Towards Personalized Guidance and Support for Learning
Proceedings of the 10th European Distance and E-Learning Network Research Workshop, 2018
Barcelona, 24-26 October, 2018
ISBN 978-615-5511-25-7
ISSN: 2707-2819
doi: https://doi.org/10.38069/edenconf-2018-rw-0034

LEARNING EXPLAINED: A SCHEMA-BUILDING SCAFFOLDING FRAMEWORK TO MAKE SENSE OF PERSONALISED GUIDANCE AND SUPPORT FOR LEARNING

Ignatius G.P. Gous, University of South Africa, South Africa

Abstract

The results of credible research on learning do not readily make it to the classroom; neither does it easily translate into useable strategies to guide and support learning. Solid, reputable and valid research on learning is often inaccessible to practitioners, while simplified research results are prone to become what is referred to as "Neuromyths". To assist in the quest for personalized guidance and support for learning, the article is based on Schema Theory. A schema is a *mental framework* humans use to represent and *organise remembered information*. *Schema Theory* demonstrates effective learning as knowledge construction by building and expanding mental schemata, rather than merely information transmission.

The article starts with the mystery in my story – an auto-ethnographical reflection on my personal journey with learning. Learning is not something abstract – it is something that develops over time, thereby creating mental schemas. That is what the narrative highlights. This is followed by discussing pitfalls to learning, namely pervasive Neuromyths. Effective learning is then brought into the picture – it can be developed, based on reputable research. Therefore, an overview of some studies on learning is given. In doing this, there is the realization that this field is so vast and so complicated, that it is easy to drown or become lost in the difficult-to-understand details. Therefore, I developed a logical scaffolding framework called The Golden Spiral of Life-long Learning, which has two major characteristics. The first characteristic is that it is emulating the learning journey, namely the way learning actually takes place. As such, even primary school children can understand and follow it. The second characteristic is that it is scalable, in the sense that it is robust enough that even specialists in the field of the scholarship of learning can use it as a scaffolding framework to organize their knowledge of the field – which in itself is a characteristic of effective learning. To show that this is the case, the framework is used to make sense of postings from two web pages devoted to promoting effective learning, namely MindShift and TeachThought.com, each with a following of more than 800 000 subscribers. The postings are based on, and refers to reputable research, but the postings have been popularised for the sake of understanding. The conclusion is that structured and guided mental schema-building is an indispensable strategy for personalised guidance and support of learning, not only by teachers, but also for students to whom this strategy should be modelled and taught.

Introduction

The results of credible research on learning do not readily make it to the classroom, neither does it easily translate into useable strategies to guide and support learning (Tokuhama-Espinosa, 2008; 2014). Neuromyths, on the other hand, spread like wildfire, and once in force, are very hard to eradicate (Tardif, Doudin, & Meylan, 2015; Dekker, Lee, Howard-Jones, & Jolles, 2012; Dündar & Gündüz, 2016). The challenge is: how can we support educators to make sense of research, empower them to identify questionable claims and problematic research claims and findings, and enable them to translate credible research into effective classroom practice?

To meet this challenge, a scaffolding framework was developed, emulating the spiralling learning trajectory, with aspects of the learning process placed along the learning pathway.

The framework was then tested by using it to explain learning to various audiences, ranging from university lecturers and students to schoolteachers and –learners, even as young as 10-year old Grade 4 learners. The framework was found to be able to guide and support all of the audiences to understand the process of learning. The framework was also found to be scalable, in the sense that on the one hand it was simple enough to help young children how to learn, but at the same time, it was robust enough to help specialists in the field to organize research results in a coherent and interconnected set of schemas and frameworks.

In this article, the author reflects on his own learning trajectory as an example in case of how learning takes place in real life, as an illustration of and precursor to the theoretical discussion of the Science of Learning.

A short discussion of pervasive pseudo-science Neuromyths is followed by mentioning reputable learning theories.

The challenge to (mostly overburdened) educators is to be able to keep abreast of developments in this vast field. For this reason, based on the learning theory of mental schema-building, a scaffolding framework is proposed to help educators make sense of the results from the vast field of the learning sciences.

To test the applicability thereof, two websites were chosen, to which more than a million Facebook users subscribed. These are the kind of sources educators would choose to use – they are readily available as part of the social media platforms they access every day. The most recent 50 postings of each were accessed, and each were assessed as to which of the six plus one rubrics along the Golden Spiral they could be assigned to, thereby creating sub-schemas.

The conclusion is that structured and guided schema-building is an indispensable strategy for personalised guidance and support of learning, not only for teachers, but also for students to whom this strategy should be modelled and taught.

ISBN 978-615-5511-25-7

The Mystery in Mystory … why did it not work?

The typical trial-and-error student

If I have to share my Life Story Schema (Lewis, 2011; Bluck & Habermas, 2000), I will have to admit that I was the typical student – given content to learn, but never taught how to learn and master the prescribed content. How to do it, I had to figure out myself. So I did the usual thing copied from my peers: I read and reread the material I had to study and memorise. I underlined and highlighted. I crammed right through the night before a test. I studied in different locations – sometimes at my table, sometimes outside in the garden, sometimes on my bed. I studied from summaries – sometimes my own, sometimes ones I got from fellow students.

With this arsenal of strategies, I was a slightly above average performer at school, but not in the top performer bracket. When I moved to university in another city from where I matriculated, I felt I could make a clean start where the lecturers had no preconceived idea of my performance bracket. I also started with a challenging degree, which included foreign languages as well as courses with masses of information. I felt I owed it to myself not to fail and fall behind. Apart from being highly motivated to turn a new page, two more things happened. I befriended a fellow student who had scored straight A's at school. I also attended a study method course focused on MindMaps and time management.

Accountability partner

Unlike me, my friend was a highly organised person who studied diligently and according to a planned schedule. He became my accountability partner, and what developed was a *pacing relationship* where we regularly checked how far the other one had progressed. I usually lagged behind, but still it helped me to stay more on track and time than before. It helped me to such an extent that I also performed well, and I passed my first degree (Bachelor of Arts) with distinction.

Learning by teaching

This lead to a specific experience I remember well to this day. During my second degree (Bachelor of Divinity), we had to write a test on Hermeneutics, for which a textbook written in German was prescribed. Many of the students could not read German and therefore had to rely on summaries. I had a basic reading knowledge of German, but this book proved to be very challenging. The evening before the test, a fellow student who stayed in the same student residence as I did, came to me for help. I explained to him my understanding of the work. A while after he left, another student knocked on my door, saying he heard I explained the work to his friend, and asked that I explain it to him too. I did, and he went his way. Then a third, and later a fourth student came to me, asking the same. At this stage, I was a bit irritated, because I felt they infringed on my study time, but I also realised that every time I explained it to them, I was able to talk about the work more fluently and with more confidence. In between each visit, I checked on the parts I was not so sure about and questions that were

ISBN 978-615-5511-25-7

asked that I could not readily answer. The next day we all wrote the test, and when the marks came out some time later, all the fellow students I helped passed the test with flying colours. My performance in the test was one of the highest marks I ever obtained. Teaching, I realised, was a powerful learning strategy.

