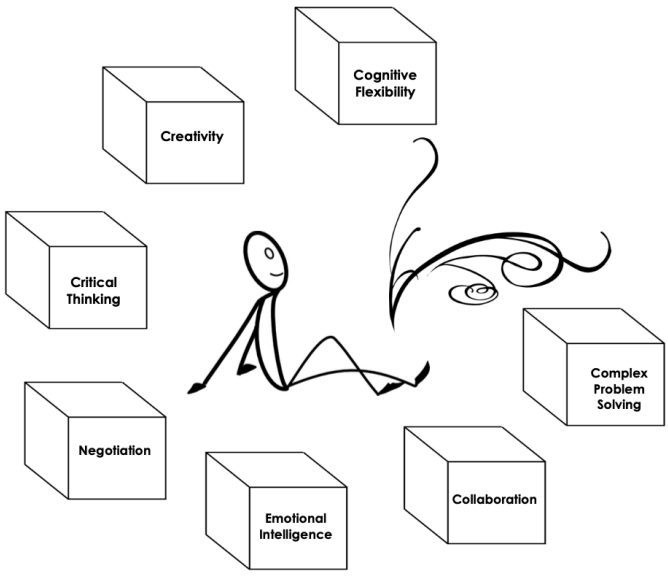
What if...The Comprehensive Guide to Creating Phenomenon-Based Learning Projects

VOLUME 4

Phenomenon-Based Learning: Heuristics to Higher-Level Thinking: Using DOK tools in PhBL projects



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Introduction

What if…insanity ran in your father's family. Your mother, determined to make sure that you will not be affected by this trait, looks for every means she can find to give you the most advantageous future possible. What types of tools could she use?

Anne Isabelle Bryon, wife of the poet Lord Byron, looked for just such a remedy to counteract the genetic predilections her daughter might have inherited from a father, infamous for his unpredictable and eccentric behaviour. After a contentious divorce, this extraordinary woman - a mathematician in her own right - intentionally surrounded Ada with people who would stimulate her cognitive skills, thus disciplining what might have otherwise been a wandering mind. The mother's efforts were successful as Ada Lovelace became one of the greatest thinkers of her time, and in fact is credited with being the first computer programmer.

How did this happen? How can our habitual thinking patterns so profoundly affect our possibilities?

Heuristics

Heuristics are methods or strategies that often lead to problem solutions. They can be thought of as general cognitive frameworks that humans rely on regularly to resolve challenges in everyday life.

Let's consider the tools we include in the learning environment we create for our students. What are our overriding goals? What are the tools that we use to move us toward these goals? At the curricular level, most of us will probably say that our intentions are to inculcate in our students an excitement of learning information imposed by national standards, and the tools we use are the resources our schools have put at our disposal. On a wider level, we will probably say that we want them to acquire an awareness of how they can be productive and compassionate citizens of the world. And if we are in the minority group of educators who see the even larger picture - the implications of the Fourth Industrial Revolution for our students' future - we probably design activities that

encourage the development of 21st century skills[1] necessary to enable our students to be qualified for positions that outsource technology.

Another way of explaining 21st century skills is saying that they include any skill that only a human can excel in (and technology cannot). As educators, our chief responsibility needs to be to strive to give our learners opportunities to develop higher order thinking skills, creativity, autonomy, self-management abilities, and also empathy, compassion, intuition, anticipation, generosity...and *largesse*. As most of us know, standard publishers' books are not geared toward these extracurricular foci. In one study done by David Marsh (Frigols, et. al., 2019) using a cross-section of textbooks in different countries, different languages, and different age levels, one of the overriding conclusions was the dearth of activities and perspective these books included that promoted those very skills that would help students to define themselves as individuals and thus be more qualified than what their prime competitors – technology - could already do more efficiently, reliably and quickly.

This is a rather daunting reality for educators. It means that, if we want to present lessons based on competences and not solely on content, we need to spend a lot of our own time creating appropriate activities. This volume is designed to help you in this pursuit, offering four incredibly effective DOK (Depth of Knowledge) tools you can use to instill in your students structures that will habitually lead them from superficial knowledge to deeper, more lateral, analytic, and original thinking...just as Anne Byron did for her daughter - without, perhaps the same tools as we do now. By being aware of these DOK tools and learning how to use them to their best advantage, we will be infusing in our PhBL projects not only creative conclusions of collected information, but also the opportunities to develop the skills that will help those conclusions reflect the best that our students can be, as future leaders of the world they are inheriting - at local, national and international levels.

