Understanding Visible Learning Through a Brain Targeted Teaching Framework

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Abstract
The teaching learning process is not a place for guesswork. That assumption lies at the core of John Hattie's body of research, *Visible Learning*, and has informed educational settings based on empirical evidence since it became known. To make what works best in Education understood and effectively incorporated in instructional practices, there needs to be a framework where emotional, physical and cognitive processes involved in teaching and learning are taken into account. This is the realm of Mind, Brain and Education science and bringing both to enhance and contribute to the development of teachers' continued praxis is the ultimate goal of this paper (presentation).

Keywords: learning, teaching, visible

Introduction

This presentation was prepared to be delivered in a F2F session which should ideally last 4 hours. The topic is *Visible Learning*, term coined by Prof. John Hattie upon studying hundreds of metanalyses to search for the answer to an apparently simple question *"What works best in Education?*". More than a decade later and now counting with a team of experts who are constantly processing information generated from a bank of over 1,400 meta-analyses on the topic, Prof. Hattie has made quite an impression worldwide by taking the guesswork out of Education.

After analyzing an initial body of 800 plus meta-analyses, the first book on what would become a series about *Visible Learning*, concentrated on influences that had an effect size of over 0.4 on a scale from 0 to 1. This has been clearly demonstrated in the *barometer of influence* and Prof. Hattie has brought to fore many influences that have for years been considered empirically as exerting a high effect (such as reducing class size and individualizing instruction), but which in fact produce a low effect on learning (0.21 and 0.22 respectively). This kind of evidence-based knowledge can effectively serve teachers in procuring ways to increase students' achievement.

In order to bring that concept and body of research to years/grades 1 to 12 teachers in Professional Development (PD) sessions, a brain-targeted teaching framework was developed that made use of scientifically sound ways of conveying information to present to teachers the main ideas of *Visible Learning*, where it becomes visible what teachers are teaching so that students know what they are learning.

To achieve that purpose, a clear set of success criteria was established which, according to Hattie's research, is adamant for achieving the goal that all teachers should have: making students' learning visible so that they could become evaluators of their own teaching. The criteria follow: 1) understand what *Visible Learning* is; 2) know the main implications of *Visible Learning*; 3) understand the attitude of expert teachers; 4) prepare lessons for *Visible Learning*; 5) analyze feedback; 6) investigate one's mind frame.

General Overview

Setting the Emotional Climate

To establish a positive emotional connection between the group and the topic, which comes from solid neuroscientific research with implications for Education (Colibazzi et al, 2010), I thought hard about a way to state clearly what *Visible Learning* proposes, what it intends to deliver, and how sound that body of research is so that teachers in the K-12 spectrum can: get in touch with the most current research in terms of effectiveness in classroom teaching; know what the major influences in teaching and learning are as well as their size effects; and have a basis on how to incorporate those influences into their practice.

Regarding that change is not easy and that a great part of the buy-in from teachers comes from their emotional engagement with the content of this session, I have incorporated several components that cater for the emotional climate. One such component, and perhaps the most important for this PD session, is clarity. Besides

straightforward intentions, one must understand that, more often than not, teachers' and students' perceptions about what successful communication entails may be at opposing ends (Levy et al, 1992). Therefore, it is important at the setting of the emotional climate, to create opportunities for clarity to come forth as often as possible. A first opportunity was provided through Kahoot, a tech app that allows users to choose and control their participation using their own tech device (computer, tablet or smartphone). I have used Kahoot in other instances, throughout this session, to fulfill different objectives, but all remain strongly grounded on the idea that emotional climate setting must offer students control and choice over manipulation of the content (Wentzel & Wigfield, 1998).