Learning how to learn – by trial and error

The initial course I attended in my first year fuelled a life-long interest in how to study effectively, and I read every book and source about learning I could lay my hands on. This lead to peculiar actions and habits. I made huge and colourful MindMaps on the backs of old calendars, computer paper and flipchart papers – which lead to amused looks from fellow students when I took it out to revise in class – also because I needed the space of about four students to do revision. I always had something on my ears when studying – from industrial noise cancelling earphones to create total silence, to earphones for listening to anything from white noise to baroque music with 40 to 60 beats per minute, or music without any beat at all. I numbered everything I had to learn and tried to memorise it by using anything from number-sound and number-shape methods, including using the Major System. When I ran out of numbers, I tried to drape them in colours or states like fire, ice or water (Worthen & Hunt, 2011; Mostafa & El Midany, 2017; Aydin & Sunbul, 2012).

Metacognition

I passed all of the tests and exams I wrote. However, most of these strategies did not actually make the learning process and experience faster, more efficient or easier. To the contrary, they actually made it more cumbersome and even awkward. I felt I merely did all the wrong things very well.

I had to take stock, stand back, weigh and evaluate all I did. What worked, and why? What did not work, and why not?

What worked well?

What stayed with me were two strategies. The first one was to start by learning a table of contents of a book and all the headings of a chapter by heart, and then adding detailed information. In this way I had a schema that could organize new information, and that could be elaborated and added to. The second strategy is to teach what I have learnt – be it to a real person, or just by talking out loud (which added to the perception that I was an "odd" learner). Teaching showed me what I knew well enough to talk about coherently, and which aspects I did not know well enough and needed to revisit (Gous, 2015).

What I wondered about were all the strategies that did not work well, and especially why. Did I use them incorrectly? Did I expect too much of them? Were they really effective? All along, I had this nagging feeling that many of the strategies were not geared for the study of serious and difficult academic work. They might be good for remembering a grocery list, but not the elaborate content of a course that may run over two or three years.

ISBN 978-615-5511-25-7

It was then that I came across the term *Neuromyths*.

Seduced by Pervasive of Neuromyths

Neuromyths are remarkably persistent beliefs about the brain and the mind which relate to learning and education (Ansari, Coch, & de Smedt, 2011; Dekker et al., 2012; Ferrero, Garaizar, & Vadillo, 2016; Geake, 2008; Gleichgerrcht, Lira Luttges, Salvarezza, & Campos, 2015; Purdy & Morrison, 2009; Tardif et al., 2015; Tokuhama-Espinosa, 2011). Many of the beliefs originated in reputable research findings, but were used beyond their original intention, transmitted in a diluted form, or incorrectly applied. Still, they stick.

The neuromyths had an influence on my self-perception, telling me I use only 10% of my brain. I saw myself as a right-brained person who looked creatively at the big picture, and I neglected the details of what I was studying.

The neuromyths also had an influence on my learning strategies, because I tried to learn according to my learning style, which is supposed to be visual. I neglected listening and doing, I tried to put all my summaries in visual format, which took an inordinate amount of time, and I seldom had time to actually memorize my MindMap summaries. To my dismay I realized I could not remember the pictures I had drawn, even though visual memories were supposed to be almost infallible (Kampwirth & Bates, 1980; Doyle & Rutherford, 1984; Curry, 1990; Snider, 1990; Stahl, 1999; Doyle, 2011; Gutierrez & Rogoff, 2003; Dembo & Howard, 2007; Purdy, 2008; de Bruyckere, Kirschner, & Hulshof, 2015; An & Carr, 2017).

The baroque music also did not have a major influence. The only lasting influence was that it actually spoiled my enjoyment of the music, and to this day when I hear some of those pieces, it reminds me of studying under pressure, more than remembering what I tried to remember about the work.

Neuromyths are much like rumours. They stem from a (seemingly or real) credible source. It is well known that every magazine with a picture of a brain on the cover sells well. They simplify a believable truth to manageable proportions. They are repeated enough times that they are still believed even when questioned or disproved. It took personal experience that they do not work to force me to reconsider them, and to think about them metacognitively.

If there are many wrong, outdated or skewed views about learning available that people still believe, where do we get credible guidance?

The many faces of learning – and the credible Theories that explain them

Learning is a natural activity, and people do it from birth onwards to survive. As such, it is seldom explicitly taught – who teaches people to breathe? Therefore, people do not necessarily reflect on their own learning. It just "happens". When it works more or less well, people do not examine it critically. However, since learning became formalised, learning theories developed. Thinking about learning developed into disciplines, namely the Sciences of

ISBN 978-615-5511-25-7

Learning (SoL), or the Scholarship of Teaching and Learning (SoTL) (Mayer & Mayer, 2014; Mayer, 2008; Meltzoff et al., 2009).

Learning is not a one-size-fits-all endeavour, but rather a complex and multi-faceted human activity, an interplay between the learning individual, the to-be-learned material, and the relevant and available sets of strategies.

Since the beginning of time people thought about it, leading to contrasting views on it.

Tokuhama-Espinosa discusses (2016) "Theories of how humans learn" in a March 3, 2016 lecture (Neuroscience of Learning: An introduction to Mind, Brain, Health, and Education – PSYCE-1609) prepared for students at Harvard. In summarised form, these are the learning theories a researcher or practitioner needs to know about. The mere mentioning of the list is to indicate the extent and intricateness of the field, which makes it difficult for a practitioner to navigate the terrain with more success and joy. (See also Zhou & Brown, 2017; Mowrer & Klein, 2001).

Humanist theories:

- Emotional intelligence,
- Experiential learning,
- Maslow's hierarchy of needs,
- Positive psychology: Flow and grit,
- Self-determination theory.

Behaviourist theories:

- Classical conditioning (Pavlov),
- Operant conditioning (Skinner),
- Social learning theory (Bandura).

Cognitivist theories:

- Information processing theory,
- Cognitive load theory,
- Expertise theory,
- Gestalt theory,
- Theory of mind.

Connectivist theories:

- Anchored instruction,
- Cognitive dissonance,
- Communities of practice,
- Situated learning,
- Social development theory,

ISBN 978-615-5511-25-7

- Problem-based learning.

Design-based theories:

- ADDIE (Analysis; Design; Development: Implementation; Evaluation) model of instructional design,
- Elaboration theory (scaffolded instruction),
- Learner-centred design,
- Multimodality,
- Digital citizenship,
- Gaming.

21st century skills:

- Soft skills,
  - Collaboration,
  - Communication,
  - Caring,
  - Critical thinking,
  - Culturally sensitive,
- Technology,
- Life-long learning.

Constructivist theories:

- John Dewey,
- Maria Montessori,
- Wladyslaw Strzeminski,
- Jean Piaget,
- Lev Vygotsky,
- Heinz von Foerster,
- George Kelly,
- Jerome Bruner,
- Herbert Simon,
- Paul Watzlawick,
- Ernst von Glaserfeld,
- Edgar Morin,
- Humberto Maturana.

New theories:

- Plasticity, gene and environment interaction,
- Neuroconstructivism,
- Neural networks,
- Five pillars: Symbols, patterns, order, categories, relations.

ISBN 978-615-5511-25-7

Overworked and Overwhelmed – No ways I can keep up with all of this!

