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The Neuroscience of Learning and Development and its Implications for Inquiry

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Abstract

We understand that providing students the ability to reflect on their learning experiences is key to development. Emerging neuroscience research illustrates that it takes at least 30 minutes of focused attention training for 8 weeks in a row to change certain portions of the structure of the brain. The portions of the brain that can change structure and therefore function include the emotional center, memory center, sensory perception areas, and the center for executive functions such as analytical reasoning, prioritizing, and decision-making, which may be critical for lasting learning and development. If we consider the space for reflection and this neuroscience research, how might we re-design our co-curricular education and evaluation systems?

Seeing's believing, but feeling's the truth

– Thomas Fuller*

Emerging findings in neuroscience provide extensive evidence to support the 1996 Learning Imperative statement, “learning, personal development and student development are inextricably intertwined and inseparable” (extracted from <http://www.myacpa.org/sites/default/files/ACPA%27s%20Student%20Learning%20Imperative.pdf> on February 10, 2015). While student affairs professionals may have intuitively known this for decades, we have yet to see the emerging science that supports this statement *systematically* find its way into the design, delivery, and evaluation of our work. This manuscript draws on research contained in the forthcoming Neuroscience of Learning and Development book (Bresciani Ludvik, Ed., In Press anticipated 2015) to illustrate considerations for our profession as we seek to implement holistic learning and development inquiry and evaluation methodology.

Setting the Context

The need for holistic student learning and development design, along with the collaborations among academic and student affairs professionals that are needed to make it happen are all conversations we have been having for decades. So, why is it that we often feel we are still having the same conversations? Furthermore, why is our country the leading “producer” of baccalaureate degrees, yet graduating students with degrees who perform statistically below the international average in numeracy, literacy, and problem solving outcomes (OECD, 2013)?

The answers to these questions are perplexing and have informed discussions we also have been having for decades. Still, now, more than ever, those holding us accountable for “producing” required learning and development outcomes are calling for us to be more innovative in our design, delivery, and evaluation of higher education. Many policy writers are inviting us to share our innovative practices so that we can host a different and potentially new national conversation about advancing access, equity, and student success. So, where is our voice in this conversation? What are we doing to foster innovative ways of designing, delivering, and evaluating higher education? How is the way we engage in

inquiry advancing policy discussions?

As we may assume, many insightful voices are buried underneath heavy workloads; the invitation to be innovative or share their innovative practices widely may feel like just another task on their “to do” lists. Still, every day, I get to work with inspired masters and doctoral students. I also get to work with professionals from around the world who inspire those students. There are many who take up the innovation challenge with excitement. And when they move into their workplace to “try out” something innovative or systematically implement an innovative practice, many – not all – feel beat down by the “system.”

Who makes up the system? We do; people do. Why do some people beat other people down when they are approached with new ways of doing or inquiring or being? Well, again, there are many reasons, but let’s just take a moment and simplify the answer to illustrate that the mindset of the one who is hearing the innovative idea and rejecting it before it is even vetted may simply be tired or she may simply be unaware she has a fixed mindset (Dweck, 2007). When one is tired or when one has a fixed mindset, the practice to see clearly what is right in front of one and to examine whether what is being proposed is even possible simply seems daunting (Scharmer, 2007; Newman & Newman, 2007; Shove & Spurling, 2014; Benn, Dunphy, & Griffiths, 2014). Thus, it may seem far easier to simply reject the idea.

What is ironic about all of this is that the same emerging neuroscience that is giving us insight into how learning and development occurs also provides insight into how we can suspend – just for a moment – the very judgments and resistance that squash innovative practices that can transform learning and development. The practices that literally change the structure of the brain, and therefore change the function of the brain, are also the practices that can allow one to regulate the stress that may arise when asked to “do” something differently while simultaneously accessing analytical reasoning and creative processing to arrive at innovation and sustainability (Scharmer, 2007; Senge, Scharmer, Jaworski, & Flowers, 2005; Shove & Spurling, 2014; Benn, Dunphy, & Griffiths, 2014; Kaufman & Sternberg, 2007; Shernoff, Csikzentmihalyi, Schneider, and

Shernoff, 2003). These findings apply to us, the people within the system, as well as to our students that the system is intending to serve.

