b). The rising tide of preventive dentistry through education. *Oral Health*, *13*(6), 214–224.
Bring the children to the fair. (1916, August 24). *The Progress Examiner*, *1*(8).
Burritt, M. C. (1922). *The county agent and the farm bureau*. New York, NY: Harcourt, Brace and company.
Calkins, R. D. (1918a). Commercial geography from the regional point of view. *The Journal of Geography*, *17* (September), 18–25. doi:10.1080/00221341808984368
Calkins, R. D. (1918b). *Commercial geography from the regional point of view*. Paper presented at the Journal of the Michigan Schoolmasters' Club, Ann Arbor, MI. 17 18–25 doi: 10.1080/00221341808984368
Canfield, B. R. (1940). *Salesmanship practices and problems*. New York, NY: McGraw Hill Book Company.

Cassell, M. E. (1922). Geography seven. *Home and School A Journal of Christian Education*, *14*(1), 24.
Cheever, D. W. (1871, oct. 2, 1871). An introductory lecture delivered before the medical class of Harvard University. *The Boston Medical and Surgical Journal*, *8* (14), 209–218. doi:10.1056/NEJM187110050851401
CIT: More than 100 years in the making (n.d.). Retrieved from https://www.cit.cmu.edu/about_cit/history.html
Conat, M. L. (1920). Illustrative material. *Detroit Educational Bulletin*, *3*(8), 14.
Cooper, J. W. M. (1919). *The public schools social studies report*. Oakland, CA: Board of education.
Cronk, E. C. (1918). The sixth sense in missionary training. *The Missionary Review of the World*, *41*(5), 368–374.
Cronk, E. C. (1925). *The home as an agency for missionary education*. Paper presented at the The foreign missions convention Washington.
Day's issues treated by Agency officers. (1918). *The Insurance Field (Life Edition)*, *38*(20B), 8–11.
Diachun, L. L., Dumbrell, A. C., Byrne, K., & Esbaugh, J. (2006). But does it stick? Evaluating the durability of improved knowledge following an undergraduate experiential geriatrics learning session. *Journal of the American Geriatrics Society*, *54*, 696–701. doi:10.1111/j.1532-5415.2006.00656.x
Dixon, H. M. (1928). *Farm-Management extension, 1914–1924 circular*. Washington, DC: U.S. Department of Agriculture.
Doing and remembering. (1928, May 22). *Reading Eagle*, p. 16.
Doing means remembering. 1928. *The Blister rust news*, Vol. 12. United States Department of Agriculture, Bureau of Plant Service: Washington DC. (8) 133.
Ebbinghaus, H. (1964 [1885]). *Memory: A contribution to experimental psychology*. New York, NY: Dover.
Every Child Loves to Dress Up. (1919). *Mission Studies: Woman's Work in Foreign Lands*, *37*(8), 247.
Forgetfulness and how to cure it. (1862). *Barkers' Review of Politics, Literature, Religion, and Morals, and Journal of Education, Science, and Cooperation*, *2*, 724–727.
Fowler Jr., Nathaniel C. (1915). A new method of imparting business education. *Journal of Education*, *81*, 345–348. doi:10.1177/002205741508101305
Geake, J. (2008). Neuromythologies in education. *Educational Research*, *50*(2), 123–133. doi:10.1080/00131880802082518
General discussion on advertising. (1918, November 14). *The National Underwriter*, 4.
Goode, K. M. (1932). *Manual of modern advertising*. New York, N.Y.: Greenberg: publisher.
Goswami, U. (2006). Neuroscience and education: From research to practice? *Nature Reviews Neuroscience*, *7*, 406–413. doi:10.1038/nrn1907
The graded lessons. (1915, June 16). *Western Christian Advocate*, 597.
Graeber, R. W. (1930, February). Taking forestry to North Carolina people. *The Extension Forester*, 7–8.
Haskell, F. (1913). A good word for the Montessori method. *Journal of Education*, *78*, 637–638.