From this, it is clear that the scholarship of learning is a vast and complex field. It is difficult for specialists and practitioners alike to keep abreast of developments in the field and to make sense of new research findings that become available every day. Research on a focused topic is presented, and practitioners need to try to assess it, often without knowing from which of the various research perspectives it stems. No wonder it is a difficult task to build coherent mental knowledge schemas, and to distinguish between good and bad research findings.

One way to address this difficulty is to use the learning strategy called mental schema building. It has links to Gestalt theory as well as information processing theory, and is based on Constructivism and Neuro-constructivism. Knowledge coagulates in mental schemas, or sense-making units of knowledge. At least three general classes of schemas can be identified (Derry, 1996; pp.167-169), namely

- Memory objects (phenomenological primitives, integrated objects and object families), which is about basic and complex knowledge structures about phenomena;
- Mental models, which is about constructing, testing and adjusting mental representations, and therefore understanding complex problems and situations; and
- Cognitive fields, a distributed pattern of memory activation that makes certain memory objects available for use.

Broadly summarised, schemas are about knowledge, understanding and the use thereof. A mental schema is a framework representing some aspect of the world that has been built up over time and after exposure to inputs from people, the environment, ideas and experiences. As such, it becomes a system that helps one to organise and perceive new information. New knowledge adds to, adapts or changes the schema (see also Arbib, 1992; Bluck & Habermas, 2000; Gosh & Gilboa, 2014, McClelland, 2013; McVee, Dunsmore, & Gavelek, 2005; Plant & Stanton, 2013; Rumelhart, 1984; Rumelhart, 1991; Ortony & Rumelhart, 1977; Rumelhart, 2017; Xie, 2017).

What follows, is a schema building scaffolding framework, intended to make it easy for educators and learners to make sense of the vast discipline of the learning sciences.

The Golden Spiral for Life-Long Learning Scaffolding framework

In practical terms, learning can be described as a journey or trajectory through an area, with characteristic and recurring features and milestones along the way. People learn for a reason, they plan the process, they perform learning tasks, they make mistakes and rectify them, they ask for help and assistance, they assess their progress, and when they reach their goal, they do it all over again. It is also to reflect on the process, to see what worked well and what not, and especially why, in order to improve continuously.

The learning trajectory is depicted metaphorically as a Fibonacci spiral. The spiral portrays learning as a revisiting endeavour. The Fibonacci aspect depicts the fact that individual

ISBN 978-615-5511-25-7

aspects are useful on their own, but when used in conjunction with one another, it has an exponential effect, just as the addition of consecutive numbers leads to the widening of the spiral (Horadam, 1961).

There are six milestones along this trajectory, with a seventh meta-milestone. These six plus one aspects are present in various ways in all acts of learning. They are presented in a linear fashion, but can be used in any order, repeated or even be concurrent.

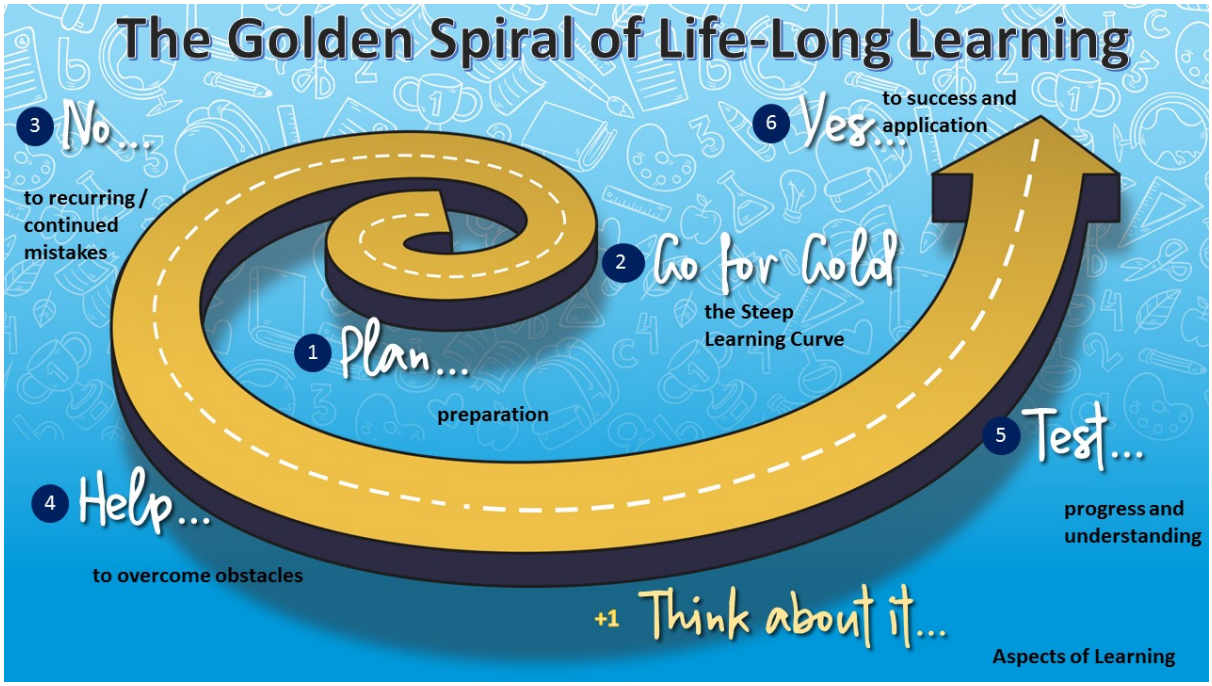

Figure 1.

Yes: the goal

The last aspect is actually the first aspect, and is about why a person studies. This can be part of a long-term life goal, translated into a medium term qualification goal, and made concrete in a short-term study session goal. Although the goal is at the end of the spiral, it is in actual fact the starting point, as in the theory of backward planning versus forward planning (McTighe & Thomas, 2003; Wiggens et al., 2005).

Plan: How to reach for the goal, how to plan the learning activity.

When the goal is clear, action steps to reach it are necessary. This is once again divided into long, medium and short-term action steps. It is also about focus and being available to learn.

Go: How to perform the learning tasks

This aspect is how to memorise and understand data, information and knowledge, and how to master necessary skills. The goal here is to be aware of many learning strategies, and to choose those geared for the specific learning task at hand.

ISBN 978-615-5511-25-7

No: How to manage mistakes

Mistakes are always part of learning. It is important to expect them, and to learn from them – what kind of mistake it was, and how to correct and, in future, avoid them.

Help: How, where and when to seek necessary help and support

Help needs to be sought after a person attempted a task. Only then can a person know what kind of help is needed and from whom it can be requested, such as from sources, experts or peers.

Test: How to assess progress

Assessment of a person's level of understanding needs to be done all along the way, and not only when writing tests and exams.

Yes: Arriving for the sake of departing again

Arrival at a pre-set goal gives feelings of accomplishment. A short-term goal fits into medium and long-term goals, and therefore the arrival at the goalpost is immediately the departure to the next part of the journey.

Plus one (metacognition): Thinking about it – reflecting on and understanding the process and the constituent parts

Understanding each of these aspects as well as how they fit into a coherent schema is important for the sentient use thereof.

These six plus one aspects are broad enough to group diverse rubrics under each of them, but at the same time specific enough to create useable strategies in real life learning situations.