A second component is the provision of procedures and expectations. This caters to every student's need for emotional connectedness and predictability: to perform well, one needs to know what is expected of him/her and the way it is communicated strengthens the bond between teacher and learner (Hardiman, 2012). By means of clear and consistent expectations, such a goal can be achieved for, as Levine (cited in Tokuhama-Espinosa, 2014, p. 227) used to say: "our job as teachers is to help students find success every day so that they develop a perception of themselves as learners.". To add to this important concept of setting high expectations, Rubie-Davies (2010) notes that students perform to the level of teachers' expectations, whether these are high or low. So, it is utterly important to the setting of a positive emotional climate that the instructor establishes, right at the beginning of the learning experience, in a clear and distinctive manner, what s/he expects of participants. This has the added benefit of reducing anxiety and nurturing their self-image, for the clearer the criteria, the more students can measure their own understanding, participation and engagement in the session (Bicchieri & Chavez, 2010). To further the reflection and mindful attitude towards the content, rubrics were offered to "allow students to take stock of what they have and have not assimilated into their own knowledge base". (Wood Daudelin,1997 as cited in Tokuhama- Espinosa, 2014, p. 173).

In fostering a propitious emotional climate, it is also imperative, especially with adult participants, to make sure that humor is present throughout. This has been catered for with visuals that reinforce the need for reducing negative emotions or perceptions (Strick, Holland, van Baaren, & Van Knippenberg, 2009).

Teachers/Instructors are models of behavior and providing opportunities to display care, warmth and kindness, which are within the realm of the emotional climate, must be part of our content planning. This sets the emotional paradigm we are to work with and works not only for certain age brackets (Resnick et al, 1997) but for the entire life spectrum (Hardiman, 2012; Tokuhama-Espinosa, 2014). This I do not only in the way I show respect towards participants and in how I address them, but also in the model of reflection/feedback tool that I use at the closing of the F2F session. By asking them directly how they feel about the way I have treated them throughout the session, I open an avenue of further dialogue and communication that can be later extended to social media channels.

Catering for the Physical Learning Experience

Since order and beauty are influential to learning (Lillard, 2005, as cited in Hardiman, 2012, p. 69), I make sure that all my slides have a good presentation and are harmonious to the eye. The use of colors greatly varies according to the time of my sessions. In the early morning, I usually opt for a yellow background as I aim at bringing the morning disposition and the sun's influential power into the classroom I am using.

However, if the session is to be delivered in the afternoon, I opt for a darker tone and highlight the message using a lighter hue for fonts. This creates an added challenge for participants to stay focused and on-task as it is more difficult for them to read the content because of the contrast (light font, dark background). I also pay close attention to the visuals that I bring to each slide as I make use of them later on to recap the written content and to retrieve what was worked once more.

I also use light in different ways. In the morning, I tend to open all the curtains to let natural daylight shine in; in the afternoon, curtains and shades are used to avoid the glare and heat of the setting sun which can be very strong in our hemisphere (south). Therefore, I make more use of artificial light and tend to turn on the light that is directed at the screen and dim those directed at the audience. When there is the need for audience participation or mixed groupings exchanges, I do the opposite and let light shine on participants (Hathaway, 1995 as cited in Hardiman, 2012, p. 64).

When participants are instructed to engage in exercises (dynamics), I use movement to improve their cognition and alertness. By means of different strategies (like 'think-pair-share'/ 'fruit salad'/ 'matching clothing items' among others), I manage to get my audience to stand up and move, something that boosts their energy and participation and increases their probability of learning (Hillman, Erickson & Kramer, 2008).

Learning Goals

The learning goals for this module were the basic concepts of *Visible Learning* together with some reflective practices which stem from teachers' routine practices to make their impact more significant regarding their own self-appraisal and the learning of their students. As straightforward as this may sound, it is not an easy target to hit. Therefore, I make use of a very powerful big concept, that is the importance of understanding research in Education and the power it exerts in making our (teachers') praxis more solid and substantial. And to do that, I assess their prior knowledge of "ulcers".

Unbeknownst to many, ulcers are not caused by stress nor anger, but rather by bacteria that is found in our gut. This rendered a shared Nobel prize in Medicine in 2005 to an Australian gastroenterologist who had to drink an infected broth to prove everybody wrong (see more at http://discovermagazine.com/2010/mar/07-dr-drank-broth-gave-ulcer-solved-medical-mystery).