Depth of Knowledge (DOK)

A framework that categorises contexts, delving deeper into meaning as a person moves along the structured thinking levels from lower- to higher-order processing.

[1] See Annex 1

Ada Lovelace was surrounded by divergent thinkers who chose to interact with their reality through higher-order thinking. They scorned mediocrity and habitually pushed themselves from heuristics (cognitive frameworks that resolve challenges in everyday life), to deep ruminations, leading to uncharted territories and knowledge in their fields. These remarkable individuals that Anne Byron handpicked for her daughter's companions, were dedicated to challenging themselves cognitively; they were risk-takers, daring thinkers, self-motivated, with the mission of carving out creative and innovative theories.

The Human Mind's Need for Structures to Reach Higher-Level Thinking

The success of these flexible thinkers led to the study of their methods in facing cognitive challenges. These studies developed into formalised strategies, and are today commonly referred to as 'depth of knowledge tools' - structures that encourage us to push past the boundaries of heuristics, so that we have guidance in proactively expanding our thinking.

For educators, this means that we have at our disposal DOK tools that can exponentiate the profundity of thinking of our students, steps that we can embed in our lessons, units and projects with the hopes that they become habitual internal cues for our students whenever faced with cognitive challenges. Along with using them to plan projects, we can model these tools for our students by regularly pausing to review, reflect, analyse, weigh, consider, negotiate, debate, observe, stretch, and question issues.

Some DOK tools (and one that we will examine in this chapter) specifically promote metacognition[2]. These tools direct students to become more conscious of and verbalise what they are going to do before beginning a task, what they are doing during the work sessions, and what they have done after they have presented their work. This process has a dual purpose in that, not only does it foster critical thinking, but it also addresses and reduces the occurrence of cognitive overload[3]. By having to consciously review and then communicate a process before, during and after your involvement in it, the basic information becomes ingrained in your mind both experientially and subjectively, thus forming a more solid basis from which you can then spiral upwards towards original, innovative conclusions[4].

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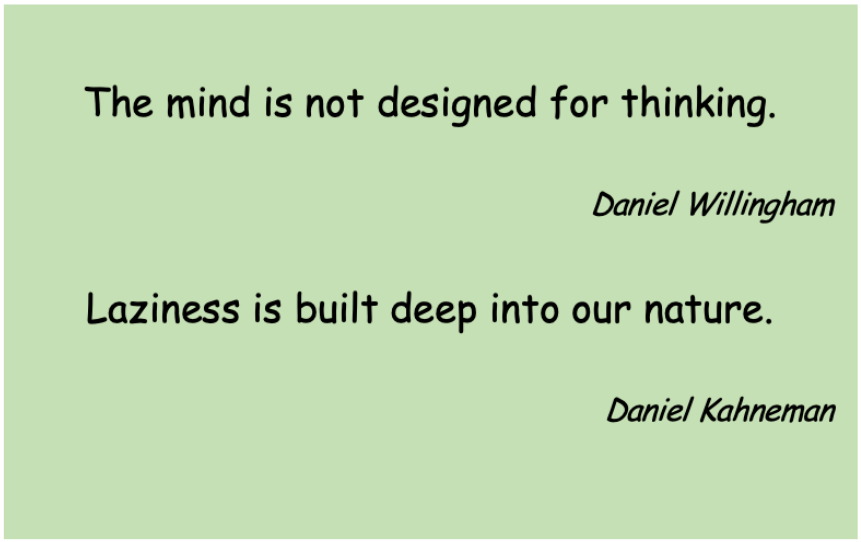
[2] Mosely et. Al, 2005 (p. 34)

[3] Cognitive overload: In the best of circumstances, studies purport that the human mind can hold only seven new bits of information at a time. If our students are exposed to more than this (and on a daily basis they are usually bombarded with hundreds of new bits of information in various styles at different times), their minds become blocked. This is commonly referred to as 'cognitive overload'.