Scaling the Scaffold, Testing the Framework: Mindshift / TeachThought Websites

The question is whether this scaffolding framework will actually help educational practitioners and researchers to get a grip on the complex field of the scholarship of learning. For this reason, I chose two websites with a substantial following where people choose to get updates on postings. Both sites can be followed or "liked" on Facebook, which means followers get automatic updates of postings on their Facebook walls.

The first is MindShift, with a following of 812606. It describes itself as "a podcast about the future of learning". It is also available on http://mindshift.kqed.org, Google Play, NPR One, and Stitcher.

The second is TeachThought, with the goal being "an organization dedicated to innovating education through the growth of outstanding teachers", and with the mission "to support teachers as they grow into innovative educators".

ISBN 978-615-5511-25-7

The methodology was to take the last 25 postings of each of the websites on a given date (September 25, 2018), give a short summary of what the posting was all about, and then to see if and where it fits under the 6 + 1 rubrics along the Golden Spiral of Life-Long Learning.

The ratings of the postings were done by a masters' student of educational psychology, who also acts as an assistant teacher in a South African school. Afterwards, the author of the paper did the same to see if his assessment coincides with that of the first evaluator.

Table 1: The articles and their categorization (MindShift)

No.	Title	Summary	Student	Author	Differ
1	Overcoming childhood trauma: How parents and schools work to stop the cycle	This article acknowledges the learner's challenges and recognises school attendance as willingness to learn and attitude of ownership of their life despite their challenges. Parent-child interaction therapy serves as a method of improving communication between child and parent and helps with management of tantrums and aggression.	Help	Help	
2	How tips via text messages help parents and preschool learners learn	Technology-generated reminders of simple tips on how parents can engage with pre-schoolers by means of simple learning activities they can do together. Researchers are exploring how a simple text-based nudge to parents could improve their kids' academic performance by making engagement easier and even habitual for parents.	Help	Help	
3	How to use YouTube video essays in the classroom	Motivation on why videos should be used in the classroom - capture attention of students and simplify complex topics.	Learning curve	Learning curve	
4	Voice of witness: Bring the power of oral history to your classroom	The exposure of students to different stories, helping them see that they are participants in history. Helping those with a silent voice to be heard, by telling their stories.	Learning curve	Learning curve	
5	The five types of mentors you need in your life	How to develop deep connections with mentors, teaching both the mentor and the mentee.	To success and application	Help	*
6	Tech tips: Make the most out of your coaching experience	The importance of a teacher having a coach that provides them with feedback and support. Steps to build such a relationship.	Metacognition	Metacognition	
7	Working in a group might be the best way to help kids meet individual goals	Learning is a social activity and learners must be involved in each other's learning process thus the argument for group work. Group learning personalizes the work.	Plan/ the learning curve	Learning curve / Help	*
8	How parents can help improve the quality of a teen's sleep	Importance of sleep in the adolescent developmental phase and of reducing the use of electronic devices. A call for parents to be active.	The learning curve	Planning / Metacognition	*
9	How cross-cultural dialog builds critical thinking and dialogue	Ways teachers can encourage dialogue among students to share different perspectives.	Help	Help	
10	How advisers connect via tech to help low income students apply to college	A free virtual advisor taking the pressure of learners to apply for college education. A virtual career guidance helper assisting: Step by step	Help/ Plan	Help / Plan	
11	Learning mindfulness centred on kindness towards oneself and others	Mindfulness empowers and excites students to grow personally and academically. Mindfulness practised for the classroom.	Learning curve	Plan	*
12	Improving academics: Why school climate matters	A positive school climate encourage teachers to be their best and contributes to positive job experience resulting in learners enjoying coming to school.	Think about it	Plan / Metacognition	
13	Three tools for improving critical thinking and problem solving skills	Integrative thinking can build critical thinking at a young age. Examples of integrative thinking tools for the classroom.	Learning curve	Learning curve	
14	Even when research	The importance of a quality preschool is stressed.	Metacognition	Metacognition	

ISBN 978-615-5511-25-7

	supports changing traditional teaching, parents make it hard	Interactive learning is of utmost importance, there need to be hands-on activities (experimental training).			
15	Three things top performing students know that their peers miss	Learners must study in a way that requires more than just memorizing material. The importance of study schedules is stressed.	Learning curve	Planning / Learning curve	*
16	How to develop mindsets for compassion and caring in students	A mindset of resilience needs to be fostered in learners. Strategies on how teachers can be more intentional in their classrooms to build compassion and care into students - resulting in resilience	Metacognition / Help	Metacognition / Help	
17	What do we lose by measuring "average" in education	An argument against generalization as individual's backgrounds and circumstances differ. Equal fit approach to a situation, rather than average.	Learning curve	Metacognition	*
18	Could this digital math tool change instruction for the better	A program that harnesses the social nature of online interactions into meaningful math inquiry. Learning is social and students are encouraged to think beyond equations, processes are made visible and students get written feedback.	Help	Help	
19	Bay area (USA) teens on the books that change their world	Short book reviews from learners' perspective on popular modern books that learners resonate with today.	Metacognition	Metacognition	
20	Confessions of a former teacher	A teacher sharing her regard for education. She is of opinion that the best way to work with students is to work with them directly. A reflective approach to her experience as a teacher.	Metacognition	Metacognition	
21	A learning experience is different in a school that assigns laptops, a survey finds	This study reflects that technology increases student engagement with the learning material and a higher motivation to learn. An approach where technology is used as a tool to increase peer-to-peer interaction.	Learning curve	Learning curve	
22	7 strategies to keep your phone from taking over your life	Bit size information keeps our brain addicted to our smartphones. The human relationship with their smartphones are explored with 7 recommended changes in behaviour.	Help	Plan	*
23	How to talk to young people about the Kavanaugh story	The importance of educating young people on sexual violation is stressed and tips on how to do so are elaborated on.	Metacognition	Metacognition	
24	How to support your kid at school without being a helicopter parent	A call for parents to build resilience in their children by introducing four skills to instil in children.	Help	Metacognition / Help	
25	Forget talent: Why practise is key to most prodigies' success	An argument between hard work vs natural talent. This article suggests that practise leads to the development of natural talent.	Learning curve	Learning curve	
26	Tips and tricks to keep kids on track during genius hour	The article talks about how to help children solve problems, by breaking them down. Independence in the learning process is stressed and learners need to reflect on their learning.	Help	Metacognition	*
27	Another advantage of wealthy students	An explanation on the academic performance of students, the focus is on the advantages of the high economic class and context.	Metacognition	Metacognition	
28	Why schools are banning yoga	The article focuses on the importance of yoga and mindfulness and stress, the importance that children need to learn to divorce their negative thoughts and emotions. The clash between eastern religion and western science is a golden thread.	Learning curve	Metacognition / Plan	*
29	Teachers strategies for pronouncing and remembering students names correctly	The effect on names are discussed. It influenced self-esteem, self-concept, self-worth etc. Tips on how to handle mispronunciation.	Learning curve	Metacognition	*
30	How to help teenagers embrace stress	A psychological perspective on the effects of stress on the brain and behaviour.	Help/ Learning curve	Help/ Learning curve	
31	The curse of America's illogical school day schedule	Comments on the school day. Suggestions made on how to make school more enjoyable for students and teachers. The benefits on why school should start later and go for longer are stated.	Metacognition	Metacognition	
32	Kids are starting a revolution to get	An article on what science says about the effect of technology on parenting. The effect on child behaviour	Learning curve	Metacognition	*