Learning Experience Design

To design this learning experience in such a way that research has to be unmistakably understood as an inherent basis of our professional beliefs and practices, I start with a simple yes/no question: "do you agree that ulcers are caused by stress?" Then I divide the 'yay' from the 'nay' sayers in the room and ask each group to draw a big concept map to illustrate the reasons, the examples and the evidence both teams hold to make their case. For that I allow them five minutes and give plenty of stationery material for them to draw their big concept maps. After the time allotted, both maps are displayed in opposite sides of the room and teams get to see each other's productions. This inevitably leads them to the self-realization that there is no evidence to consubstantiate the belief that ulcers are caused by stress, only hearsay passed from generation to generation.

After that provocative start, the learning experience, that is to be shaped by the realization of how and the extent to which research has to provide evidence to support everybody's practice, gets a much larger buy-in from the audience. Their *schema* to dispute, accept, base and reflect upon the knowledge about what constitutes *Visible Learning* is then ready to make sense of what is to come (the learning goals or success criteria) which is thus accepted without a reactionary stance. This ensues a higher probability for the content in the designed learning experience to be retrieved and consolidated (Byrnes, 2008).

Instead of using a mind map, just like the one cited above, to present the most important influences on learning according to effect sizes and contextual preferences, I opted to assess prior knowledge by using Kahoot. This was done for two distinct reasons: the first is that there are too many influences that are addressed under the overarching research of Prof. Hattie to establish the concept of *Visible Learning*. Therefore, I had to choose and control what influences were the most pertinent and relevant to be brought to my audience's attention. To remain true to the research conducted by Hattie (2012) and employ a tool that reflected that choice, Kahoot was chosen.

A second reason is that the questionnaires, created within Kahoot's main website that serve as the basis for audience participation, remain free and accessible by anyone when they become members of the Kahoot community. This fact favors my audience in providing them with opportunities to reflect, reassess their own knowledge and retrieve the memories encoded during the PD session as many times as they wish. This employability might not often be found with mind maps displayed once during the session but not retrieved at subsequent stages.

To provide a chance for participants to act on the knowledge they have been exposed to, there is a table (to be projected on the screen) containing slots for the insertion of each influence on learning together with a correspondence to the effect size that it has according to Prof. Hattie's research. This provides a chance for participants to generate the effect size bandwidth for each influence (for I had asked them to retrieve this information from memory encoded during the Kahoot session) and also to physically manipulate the slips and stand up to insert that slip in the appropriate box within the projected table. Research shows that exercising more effort to retrieve

information, what is known as the generation effect, delivers higher probability for memory recall (Slamecka & Graf, 1978).

For this dynamic, I printed each influence and participants had to report back to me the effect size bandwidth in which they should be placed (low/medium/high columns in the table) according to the feedback they had received using Kahoot. This offered them the opportunity to see the big picture again (all the 16 influences picked for this session together with their effect sizes) mapped together and inserted in the big projected table on the wall of our classroom.

To make use of the great impact that visuals create in bringing novelty to the environment (Posner & Rothbart, 2007 as cited in Hardiman, 2012) and to add expectation to that heightened attention (Summerfield & Egner, 2009), the barometer of influence, one of the most cited and widespread visuals based on Prof. Hattie's *Visible Learning* research, is explored to add strength and turn the idea of effect sizes relative to each influence more familiar to the audience. Designing learning experiences that cater for memory encoding, storage and retrieval do tend to facilitate learning (Barrouillet & Gaillard, 2011 as cited in Tokuhama-Espinosa, 2014, p. 126).

Brain-based strategies and justification

To distinguish the memory encoded or retrieved through facts and language (declarative) from that memory created by repetition of movements (procedural), we need to retrieve what is familiar to provide a basis or a place for the unfamiliar to find opportunity for encoding and retention. That was created in this presentation via access of prior knowledge using Kahoot (Lewis & Williams, 1994).