The Neuroscience

Many neuroscientists have confirmed that, “our experiences - the things we see, hear, or do - can trigger long-term changes in the strength of the connections between nerve cells in our brain, and these persistent changes are how the brain encodes information as memory” (Kim & Linden, 2007). This is a key finding that has been replicated and affirmed in several studies (Chiesa, Calati, & Serretti, 2011; Goldin, & Gross, 2010; Hutcherson, Goldin, Ramel, McRae, & Gross, 2008; Kozasa, Sato, Lacerda, Barreiros, Radvany, Russel, Sanches, & Mello, 2012; Holzel et al, 2011a; Holzel et al, 2011b; Lazar, Kerr, Wasserman, Gray, Greve, Treadway, McGarvey, & Quinn, 2005; Todd, Cunningham, Anderson, & Thompson, 2012). When it comes to fostering innovation, it may be important to hold this finding in front of us as we design learning and development opportunities for our students, and also as we inquire into and evaluate that learning. If we design evaluation methods that require students to piece together memories, then we are likely focused on evaluating learning that is held in short-term memory – the kind that will have no lasting effect and likely the kind that will not further innovations in holistic learning and development. We also may be evaluating students’ learning and development irresponsibly if we haven’t intentionally provided students with the kinds of experiences that will literally change their brain.

In many of our classrooms, for example, we see faculty designing learning and development activities to enhance short-term memory and exam recall. Some faculty only have 4 weeks to provide such learning experiences, while others have 16 weeks. Some faculty also have hundreds of students in their classrooms, whether hosting students virtually or in person. When time is of the essence, using exams to measure learning is understandably much more efficient than is inviting students to construct projects that result from experiential learning or inviting students to write essays, compose music, design case studies, create drawings, role-play, or snap photographs that illustrate their discovery or

way in which they are making meaning out of their engagement in the presented material. Yet, these are the very ways in which the brain engages more fully, providing students deeper and longer lasting ways to learn and develop, particularly when welcomed emotions are evoked during the process (Zull, 2011; Carey, 2014).

If we think about how our student support services are designed, we have a similar challenge. We have very short-term and often not systematically designed ways in which we interact with students to foster their engagement in their learning and development experience. We often provide them with a few hours of workshops and expect their behavior to be transformed. Yes, we can evaluate what they learned after having participated in this workshop. However, when we apply the principles of neuroscience, we can quickly see that the learning and development we did design is likely very short-term.

We have plenty of research that illustrates that what we store in short-term memory is indeed short-term and thus doesn't last very long (Zull, 2011; Carey, 2014). Oddly, the very computer games designed to enhance memory have been determined, in a recent study (Linden, 2014) to have low effects in increasing short-term memory and to have effects that don't last very long. In essence, playing these computer games creates opportunities for you to become better at playing the computer games and when you stop playing the games, you forget how to be "good" at the games. This shouldn't be surprising, as neuroscience has repeatedly shown us that what we pay attention to and focus upon does indeed change the structure and function of our brain (Bush, Luu, & Posner, 2000; Chiesa, Calati, & Serretti, 2011; Goldin, & Gross, 2010; Holzel et al, 2011a, Holzel et al, 2011b; Hutcherson, Goldin, Ramel, McRae, & Gross, 2008; Kozasa, Sato, Lacerda, Barreiros, Radvany, Russel, Sanches, & Mello, 2012; Lazar, Kerr, Wasserman, Gray, Greve, Treadway, McGarvey, & Quinn, 2005; Todd, Cunningham, Anderson, & Thompson, 2012). What happens when we shift our attention from one course to another or one activity to another?