[4] In scientific terms, you might be familiar with the concept of myelinated neurons. The more repetition of a word, term, concept, idea, feeling, physical action, etc. the mind experiences, the more myeline forms on



You may ask: Are frameworks necessary for critical thinking? Doesn't hierarchal thinking come naturally with the desire for more profound conclusions? Well, you may be very surprised by the answer. Daniel Kahenman, Nobel prize-winner for his book *Thinking Fast and Slow* (2002), devised System 1 and System 2 thinking, and sums up our cognitive tendencies by stating: 'Laziness is built deep into our nature'. He explains that our minds are comfortable processing information within a narrow band, and if we are not deliberate in delving into deeper meaning, we remain in a superficial and narrow spectrum of cognitive processing.

Kahenman presents the theory he and his long-time collaborator Amos Tversky experimented with - that the majority of time, we function using System 1 thinking as this requires little effort. This level is driven by emotions and quick judgements, often based on incomplete information. System 2 thinking, on the other hand, is the conscious, effortful, logical, and deliberate way we consider knowledge slowly and methodically. It is not comfortable, it is not innate, our minds are resistant to stepping outside of our own comfort zone, and so this deliberate thinking is atypical.

As educators, we have natural curiousity, and so we push ourselves past our initial resistance of superficial thinking. Most of the time we do not even recognise the discomfort we may feel, because our desire to learn outweighs the satisfaction of arriving at deeper knowledge. Our students, however, do not have the same natural proclivity to pursue strands of inquisitiveness. (Note: as children, we are all innately curious; however,

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the pathways of the corresponding neurons, thus, literally, greasing them so that the voltage between neurons is faster and more efficient. The more our neurons are myelinated with core information, the more we can then expend cognitive energy on using the base knowledge towards more creative, original, higher-level thinking.

traditional teacher-centred environments and passive learning usually expunge that curiosity from us in a very timely fashion). In general, our students do not have the natural inclination toward pushing themselves past the heuristics they have acquired over the years as educational survival mechanisms. They internalise fairly superficial strategies either through osmosis or perhaps more deliberately, so they can complete tasks - not necessarily exceptionally well, but enough to complete the bare minimum.

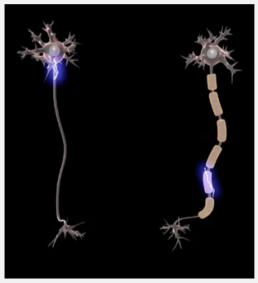
As stated above, the word *natural* is critical here; biologically speaking, what is *natural* for the human mind is inertia - functioning on what we've learned through empirical experience and repetition. So, as educators, our job, in helping to prepare our students for the world outside the classroom, is to use as many opportunities as possible to embed depth of knowledge tools in their daily learning, thereby transforming heuristic habits into habitually flexible and open-minded thinking.

Again, when you ask 'Why is all this effort to include higher-level thinking in our lessons so important?', we remind ourselves that it's so that our students leave our classrooms with skills that render them more qualified than technology in the world that is continually evolving around them.

If you think that Kanheman's discernment of our brain's tendency toward stagnation (or maybe a more appropriate pop-culture terminology could be 'hovering'), is isolated, we turn to Daniel Willingham's conclusions. Williamgham, another erudite in the field of critical thinking, supports Kanheman's assessment of cognitive patterning, stating that 'by nature, we try to avoid thinking. We try to solve problems using our memory.'[5]

Why is this so? Well..

Memory is comfortable.
Memory is familiar.
Memory has a cognitive revolution
that is familiar and so the mind
arrives at answers without much effort.



(think: myelinated neurons)

[5] Willingham, 2007

These concluding evaluations of the mind's complacency and inclination to be completely satisfied in first gear, could be explained by going back to our hunter-gatherer beginnings. At that time, our only needs were immediate and biological: sustenance and safety. We had to internalise those repetitive experiences that kept us alive - strategies that aided us in solving life's challenges quickly and often even efficiently without having to thinking deeply. Heuristics - first gear thinking - was sufficient for our needs in our ancient past. Our survival probably did not include clarifying the distinction between partisan or non-partisan political agreements, or contemplating the philosophical discrepancies of our existence. (Although perhaps they *were* actually the theme of some of the drawings we have found of our cave-dwelling ancestors, and not hunting stories!)