ISBN 978-615-5511-25-7

	their parents to put down their phones	is elaborated on.		
33	Feedback tips on saving time and improving student writing	Factors that influence students' responsiveness on comments are discussed. Guidelines for constructive feedback are given.	Learning curve	Learning curve
34	Why group work could be the key to English learner success	Practical tips on teaching English to students and the importance of where students are placed in the classroom and with who they are paired is elaborated on.	Help	Help
35	What writing Wikipedia entries can teach students about digital literacy	According to this article, Wikipedia makes information more visible to students. It seems as if educators are among those loading information onto this platform	Metacognition	Metacognition
36	School year screen time rules from a teacher	This article is part of Common Sense Media's Parent Voices series, which provides a platform for opinions about parenting in the digital age. All ideas expressed are the writer's own.	Metacognition	Metacognition
37	Does too much credit recovery lead to inflated graduation rates?	There is questioning about how many students really deserve diplomas due to the cutting of credits. Graphical statistics indicate the credits. Recommendations are made for this worrying issue.	Test	Test
38	The coucher program we really need is not for schools - its for after school	The urgency for after school funding are emphasised, parents struggle to afford school fees and cannot afford after school care. The effect on the child's wellbeing is stated. Child supervision is of utmost importance.	Metacognition	Metacognition
39	10 jobs that should be safe from automation	Robots are taking over the workforce by force. The spread of artificial intelligence does not only automate the rote parts of our jobs, but encourages humans to take on more complex tasks.	Goal planning	Goal planning
40	Research based strategies to help children develop self-control	The importance of delayed gratification is stressed and focus is placed on "the marshmallow experiment" that teaches children self-control. The researcher speaks about the importance of trust in a relationship where delay of gratification is initiated.	Plan	Plan
41	Childhood trauma and its lifelong health effects more prevalent among minorities	People with low-income and educational attainment, people of colour and people who identified as gay, lesbian or bisexual had a significantly higher chance of having experienced adversity in childhood. The psychological effect of these traumas are discussed.	Help	Help
42	How do you know when a teaching strategy is most effective	A model that proposes why different learning strategies might be more effective at different stages of the learning cycle. The overall theme is that the "purpose of schooling is to equip students with learning strategies, or the skills of learning how to learn".	The learning curve	The learning curve
43	Why unlearning old habits is an essential step for innovation	The importance of unlearning certain habits is emphasised as well as a framework for implementing unlearning. If something needs to be unlearned, Biller's three frameworks for implementing unlearning are introduced: changing mindsets, changing habits and changing organizations.	The learning curve	The learning curve
44	As one Nashville group quietly re-segregates a group of parents pushes back	Parents are pushing to bring change in Nashville, comments from parents are captured and insights are shared.	Metacognition	Metacognition
45	Throw your children's art away	A call for parents to let go of nostalgic memories. The value of child art is discussed and the feelings around letting go of their pictures.	Metacognition	Metacognition
46	Reading responses that engage the real student	When teaching contextual analysis, it is more effective to use reading responses, rather than comprehension questions. Four rules to writing reading responses are shared.	Help	Help
47	How reading aloud to therapy dogs helps struggling kids	The use of a therapy dog that teaches children empathy, compassion and a deeper love for literacy. The therapy dog takes on the attention and helps learners feel less self-conscious and makes the child more confident and open to learning and their spirits are lifted.	Learning curve	Learning curve
48	Why teachers should help students learn effective study strategies	Dunlosky was looking for strategies that are broadly applicable and do not just aid memorization; he wanted to find the approaches that deepen understanding and help students transfer learning to new situations. A few	Help/ The learning curve	Help/ The learning curve

ISBN 978-615-5511-25-7

		practices are mentioned and discussed in detail.			
49	Forest preschools let kids run free, but can they change to reach diverse families?	Arguments that children thrive outdoors and while playing outdoors they are developing independence, resilience, and other valuable social-emotional skills. A tested model in Colorado.	The learning curve	The learning curve	
50	How can we teach math to encourage 'patient problem solving'?	Inquiry-based teaching, insight is shared that we need to build on students' current maths experiences and make it part of everyday life.	The learning curve	The learning curve	
					11/50 22%

Table 2: TeachThought Site

No.	Title	Summary	Student	Author	Differ
1	What is Bloom's Taxonomy? A definition for teachers	The hierarchical ordering of cognitive skills that help teachers teach and students learn. The different levels of Bloom's Taxonomy explained in a useful way.	Learning curve	Learning curve	
2	What do students think of your class	The importance of classroom identity is emphasised and lessons on how to establish a classroom identity is shared.	Help	Help	
3	The diagram of 21st century Pedagogy	The capturing of several core components of modern learning: Metacognition (reflection), critical thinking, technology, and problem and project-based learning.	Learning curve	Learning curve	
4	What is genius hour?	An approach where students are guided by their own interest, background knowledge and curiosity to learn. A process where students personalize their learning process. 3 Rules to this approach.	Learning curve	Learning curve	
5	Education 3.0 where students create their own learning experiences	The importance is stressed that learners are the creators of their own learning experience and the "curriculum" become the network, the access, and the endless modelling (good and bad) that these physical and digital networks provide.	Learning curve	Learning curve	
6	6 domains of cognition: The TeachThought taxonomy	A linear form of taxonomy simplified for the classroom. 36 rules to assist students with that battle with complexity.	Help	Help	
7	Volunteering in my wife's classroom opened my eyes	A collection of a teacher's reflections on the dark stories of the experiences of the learners in her class.	Metacognition	Metacognition	
8	30 storytelling tips for teachers: How to capture your student's attention	The importance and place of storytelling in learning was captured and tips are shared.	Help	Help	
9	8 strategies to make learning visual in your classroom	It is important to have different learning styles and as visual learning is one strategy its need and use is elaborated on. 8 practical strategies are shared.	Learning curve	Learning curve	
10	The most important thing a teacher should know	A brief explanation of the different ways the brain learns are stated and educators are encouraged to teach according to the way the brain learns, thus they need to adapt their teaching techniques to the material being taught.	Learning curve	Learning curve	
11	Wendal Berry and the loss on the University	An argument whether theory or thought should be taught. The context of education inspires what needs to be taught.	Metacognition	Metacognition	
12	25 of the most misunderstood ideas in education	It is mentioned that the education sector suffers from external pressure, but the internal structure is what drives it. The internal structures are determined by external forces sure as policy and government…this article aims to rectify certain misunderstandings about the internal education system.	Metacognition	Metacognition	
13	20 observable characteristics of effective teaching	A list of 20 measurable and observable characteristics of effective teaching - practical for teacher reflection.	Metacognition	Metacognition	
14	How to make friends: 10 teambuilding games for students	Graphical explanation and display of games that may contribute to a friendly classroom.	Help	Learning curve	*
15	20 collaborative learning tips and strategies for teachers	An argument that groups experimental learning or social learning deepens the taught content in the long term memory. Group formation is delegated into practical steps.	Help	Help	