When we rely on memory, many strategies have to be considered and incorporated for learning to happen. One such strategy is chunking, that makes use of groups of structured concepts or ideas put together to facilitate encoding, storage and retrieval (Gobet et al, 2001). Based on that strategy, I have included some slides of previous PD sessions where I anchor the unfamiliar concept being presented on what is familiar to them using the priming for pattern detection that our brains are wired to employ (Vanderberghe et al, 1996).

Whenever a student sees something new, an added bonus to memorization is set; one that is reliant upon the biophysical heightened attention humans pay to anything that is new (Balderston, Schultz & Helmstetter, 2011). However, for that novelty to promote the process that leads to long term memory, i.e. learning, we have to offer plenty of repeated rehearsals, elaboration and desirable difficulties (Bjork, 2017). Put altogether it seems to be difficult to achieve, but when we understand, as designers of learning experiences, that we have to make the brain use whatever information it has been exposed to not to lose it (Hebbinian Rule), then those concepts and ideas explored by neuroscience and cognitive psychology start falling into a pattern of interconnectedness that any educator must strive to make sense of and implement in their daily praxis.

Knowledge Transfer

When a student is told to apply the knowledge s/he has been receiving to make it understood by a wider audience, then there is room for creativity and real transfer of

knowledge (Barron et al, 1998; Barron, 2006). This happens because such student has thereon a problem to solve: how and in which ways is s/he going to make content accessible to different people? What ways are there to convey the depth and relations that this concept has with all the other concepts and ideas at their disposal? And what will create that everlasting impression, the imprinting that we all desire when we truly wish someone learns something?

That is the kind of challenge that I pose to teachers (turned students) at the end of my presentation when, after reviewing with them the content through visuals, I cast my die: it is always an unpredictable result that we, as designers of learning experiences, have when such challenges are proposed. There can be innovative results, beautifully accomplished models of transferred knowledge but there can also be meager and scarce examples of what was understood. Therefore, a teacher who is willing to prepare and deliver activities for extension and application of knowledge must never cease to be humble and to expect the unexpected. For that is how the human mind operates. There may always be a surprise for us!

Once that is well understood by the teacher/designer, there comes the part which this same teacher/designer plays in grand style: propitiating contexts where there is room for error and trial because this is the place where one can really create. We have to accept people, and learners, for who they are, for what they bring to the learning experience, and for the things they are capable of doing. That acceptance has nothing to do with lowering standards, but is rather firmly based on trust, on the belief that every human is different and can assimilate and deal with content and creation at differing stages and paces. Instilling in students the impetus to always do what reflects their best is what teachers should aim at. Ultimately, that is the mindset that will endure the extension and application of knowledge that stands the test of time (Dweck, 2006; 2015).

When teachers understand through firsthand experience how "fluency, originality and flexibility" are indeed associated with divergent thinking (Chávez-Eakle et al, 2007), it is more likely that they will try to foster activities that promote divergent thinking and freer and novel application of knowledge. When I invite teachers to exercise their expertise by conducting investigations of how they access their students' prior knowledge which is adamant to the *Visible Learning*, I give those teachers the responsibility and freedom of deciding about what is best for each student individually considered, and to create different modes of assessment so that the end result displays the variability and jaggedness that we all have (Rose, Rouhani & Fischer, 2013).

Providing Feedback

Feedback is indeed the fuel of learning and that main, straightforward and relevant message is at the pinnacle of John Hattie's work (2011, 2016; Hattie & Gan, 2011). Therefore, the target of evaluation and its importance to learning has been at the top of my mind since the creation and preparation, going on during delivery, and at the closing of this PD session. The fact that feedback has to be given throughout the learning process is something well accepted by teachers albeit rarely done. One fact is that it truly demands creativity from the teacher/designer and also a heightened attention to the question of formative assessment. The influence of each context is

also to be gauged as the teacher may even be flexible in thinking, planning and delivering formative evaluations, but in a school that is not cognizant of this need nor allows teachers to perform such assessment, there is no room for change. That is why I always work with school leadership prior to this PD session to investigate their evaluation method.