Our existence has evolved, however, and survival now has more to do with intellectual qualifications and excelling in those skills that distinguish us from machines. Therefore, if we put our faith in the studies carried out by educational scholars such as Kahenman and Willingham (and I encourage you to read their studies as they are intriguing, illuminating, and are supported by enough studies to afford them undeniable credibility), then our job in the classroom is to use tools that give our students structures that encourage their reluctant minds to use all their gears, to convince them not to stop and idle at the first cross roads, but rather roar down the road to discovery.

DOK tools in are powerful catalysts for development of cognitive depth. Today, we need to proactively help our students to develop a mindset that will render them more qualified than technology in higher-level processing of information. Consequently, our classes will be more exciting and interesting as well!

Well, how do we do this?

Living Examples of Higher-Order Thinking

We use heuristics as the springboard towards depth of knowledge.

A heuristic is a mental shortcut that allows us to make decisions, pass judgments, and solve problems quickly and with minimal mental effort. Heuristics are helpful in immediate circumstances in recalling information, performing simple tasks, explaining procedures, etc. Using heuristics is meant for speed and not for moving into new or deeper information. In other words, heuristics are valuable and necessary; however, they are useful in lower-level thinking that, in the end, technology can perform faster and with more accuracy than the human mind.

We use DOK tools to create a bridge for our students toward higher-level thinking - to creatively collate information (a function that technology can still not do), thus forming innovative, original solutions.

What Lady Byron did to counteract a potentially lazy mind in her offspring is anthropomorphising depth of knowledge structures through the people she surrounded her daughter with - dynamic, inquisitive, and pro-active thinkers who pushed the boundaries of what was accepted and known. Ada Lovelace's mother refused to accept an idle mind in her daughter, one that was comfortable, depending solely on heuristics. Instead, she insisted that Ada continually push her intellectual limits with the support of upward spiraling, living models.

These living models speak for themselves. Ada's tutor, for example, Mary Somerville, was a noted researcher and scientific author who infused in her tutee a broad base of the analytic perspective of the world. Charles Baggage, known as the 'father of computers', influenced his young assistant (later his professional partner) regarding crucial early choices she made, convincing her to dedicate herself first to building a solid foundation of study of applied maths before moving to more lateral pursuits. In fact, Ada eventually surpassed Baggage's own work in that field, earning a reputation for herself as an eminent analytic in maths and other disciplines.

Lady Byron's daughter was also deeply influenced by her friendship with literary genius Charles Dickens, from whom she developed a more empathetic, humanistic appreciation of the world around her.

These and many more influencers, modeling the habitual effort needed in uncovering deeper knowledge, contributed to the breadth of thinking that Ada assimilated as her own.

We may not have people of this stature available to exemplify such lateral thinking for our students on a regular basis; however, we do have DOK tools that are designed to be used for the same purpose. They are structures that we can embed in our lessons that will push our students out of our comfort zone – heuristic, routine thinking patterns – so that they become more fluid, habitually flexible and original thinkers.

DOK Tools and Phenomenon-Based Learning Projects

Depth of thinking tools are integral to the Phenomenon-Based Learning structure. From the very beginning of a project, they aid in the active participation of the students, giving them direction, so that paths of research are more varied and expansive. Using

DOK tools sets up patterns of approaching new information so that the thinking becomes more automatically geared toward alternative perspectives. In PhBL projects they are especially useful as they aid in the mixing of interdisciplinary subjects and in addressing multi-cultural elements in original tones[6]. In particular, the deliberate push towards higher-level thinking opens gateways to including 21st century skills[7] in natural and dynamic ways.

So, how do we include them in our PhBL projects?

The following are six specific examples: four DOK tools used in different PhBL projects. Which one do you like the most? Which one makes the most sense to you? Which is the one you will use in your next lesson?

DOK tool 1: Circle of Reflection
Project 1: Weather Island

The first DOK tool we are going to consider is adapted from Belle Wallace's TASC Wheel (2000), a structure used in schools all over the world to support the 'development of independent, creative thinking and personalised learning, to raise

[6] Moseley et. al., 2005 (p. 1)
[7] See Annex 1a

Find full volume here:

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Volume 4: Higher Level Thinking and DOK Tools

Heuristics is a fancy way of saying 'strategies' and with this fearlessness of using a higher term for the concept, your students are already organically and seamlessly moving into higher-level thinking. This volume presents a variety of tools that encourage depth of thinking and a genuine exploration of topics. You'll have access to resources, links, templates, and fully developed projects that you can immediately apply to your own needs.