ISBN 978-615-5511-25-7

16	How to add materials into an assignment in Google Classroom	Practical step by step break down of 'how to add materials into an assignment in Google Classroom' with digital presentations.	Help	Help	
17	Why being wrong is actually a good thing	The importance to see mistakes as opportunities to learn are stated and the reader is urged to see them as feedback loops	No	No	
18	How to help students find more time to read	Practical strategies to foster a reading to read mind set in the classroom.	Help	Help	
19	15 interesting ways to start class tomorrow	Way to set a new tone to your classroom.	Learning curve	Learning curve	
20	5 ideal traits of a project-based teacher	5 traits are shared that help teachers reach the goals of projects.	Help	Help	
21	6 strategies for getting to know your students	Strategies to help teachers lay strong foundations for their teaching relationship with their students. Strategies are shared.	Learning curve	Metacognition	*
22	12 questions to ask your students on the first day of school	A list of questions that may help teachers nourish their relationship with their students.	Learning curve	Metacognition	*
23	10 reasons teachers need a professional learning network	A list of 10 reasons teachers need a professional learning network. The importance of such a network was made clear.	Learning curve	Metacognition	*
24	12 myths about project-based learning	A graphical presentation about the myths and the importance of project based learning is stated as a progressive learning model that can grow teachers –and thus grow the minds and potential of students.	Learning curve	Learning curve	*
25	6 strategies for creating a inquiry driven classroom: Modern education	Teachers are encouraged to allow students to be curious and teachers are urged to be more flexible with their lesson plans. Strategies are shared to practically assist teachers to be open to students yet keeping to the lesson plan.	Learning curve	Learning curve	
26	A letter grade is not A letter grade: Why we should stop averaging scores	10 reasons why scores should not be averaged. The importance of accurate communication is emphasised.	Metacognition	Metacognition	
27	How I use video for assessment in my classroom	Assessment of learning is not as important as assessment for learning. Videos are used to captivate students' attention in a way that they resonate with the content and enjoy learning. Tips on how a teacher uses video in the classroom are shared.	Learning curve	Learning curve	
28	10 ways to Readworks in the classroom	The aim is to use an online platform to improve literacy skills in schools. The benefits of the Readworks program are stated and elaborated on step by step.	Learning curve	Learning curve	
29	7 ways to assess without testing	7 practical ways are shared on how to assess children without testing them. Assessing abilities are done in a way that children enjoy.	Learning curve	Test	*
30	The enduring residue of project-based learning	Insight is shared on how to present project-based learning in a meaningful and purposeful way. Emphasis is placed on the reason why teachers and students do what they do and the appropriate use of questions are stressed in project-based learning.	Learning curve	Learning curve	
31	A writing strategy that works for every student every time	The writer is reminded to remember the reason for documenting his chain of thoughts. It is suggested that if one knows the purpose of writing then the expression of thoughts will be led by the purpose. The pre-writing strategy T.A.P.E is shared with the reader.	Learning curve	Learning curve	
32	8 types of imagination	The effect of imagination on the brain is explained and the importance of it is stressed. 8 types of imagination and their use are introduced.	Learning curve	Learning curve	
33	What students will learn in the future	The 8 new content areas for future education is introduced after a reflection of the past education areas. The running theme is that the world is constantly changing.	Metacognition	Metacognition	
34	27 ideas for students who finish their work early	Practical tips on how to handle early finishers in the classroom are provided for teachers.	Help	Help	
35	How deductive thinking can drive student designed research	Insight into the student's process when selecting a topic to write about. Tips are shared to slow the process down and to help teachers assist students in this process, common mistakes are shared as well.	Help	Help	
36	Refuse to be a boring teacher	Boredom result in intentional planning, the article addresses the temptation to become boring through the	Help	Help	

ISBN 978-615-5511-25-7

		routine of the everyday life and suggest 8 ways to be a less boring teacher.			
37	30 questions teachers can ask at their next job interview	A reminder that the teacher is interviewing the school just as much as they are introducing themselves. 30 proposed questions are stated that teachers can ask the school.	Metacognition	Metacognition	
38	10 strategies to make learning feel more like a game	Making the classroom work like a video game could potentially be enjoyable to students. 10 strategies are shared to make this practical.	Learning curve	Learning curve	
39	What are the habits of the mind	To enhance performance under challenging conditions that demand strategic reasoning, insightfulness, perseverance, creativity, and craftsmanship to resolve complex problems certain dispositions and habits of the mind need to be internalized in the classroom. The habits of the mind are listed individually.	Learning curve	Metacognition	*
40	A really, really cool website for students who think they hate math	A website called Numberphile is a problem-based learning kind of approach that makes learning math more enjoyable for scholars	Help	Learning curve	*
41	How to never run out of new ideas as a teacher	How a teacher approaches their teaching influences the way students approach their learning. This article stresses the importance for teachers to have imaginative minds with creative ideas.	Help	Metacognition	
42	7 ways to improve parental improvement in the classroom	7 ways are shared for teachers to communicate and interact with parents. The emphasis is placed on the relationship between the teacher and the parent.	Help	Help	
43	Learning is complex, what do we know so far?	Learning is redefined in the modern context and its relationship to neuroscience. The effect of learning on the brain is briefly explained.	Learning curve	Learning curve	
44	Learning beyond the curriculum	A brief overview of what we know about learning thus far is shared and its effect on the brain. Learning must go further than the classroom, further than teacher-based learning.	Learning curve	Learning curve	
45	5 ways to engage reluctant learners	This article suggests that intrinsic motivation lies at the heart of all learning. 5 strategies on how to unlock this motivation are shared with the teacher-student relationship as the foundation.	Help	Goal and success	*
46	This is one of the best games to teach social studies	An introduction to a few games that can be integrated with learning and teaching students social studies.	Learning curve	The learning curve	
47	12 of the best ASMR videos with no talking	A list of "Autonomous Soothing Meridian Response" sounds that students find soothing.	Help	Plan	*
48	What teachers want to hear students say	A list of things students say that should light up the heart of a teacher and help with assurance that the teacher's teaching is impacting.	Metacognition	Metacognition	
49	9 strategies for getting to know your students	The importance of knowing one's students are stressed and the impact of knowing them on the teaching relationship is elaborated. Practical strategies are shared.	Help	Help	
50	3 types of project-based learning symbolise its evolution	The significance of project-based learning in the 21st century is stressed and its potential and methods are shared. 3 types of project-based learning are introduced.	Learning curve	Learning curve	
					5 / 50 10%

Discussion and Findings

The goal of the article was to see if personalised guidance and support for learning could be provided to educators who want to master aspects of the learning sciences. Guidance and support to this effect was proposed by choosing one set of learning strategies, based on mental schema theory. Following these principles, a scaffolding framework was developed, consisting of a metaphor of learning as a journey, with aspects of learning as guideposts along the way. The metaphor of the Fibonacci cycle was used to indicate that each aspect on its own is important and useful, but when used in conjunction with each other they gain in strength and value. To test the applicability of the scaffolding framework, two websites with popularised

ISBN 978-615-5511-25-7

articles on research on teaching and learning was chosen, to see if the individual articles which are published randomly and without a specific curriculum or learning goal in mind, can be understood coherently and in a way that will provide guidance and support to master learning.

The first finding was that all the articles could be interpreted to fit under one or more of the seven aspects along the learning journey. Two readers were used, namely a post-graduate student in educational psychology, and the author of the article who is also the originator of the scaffolding framework.