School Support

Most often than not, the school is already implementing some form of formative assessment and teachers just need input and alternative views and ideas on how to do this; but there have been occasions in which I had to dispute and inform the leadership team about what evaluation truly entails and how feedback is always at the heart of it. In such cases, I have to make them reflect upon the importance that feedback and its basic components, to name, continuity, quality and formation, have for learning to really move forward as a lifelong process. Once that roadblock is removed, then I can work with my participants, the teachers, who will be able to experience first-hand what, how and why feedback has to be present throughout any learning endeavor.

Assessing the experience

As cited above, and illustrative of many moments of this PD session to achieve different BTTs (brain teaching targets), I have used Kahoot to illustrate how a tech tool can be an alternative and efficient means of assessment. Being low stakes and delivering individualized and immediate feedback, tech tools such as this, which is paired in efficacy with Socrative and Quizlet, tick all boxes for the kind of formative assessment teachers have to provide to students without overloading their heavy and busy schedule.

Additionally, such a tool, by offering the benefit of being accessible to students outside the classroom and on an on-demand basis, paves the path for the self-regulatory kind of feedback that should be the aim of every teacher. Once a student realizes how to give him/her own self the feedback that propels learning, then teachers and tools have achieved their ultimate goal: fueling lifelong learning (Mynard & Navarro, 2010).

Another critical component of evaluation is rubrics. How are we to know how far or how well we have fared if there are no signposts to tell us if we have made it to the end accordingly? The setting of clear rubrics, irrespective of the age, content or level of achievement of one's audience, is inherent to the determination of one's success (Hardiman, 2012; Hattie, 2012, Tokuhama-Espinosa, 2014). The rubrics I have set forth to my audience had this rationale at their inception.

As important as knowing the signposts is having the right map in your hands. This 'map' when learning is involved refers to the answers that have to confirm, disconfirm or explain one's efforts either way. It is by supplying students with answers after an activity, preferably with a delay, that memory is more potently affected (Fazio et al, 2010). Another powerful effect on memory that feedback promotes is when it is delivered little by little, that is, in scaffolded instances (Finn & Metcalfe, 2010), as this is the time when students have more chances to reflect on their right and wrong answers and to deal with the dissonance henceforth created.

Apart from providing variability in the form of alternative assessments, when evaluation is targeted by the teacher/designer, authenticity must be present as well. This can be offered whenever the student has the 'upper hand' in developing and delivering the evaluation. Instruments that cause self-reflection and that draw upon an individual response to a task are the ones that cater for authentic evaluation (Horz, 2012). A superior form of authentic learning is brought about when the student is asked to self-evaluate against a given rubric; not only is it original, but also draws on their reflective capacity to analyze his/her own achievement.

To summarize, the conductor has to exemplify how feedback is to be received: when it is candy or ineffective (Brookhart, 2017), all is apparently well, but what happens when the candy gets tough, i.e., when quality demands honest and exponential feedback? Therefore, submitting oneself (the conductor, teacher or designer in charge) to the feedback that students can and should give in every learning experience is one of those things that one should rather do than say. The results may not be a 100% sweet, but they are always nourishing.

Conclusion

Knowing what works best in Education is essential. But this knowledge does not come to fruition if not grounded on principles that determine how we learn. Catering for the emotional climate, the physical setting and for the apt determination of goals that are to be developed, mastered and evaluated have to present, in tandem, for the improvement of teaching practices and learning processes. In this joint effort, i.e., *Visible Learning* coupled with Mind, Brain and Education principles, not only teachers come to benefit but their students, their settings, and their communities. It becomes a framework for practice where one informs and gets informed, via constant and quality feedback, where empirical evidence is matched to neuroscientific data and cognitive psychology findings for the benefit of entire communities.

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