The computer games designed to enhance cognitive processes apparently do very little, if anything, for cognitive processes. Instead, Linden (2014) argues, if you want to enhance cognitive

tasks, engage in moderate, low intensity exercise such as going for 30 minute walks every day and you will likely experience gains five times more effective and effects that are longer lasting than you will with an investment in the computer games. Other research has emerged that highlights trait changes in the brain; some of the more recent illustrating the positive effects of prolonged focused breathing exercises as well as other methodologies (Holzel et al, 2011a, Holzel et al, 2011b).

While the computer game findings have yet to be replicated and the focused breathing exercise studies along with other methodologies are being replicated at a high rate with consistent findings, neuroscience contains extensive clues into how we can create the kinds of learning and development that our constituents demand. What neuroscience is showing us is that if we want to foster deep lasting learning and development, we need to design deep lasting learning and development opportunities. How do we “do” that?

Inquiring Minds want to Know

Neuroscience indicates to us that the interiority of the mind – whatever it is that initiates the thought, the emotion, or the awareness of the thought or emotion - can't readily be identified (Siegel, 2007; Hanson, 2013; Kaku, 2014). We appear to be able to view what is being processed by the brain in correlation to behavior such as a furrowed brow, a smile, or the movement of a hand. And we can view brain activation in correlation with physiological markers such as increased heart rate, blood flow, and sweat gland activation. So, we can view a correlation of observed behavior or a physiological marker with regions of the brain that consistently become electrically activated or have oxygen flow toward them, but we don't actually know what a person is thinking or feeling at the time we observe these brain region activations until the subject self-reports what they are thinking or feeling during the observation process. Fascinating – yes?

The brain, which has been historically credited as the center of all learning and development - and therefore the construction of evaluation tools may have been designed in accordance with this understanding - may only be the center for processing and

perhaps storing and recalling learning and development and not actually the place where the initial receptors or initiators are located. Just think about something as simple as your vision or hearing; vision and hearing don't initiate in the brain. What you think you see and hear appear to be processed in the brain - for which memory storage and recall play an important part - and thus, we have come to believe that what we think is initiated in the brain. But we actually don't *know* that because we can't locate the initiation point of thought.

Some people believe that what they feel is initiated and processed in the heart. Others feel that what they believe is initiated and processed in the gut. We don't know; currently our imaging and data collection is focused on the brain. We can certainly observe patterns in brain activation in the limbic system (considered the emotional center of the brain) and other regions of the brain (hippocampus where memory is understood to be primarily stored and recalled) when people are self-reporting feeling specific emotions or absorbed in certain thoughts. But at that point, is the feeling now a thought? When did the thought become a thought? Where did the thought originate? Where did the feeling or belief originate? If knowing the origin is important to improving the design, delivery, and evaluation of education, we are in a very fascinating predicament. If knowing where the thought is processed, neuroscience gives us clues as to which portions of the brain we may want to activate and how to consistently activate those regions.

Since we know so very little about the brain and what we do know requires subjects to be aware of what they are experiencing in order for us to better understand the correlation of activated brain regions to feelings, beliefs, or thought processes that initiate certain behaviors, what appears to be true is that the development of self-awareness that extends into bodily awareness also seems to be important for enhancing learning and development opportunities. Why? Because according to emerging neuroscience, it is as was reported in 1996 by student affairs professionals, all intertwined.

While we have lots of inventories in higher education that students can complete and upon doing so, can then be classified

into a category of who they are and what they like to do, we don't actually know how these inventories correlate with brain processing. We also don't know how these inventories correlate with what the student was thinking or feeling when the inventories were completed. And we don't know how classification by these inventories may contribute to a fixed mindset, even though neuroscience has evidence that shows us how dynamic neural connections are and therefore how dynamic learning and development is. Fascinating, isn't it?

Our brain is complex; our nervous system (of which our brain is a part) is complex and extensive. What we do know is that there are regions of the brain that can change and there are regions of our nervous system that can regenerate itself. How are we using this profound discovery in the design and delivery of our learning and development opportunities? How are we using this science in the way in which we inquire into and evaluate student learning and development?