Regarding the 50 articles taken from the MindShift website, there was a 78% correspondence and consensus as to where the articles belong. The 22% difference is quite high, but it can be ascribed to the fact that the student was deliberately given just the graphic of the spiral with the headings and short description to guide her, while the author had a much longer experience with the framework. Seen as such, it is actually a remarkably high percentage of agreement, which points to the intuitiveness of the framework.

The percentage of agreement on the TeachThought website was 90%, which is 12% higher than the previous one. The higher percentage may be ascribed to the fact that the student had the experience of the first one, as well as having had access to how the author interpreted the first one, and see where he differed from her interpretation.

It therefore does seem that the framework is successful in guiding and supporting people to understand aspects of learning.

Looking at the spread of articles in relation to the aspects of learning, the following picture emerges.

Table 3:

Spiral Theme	MindShift 50	TeachThought 50	Totals 100
Plan	6	1	7
Learning Curve	12	21	33
Mistakes	0	1	1
Help	11	12	23
Test	1	1	2
Goal	1	1	2
Metacognition	19	13	32
	50	50	100

Most of the 50 articles in the MindShift site were about metacognition, while in the TeachThought site it was about the learning curve. Overall, these two aspects were almost even, while the aspect of help and support came third in both separately and overall.

This gives a rough idea of where the focus of research might be, although it is too small a sample to be specific. What it does help, though, is to guide and support learners to see the bigger picture, and not only the unrelated individual articles. They become learners who

ISBN 978-615-5511-25-7

understand, not merely consumers of what is being presented to them. Some of the aspects along the learning journey received very little attention. Seeing that as such, may help learners to go look deliberately for articles and information regarding those aspects. In this way they not only personalise their learning, but they also are in control of becoming a person well versed in every aspect of learning.

What did come to the fore, was that it is important to make a distinction on who is reading the articles, and for what reason. Both websites are aimed at teachers. The seven aspects along the learning journey has a different slant to it when read for teaching purposes and supporting learning, over against reading it for personal learning purposes. It does seem that there should be two Golden Spirals – the one for teachers, and the other for learners.

To summarise and conclude, the following statements are in order:

- Research findings and reporting thereof comes in snippets and in disjointed format. It is left to the reader / practitioner / researcher to make sense of it, and fit it into some kind of framework.
- Disjointed, atomised information is more difficult to evaluate critically because there is no frame of reference against which to measure it.
- People are usually well versed or experts in some fields, but not all, making it difficult to assess the validity and usability of all findings.
- The Golden Spiral scaffolding framework has successfully shown itself as a tool to make sense of research findings in this vast field.
- Because findings are lumped together in smaller fields it is easier to remember and apply and also easier to assess for validity because it can be compared to similar findings.
- The Golden Spiral is a metaphor that makes the act of learning by means of schema building easier. The end result of the process is that schemas on various levels are being created. There is an overarching metacognitive schema, guiding thought about learning. Then there is the comprehensive schema, where all the aspects work together in a coherent and mutually supportive role. Lastly, there are sub-schemas, where each aspect is being elaborately understood and put into action in real life learning situations.
- Using it in this way, a mental schema could be created, guiding and supporting learning. In this way, one can see the forest, as well as the trees.

References

1. Al-Issa, A. (2006). Schema theory and L2 reading comprehension: Implications for teaching. *Journal of College Teaching and Learning, 3*(7), 41–48.
2. An, D., & Carr, M. (2017). Learning styles theory fails to explain learning and achievement: Recommendations for alternative approaches. *Personality and Individual Differences, 116*, 410–416.

ISBN 978-615-5511-25-7

3. Ansari, D., Coch, D., & de Smedt, B. (2011). Connecting education and cognitive neuroscience: Where will the journey take us? *Educational Philosophy and Theory, 43*(1), 37–42.
4. Arbib, M. A. (1992). Schema theory. In S. C. Shapiro (Ed.), *The encyclopedia of artificial intelligence* (pp. 1427–1443). Wiley Interscience.
5. Aydin, M., & Sunbul, A. M. (2012). Effect of the verbal mnemonics on students' achievements and their attitudes. *Procedia – Social and Behavioral Sciences, 47*,1506–1510.
6. Bluck, S., & Habermas, T. (2000). The life story schema. *Motivation and Emotion, 24*(2), 121–147.
7. de Bruyckere, P., Kirschner, P. A., & Hulshof, C. D. (2015). *Urban myths about learning and education.* Academic Press.
8. Curry, L. (1990). A critique of the research on learning styles. *Educational Leadership, 48*(2), 50–56.
9. Dekker, S., Lee, N. C., Howard-Jones, P., & Jolles, J. (2012). Neuromyths in education: Prevalence and predictors of misconceptions among teachers. *Frontiers in Psychology, 3*, 1–8.
10. Dembo, M. H. & Howard, K. (2007). Advice about the use of learning styles: A major myth in education. *Journal of College Reading and Learning, 37*(2), 101–109.
11. Derry, S. J. (1996). Cognitive schema theory in the constructivist debate. *Educational Psychologist, 31*(3), 163–174.
12. Doyle, H. (2011). *College and technical college students' perceptions of their learning success based upon understanding multiple intelligences: A mixed method research.* Retrieved from http://hollyjdoyle.efoliomn.com/Uploads/Doyle. Dissertation.
13. Doyle, W., & Rutherford, B. (1984). Classroom research on matching learning and teaching styles. *Theory into practice, 23*(1), 20-25.
14. Dündar, S., & Gündüz, N. (2016). Misconceptions regarding the brain: the neuromyths of preservice teachers. *Mind, Brain, and Education, 10*(4), 212-232.
15. Ferrero, M., Garaizar, P., & Vadillo, M. A. (2016). Neuromyths in Education: Prevalence among Spanish Teachers and an Exploration of Cross-Cultural Variation. *Frontiers in Human Neuroscience, 10.*
16. Geake, J. (2008). Neuromythologies in education. *Educational Research, 50*(2), 123–133.
17. Ghosh, V. E., & Gilboa, A. (2014). What is a memory schema? A historical perspective on current neuroscience literature. *Neuropsychologia, 53*, 104-114.
18. Gleichgerrcht, E., Lira Luttges, B., Salvarezza, F., & Campos, A. L. (2015). Educational neuromyths among teachers in Latin America. *Mind, Brain, and Education, 9*(3), 170-178.