Healy, A. F., & McNamara, D. S. (1996). VERBAL LEARNING AND MEMORY: Does the modal model still work? *Annual Review of Psychology*, *47*(1), 143–172. doi:10.1146/annurev.psych.47.1.143
Henmon, V. A. C. (1912). The relation between mode of presentation and retention. *The Psychological Review*, *19*(2), 79–96. doi:10.1037/h0072813
Hincks, M. M. (1915). Convention demonstrations. *Kappa Alpha Theta*, *30*(1), 25–26.
Holbert, K. (2009). *Toward eliminating an unsupported statement in engineering education research and literature*. Proceedings of the 2009 American Society for Engineering Education Annual Conference & Exposition, Austin, TX.
Holt, N., Bremner, A., Sutherland, E., Vliek, M., Passer, M. W., & Smith, R. E. (2015). *Psychology: The science of mind and behaviour* (3 ed.). London, UK: McGraw Hill.
Howard-Jones, P. A. (2014). Neuroscience and education: Myths and messages. *Nature Reviews Neuroscience*, *15*, 817–824. doi:10.1038/nrn3817
Iden, T. M. (1918). Power and value of habit. *The Upper Room Bulletin*, *4*(16), 265–268.
Iden, T. M. (1920). Habit. *The Upper Room Bulletin*, *6*(24), 382.
Iden, T. M. (1921). Daily readings. *The Upper Room Bulletin*, *7*(17), 257–272.
Illustrations pay. (1917). *Field Notes*, *18*(4), 5.
Illustrations pay. (1919). *The Insurance field (Life edition)*, *39*(5B), 28.
Januszewski, A., & Betrus, A. (2002). *For the record: The Misinterpretation of Edgar Dale's Cone of experience*. Paper presented at the Annual Conference of the Association for Educational Communications and Technology (AECT), Dallas, TX. Retrieved from http://www2.potsdam.edu/betrusak/AECT2002/dalescone.html 11 doi: 10.1044/1059-0889(2002/er01)
Johnson, E. (1917). History Study. *Atlantic Educational Journal*, *13*(1), 94–96.
Johnson, M. (2016). Communicating politics: Using active learning to demonstrate the value of the discipline. *British Journal of Educational Studies*, *64*, 315–335. doi:10.1080/00071005.2015.1133798
Jun, C. W. (1852). Can christians, consistently with their principles, render support to the British stage? Affirmative article,-I. *The British Controversialist, and Impartial Inquirer*, *3*, 128–132.
Kendall, C. N., & Stryker, F. E. (1918). *History in the elementary school*. Boston, MA.: Houghton Mifflin Company.
Kirschner, P. (2017). Stop propagating the learning styles myth. *Computers & Education*, *106*, 166–171. doi:10.1016/j.compedu.2016.12.006
Kirschner, P. A., & Merriënboer, J. J. G. (2013). Do learners really know best? Urban legends in education. *Educational Psychologist*, *48*(3), 169–183. doi:10.1080/00461520.2013.804395
Lalley, J. P., & Miller, R. H. (2007). The learning pyramid: Does it point teachers in the right direction? *Education (Chula Vista)*, *128*(1), 64–79.
Letrud, K., & Hernes, S. (2016). The diffusion of the learning pyramid myths in academia: An exploratory study. *Journal of Curriculum Studies*, *48*(3), 291–302. doi:10.1080/00220272.2015.1088063
Mandler, G. (2007). *A history of modern experimental psychology: From James and Wundt to cognitive science*. Cambridge, MA.: MIT Press.
Masters, K. (2013). Edgar Dale's Pyramid of learning in medical education: A literature review. *Medical Teacher*, *35*, e1584–e1593. doi:10.3109/0142159X.2013.800636
Mead, C. D. W., & Orth, F. W. (1934). *The transitional public school*. New York, NY: The Macmillan Company.
Molenda, M. (2004). Cone of experience. In A. Kovalchick (Ed.), *Education and technology* (Vol. 1, pp. 161–165). Santa Barbara, CA: ABC-CLIO.
Moody, M. O. (1923). *Tales of golden deeds*. New York, NY: Abingdon Press.
Münsterberg, H., & Bigham, J. (1894). Studies from the Harvard Psychological Laboratory: (I). *The Psychological Review*, *1*(1), 34–60. doi:10.1037/h0068876