Stepping into the Darkness

I have had the joy of spending the majority of my career trying to measure everything that moved so that we could zero in on how to address the demands of where we have fallen short in higher education based on the data we have generated. Right now, I feel as if I have been similar to the character in the story below (printed in a May 24, 1924 issue of the Boston Herald).

“A police officer saw a man on his hands and knees ‘groping about’ around midnight and asked him about his unusual behavior.

‘I lost a \$2 bill down on Atlantic avenue,’ said the man.

‘What’s that?’ asked the puzzled officer. ‘You lost a \$2 bill on Atlantic avenue? [Insert long pause...] Then why are you hunting around here in Copley square?’

‘Because,’ said the man as he turned away and continued his hunt on his hands and knees, ‘the light’s better up here.’

We can either continue to spend our energy on refining inventories and tests so tightly that they continue to provide us

with amazing statistics of what we can identify in terms of learning and development. Or we can step into the darkness, embrace the ambiguity that we don't really know where thoughts are initiated – the very thoughts that our inventories are so tightly designed to measure – and invite in conversations about how to train students *into* their own dynamic self-awareness processes.

We can use emerging neuroscience findings to design, deliver, and evaluate methods that appear to change the structure and function of the brain and inquire in partnership with the students into how those intentionally designed experiences foster lasting student learning and development. We can engage in the work of constructing inquiry processes that are co-created between the students, faculty, and administrators such as reflective learning portfolios that foster deep conversations, awareness, meaning making thus challenging constructs currently taught.

If you find that you are reading this article and a feeling of skepticism is welling up within your body and making its way into your thoughts, just take moment to invite in inquiry. Can you simply stop for just a moment, take a few focused breaths, notice what is arising within your body, and just be with it while you breath? Can you notice the feelings and thoughts arising as you breath? If you notice judgment, can you suspend your attachment to your judgment for just one moment more to consider another possibility? Can you consider reviewing the emerging neuroscience? As you review the evidence, how does it align with the way you design, deliver, and evaluate learning and development opportunities for your students? How are you fostering lasting structural and functional changes to their brains? How are you embedding the many practices that foster cognitive tasks in your design, delivery, and evaluation? How are you contributing to perpetuating the OECD findings or reversing them?

This Journal

This journal is intended to publish innovative practices into the inquiry of the design, delivery, and evaluation of holistic learning and development. In so doing, we don't want to perpetuate examining learning and development where the "light is better"

when the actual learning and development may be happening in places where we can not yet see it... perhaps those places are within the interiority of the mind. And if we continue to measure learning and development with instruments that allow us to see “something,” we may not discover that the treasure lies elsewhere.

I look forward to your courage in being innovative as you, perhaps, choose to disregard the use of the survey and the rubric and invite students to use the deep self-reported data of their own experience. Of course, we can't invite students to do that unless we also equip them with self-awareness training – the kind of evidence-based training that will foster students' own insight into their actual experiences. And perhaps we can engage in this training as well, so we can report the data in a manner that advances the ways in which we understand how students actually learn and develop.

Yes, we can continue to design, deliver, and evaluate higher education in ways that perpetuate the use of exams and surveys. It is easier to use those; there is societal acceptance for their use as well. We already built a fabric of performance indicators that some states use to allocate funding. It is a system where we can end the day counting what has occurred underneath the light of our office lamps. Or we could step into the darkness of the seemingly unknown and try on something innovative.

About the author:

Marilee Bresciani Ludvik, Ph.D. serves as Professor of Postsecondary Educational Leadership at San Diego State University, where she coordinates the masters in postsecondary educational leadership program in student affairs, the multi-disciplinary leadership minor, the mindfulness-based integrative inquiry program, and the Institutional Research, Planning, and Assessment Certificate. Marilee's most recent research focuses on using translational neuroscience to inform the design and evaluation of workshops and curriculum to decrease students', faculty, and administrators' stress and anxiety and increase their attention, emotion, and cognitive regulation, as well as enhanced critical thinking, compassion, and creativity. Marilee can be reached at mbrescia@mail.sdsu.edu.

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