ISBN 978-615-5511-25-7

19. Gous, I. G. P. (2015). Learning strategies. In Gous, I.G.P. & Roberts, J. (Eds.), *Teaching life orientation (Senior and FET phases)*. Cape Town: Oxford University Press. ISBN 978 0 19 905364 3
20. Gutierrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher, 32*(5), 19–25.
21. Horadam, A. F. (1961). A generalized Fibonacci sequence. *The American Mathematical Monthly, 68*(5), 455-459.
22. Jitendra, A. K., Griffin, C. C., Haria, P., Leh, J., Adams, A., & Kaduvettoor, A. (2007). A comparison of single and multiple strategy instruction on third-grade students' mathematical problem solving. *Journal of Educational Psychology, 99*(1), 115–127.
23. Kampwirth, T. J., & Bates, M. (1980). Modality preference and teaching method: A review of the research. *Academic Therapy, 15*(5), 597-605.
24. Lewis, P. J. (2011). Storytelling as research/research as storytelling. *Qualitative Inquiry, 17*(6), 505–510.
25. Mayer, R. E. (2008). Incorporating Individual Differences into the Science of Learning: Commentary on Sternberg et al. (2008). *Perspectives on Psychological Science, 3*(6), 507–508. http://dx.doi.org/10.1111/j.1745-6924.2008.00093.x.
26. Mayer, R. E., & Mayer, E. (2014). *Advances of learning in applying and the instruction science to education.*
27. McClelland, J. L. (2013). Incorporating rapid neocortical learning of new schema-consistent information into complementary learning systems theory. *Journal of Experimental Psychology: General, 142*(4), 1190.
28. McTighe, J., & Thomas, R. S. (2003). Backward design for forward action. *Educational Leadership, 60*(5), 52-55.
29. McVee, M. B., Dunsmore, K., & Gavelek, J. R. (2005). Schema theory revisited. *Review of Educational Research, 75*(4), 531–566.
30. Meltzoff, A. N., Kuhl, P. K., Movellan, J., & Sejnowski, T. J. (2009). Foundations for a new science of learning. *Science, 325*(5938), 284–288.
31. Mostafa, E. A., & El Midany, A. A. H. (2017). Review of mnemonic devices and their applications in cardiothoracic surgery. *Journal of the Egyptian Society of Cardio-Thoracic Surgery, 25*, 79–90.
32. Mowrer, R. R., & Klein, S. B. (Eds.) (2001). *Handbook of Contemporary Learning Theories.*
33. Narvaez, D., & Bock, T. (2002). Moral schemas and tacit judgement or how the defining issues test is supported by cognitive science. *Journal of Moral Education, 31*(3), 297–314.

ISBN 978-615-5511-25-7

34. Nguyen, L., Brunicardi, F. C., DiBardino, D. J., Scott, B. G., Awad, S. S., Bush, R. L., & Brandt, M. L. (2006). Education of the modern surgical resident: Novel approaches to learning in the era of the 80-hour workweek. *World Journal of Surgery, 30,* 1120–1127.

35. O'Niel, H. F. (Ed.) (1978). *The educational technology series.* Academic Press.

36. Offredy, M., & Meerbeau, E. (2005). The use of "think aloud" technique, information processing theory and schema theory to explain decision-making processes of general practitioners and nurse practitioners using patient scenarios. *Primary Health Care Research and Development, 6,* 46–59.

37. Ortony, A., & Rumelhart, D. E. (1977). The representation of knowledge in memory. In R.C. Anderson, R.J. Spiro, & W.E. Montague (Eds.), *Schooling and the acquisition of knowledge* (pp. 99-135). Lawrence Erlbaum Associates.

38. Panou, D. (2013). Equivalence in translation theories: A critical evaluation. *Theory and Practice in Language Studies, 3*(1), 1–6.

39. Plant, K. L., & Stanton, N. A. (2012). Why did the pilots shut down the wrong engine? Explaining errors in context using Schema Theory and the Perceptual Cycle Model. *Safety Science, 50,* 300–315.

40. Plant, K. L., & Stanton, N. A. (2013). The explanatory power of Schema Theory: theoretical foundations and future applications in Ergonomics. *Ergonomics, 56*(1), 1-15.

41. Purdy, N. (2008). Neuroscience and education: how best to filter out the neurononsense from our classrooms? *Irish Educational Studies, 27*(3), 197-208.

42. Purdy, N., & Morrison, H. (2009). Cognitive neuroscience and education: Unravelling the confusion Introduction: recent research into cognitive neuroscience and education. *Oxford Review of Education, 35*(1), 99–109.

43. Roediger, H. L. (2006). Bartlett, Frederic Charles. In J. W. & Sons (Eds.), *Encyclopedia of Cognitive Science.*

44. Rumelhart, D. E. (1984). Schemata and the cognitive system. In R. S. Wyer, Jr. & T. K. Srull (Eds.), *Handbook of social cognition* (pp. 161-188). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

45. Rumelhart, D. E. (1991). Understanding understanding. In W. Kessen, A. Ortony, & F. Craik (Eds.), *Memories, thoughts and emotions: Essays in honor of George Mandler* (pp.257-275). Hillsdale, NJ: Lawrence Erlbaum Associates.

46. Rumelhart, D. E. (2017). Schemata: The building blocks of cognition. In R.J. Spiro et al. (Eds.), *Theoretical issues in reading comprehension* (pp. 33-58). Routledge.

47. Rumelhart, D. E., & Norman, D. A. (1980). *Analogical processes in learning.* Technical Report.

ISBN 978-615-5511-25-7

48. Schmidt, R. A. (1975). A schema theory of discrete motor skill learning. *Psychological Review, 82*, 225–260.

49. Sherwood, D. E., & Lee, T. D. (2003). Schema theory: Critical review and implications for the role of cognition in a new theory of motor learning. *Research Quarterly for Exercise and Sport, 74*(4), 376–382.

50. Snider, V. E. (1990). What We Know about Learning Styles from Research in Special Education. *Educational Leadership, 48*(2), 53.

51. Stahl, S. A. (1999). Different Strokes for Different Folks? A Critique of Learning Styles. *American educator, 23*(3), 27-31.

52. Tardif, E., Doudin, P. A., & Meylan, N. (2015). Neuromyths among teachers and student teachers. *Mind, Brain, and Education, 9*(1), 50–59.

53. Tokuhama-Espinosa, T. N. (2008). *The scientifically substantiated art of teaching: A study in the development of standards in the new academic field of neuroeducation (mind, brain, and education science).* Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc6&NEWS=N&AN=2008-99210-276

54. Tokuhama-Espinosa, T. N. (2011). *Mind, brain, and education science: A comprehensive guide to the new brain-based teaching.* New York, NY.: W. W. Norton & Company, Inc.

55. Tokuhama-Espinosa, T. N. (2014). *Making classrooms better: 50 practical applications of mind, brain, and education science.* Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc11&NEWS=N&AN=2012-32695-000

56. Tokuhama-Espinosa, T. N. (2016). *Theories of how humans learn.* Retrieved from https://www.youtube.com/watch?v=mCrzE5Uj3zU

57. Wiggins, G. P., Wiggins, G., & McTighe, J. (2005). *Understanding by design.* Ascd.

58. Worthen, J. B., & Hunt, R. R. (2011). *Mnemonology: Mnemonics for the 21st century.* Psychology Press.

59. Xiao-Hui, L., Jun, W., & Wei-Hua, W. (2007). Analysis of schema theory and its influence on reading. *US-China Foreign Language, 5*(11), 18–21.

60. Xie, X. (2017). The influence of schema theory on foreign language reading comprehension. *The English Teacher, 34*, 64-75. Retrieved from https://journals.melta.org.my/index.php/tet/article/view/331/221

61. Zhao, X., & Zhu, L. (2012). Schema theory and college English reading teaching. *English Language Teaching, 5*(11), 111–117.

62. Zhou, M. Y., & Brown, D. (Eds.) (2015). *Educational learning theories* (2nd ed.). Education Open Textbooks.

ISBN 978-615-5511-25-7

Learning Explained: A Schema-building Scaffolding Framework to Make Sense of Personalised Guidance and Support for Learning

Ignatius G.P. Gous

ISBN 978-615-5511-25-7