On the art of spelling. (1859). *Alabama Educational Journal, a Magazine of Education, Science and General Literature for School and Home*, *1*(8), 241–245.

Orr, H. R. (1919). Training in the democracy of Jesus. *Religious Education: the Journal of the Religious Education Association*, *14*(1), 271–275. doi:10.1080/0034408190140408

Packard, E. (1918). *Picture readings: A study of paintings by the great masters*. Bloomington, IL: Public school publishing company.

Parke, E. (1923). A picture service on wheels. *The Educational Screen*, *2*(8), 387–390.

Podhaski, H. F. (1921, September3).*Human Interest in Advertising. American Gas Engineering Journal*, *114*: 212–215.

Quelling the Restless Club. (1918). *The Christian Advocate*, *93*(16), 496.

Rato, J. R., Abreu, A. M., & Castro-Caldas, A. (2013). Neuromyths in education: What is fact and what is fiction for Portuguese teachers? *Educational Research*, *55*(4), 441–453. doi:10.1080/00131881.2013.844947

Richards, B. C. (1918). Texico missionary volunteers. *Southwestern Union Record*, *17*(35), 2.

Roads, C. (1906). Further lessons from large picture. *The Sunday School Journal and Bible Student's Magazine*, *38*(8), 583–584.

Robertson, B. (1918). *Guide-posts for the school room*. Burlington, NC: Press of Burlington Printing Co.

Robertson, J. B. (1915, November 9). Educational corner. *The Twice-A-Week Dispatch*. p. 4.

Rogers, L. (2011). Developing simulations in multi-user virtual environments to enhance healthcare education. *British Journal of Educational Technology*, *42*(4), 608–615. doi:10.1111/j.1467-8535.2010.01057.x

Saunders, N. H. (1919). Reporting. *Eastern Canadian Messenger*, *19*(15), 1.

Scherr, B. A. (1922). Why. *Northern Union Reaper*, *17*(2), 6–7.

Smith, C. B. (1921). The American plan of extension work in agriculture and home economics. *World Agriculture: A Journal of Information and Opinion on the World Aspects of Agriculture and Country Life*, *1*(4), 73.

Smith, E. E., Nolen-Hoeksema, S., Fredrickson, B. L., Loftus, G. R., Bem, D. J., & Maren, S. (2003). *Atkinson & Hilgard's introduction to psychology* (14th ed.). Australia; Canada; Mexico; Singapore; Spain; United Kingdom; United States: Thomson Wadsworth.

Smith, Z. M. (1920). Foreword. *Supervised Home Project and Club Work*, *(41)*, 7–10.

Stevens, W. B. (1921). *Centennial history of Missouri: (the center state) one hundred years in the Union, 1820–1921* (Vol. 2). St. Louis - Chicago: The S. J. Clarke publishing company.

Stevenson, J. A. (1922). *Selling life insurance*. New York, NY: Harper & Brothers.

Stevenson, J. A. (1923). *Constructive salesmanship, principles and practices*. New York, NY: Harper & Brothers.

Stice, J. (2009). *A refutation of the percentages often associated with Edgar Dale's "cone of learning"*. Paper presented at the 2009 ASEE Annual Conference & Exposition, Austin, TX.

Stubblefield, D. R. (1898). The present position of the dental profession. *The American Dental Weekly*, *1*(27), 335.

Students learn most by doing. (1928). *The Official Record*, *7*(20), 1.

Subramony, D. P. (2003). Dale's cone revisited: Critically examining the misapplication of a nebulous theory to guide practice. *Educational Technology*, *43*(4), 25–30.

Subramony, D. P., Molenda, M., Betrus, A. K., & Thalheimer, W. (2014). Timeline of the mythical retention chart and corrupted Dale's cone. *Educational Technology*, *54*(6), 31–34.

Teaching hints for intermediate classes. (1901). *The Sunday School Journal and Bible Student's Magazine*, *33*(10), 730–732.

Thalheimer, W. (2006). People remember 10%, 20%…Oh Really? Retrieved from http://www.willatworklearning.com/2006/10/people_remember.html

Thomas, M. (1915). The Beginners' series. In H. H. Meyer (Ed.), *Introduction and use of the graded lessons international course, general manual* (pp. 67–77). New York, NY: The Methodist Book Concern.

Ticilos, R. O. (1922). Chow-chow. *The Spectator*, *108*(24), 18.

Treichler, D. G. (1967). Are you missing the boat in training aids? *Film and Audio-Visual Communication*, *1*(1), 14–16, 28–30,48.

Tunmore, J. S. (1921). Writing down something makes strongest argument. *The Spectator: an American Weekly Review of Insurance*, *107*(10), 31–32.

Wayland, J. W. (1914). *How to teach American history: A handbook for teachers and students*. New York, NY: The MacMillan Company.

Western Forestry and Conservation Association - Second session. (1915). *Lumber World Review*, *29*(9), 60–62.

What should be done? (1926). Paper presented at the Farm youth: Proceedings of the ninth national country life conference, Washington DC.

Willard, J. D., & Case, H. C. M. (1920). Agriculture and prices. *Journal of Farm Economics*, *2*(2), 70–82.

Wood, S. L. (1936). The Kindergarten child and his group. *Childhood Education*, *12*(6), 258–260. doi:10.1080/00094056.1936.10724027

Cogent Education **(ISSN: 2331-186X) is published by Cogent OA, part of Taylor & Francis Group.**