

## Rapid Feedback Ties to Brain Science Research Teaching in a Digital Age

Parents, teachers, and mentors, care intensely about the future of their students would like them to excel academically. Although teachers use a variety of pedagogical methods to positively impact student outcomes, researchers have indicated that rapid feedback is powerfully influential on student performance.<sup>1</sup>

Neuroscientists have a well-established understanding of how our brains acquire, process, and store information (i.e., learn).<sup>2</sup> Our brains have the ability to change and adapt to environmental demands, a process termed “plasticity.”<sup>3</sup> This process involves “creating and strengthening some neuronal connections and weakening or eliminating others.”<sup>4</sup> The extent of the processes is dependent on the type of learning acquired and the length of period of learning, with long-term learning as the most lengthy, rigorous process.<sup>5</sup>

A key component of learning is strengthening neural pathways. Neural pathways differ in processes, depending on subject (e.g., math or English) and concept of the subject (e.g., addition, subtraction, fractions). For example, subtraction is dependent on the inferior parietal circuit, whereas addition strongly relies on the fronto-parietal cortical circuit. Essentially, the more a task is practiced (i.e., strengthened), the easier the task becomes (i.e., learned).<sup>6</sup> Neuroscientists and researchers note that rapid feedback strengthens neural pathways by making memories. Psychologists support the importance of rapid feedback as well, recommending that through stimulus and response, a person can improve information storing and retrieval.

In a school environment, students who receive immediate feedback from their teachers are able to evaluate what they know and revise mistakes or misconceptions. The quick feedback helps them deepen and sharpen their understanding of the content. Judy Willis, a former neurologist turned teacher, stated that “The more ways the material to be learned is introduced to the brain and reviewed, the more dendritic pathways of access will be created.”<sup>7</sup> She further notes that students use a wide assortment of ways to retain and manipulate new information such that they activate previously stored information and increase the probability that the new information will be stored in long-term memory.<sup>8</sup>

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<sup>1</sup> Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.

<sup>2</sup> OECD (2007). *Understanding the Brain: The Birth of a Learning Science* (Paris, OECD Publishing).

<sup>3</sup> OECD (2007).

<sup>4</sup> OECD (2007).

<sup>5</sup> OECD (2007).

<sup>6</sup> OECD (2007).

<sup>7</sup> Pollock, J. E. (2011). *Feedback: The Hinge That Joins Teaching and Learning*. Corwin.

<sup>8</sup> Pollock, J. E. (2011).

Numerous studies have bolstered the positive effects of rapid feedback on learning and student performance.<sup>9</sup> In a recent study, Keri L. Kettle and Gerald Häubl of the University of Alberta in Canada investigated how the anticipation of expected feedback impacts students' performance. Results showed a strong relationship between how soon the students anticipated receiving their grades on the task they performed (i.e., presentation) and their overall performance. These researchers noted that "students who were told they would receive rapid feedback on their performance earned higher grades than students who expected feedback at a later time."<sup>10</sup>

Prominent educational researcher John Hattie of Auckland University in New Zealand further supports positive feedback as a crucial method of student learning. Hattie has written books and published numerous articles on effective teaching methods. In his most recent works, Hattie conducted a synthesis of 800 meta-analyses on best methods for training effective teachers. In Hattie's framework for teaching and learning, two primary concepts emerged from the data on student learning:

- (a) the provision of feedback takes students forward in their learning and development;
- (b) teacher evaluations of their effects on students, those evaluations that lead to adaptations, modifications and innovations within the learning environment emerge from a sound understanding of those strategies and conditions that best facilitate learning.<sup>11</sup>

Hattie states that "Feedback has the potential to have one of the most powerful influences on student learning, with an effect size twice that of all in-school effects (0.79); Yet its impact is most variable and depends upon the extent to which the right form is provided at, or just above, the level at which the student is working."<sup>12</sup>

Although rapid feedback is not a new concept, it has gone through many transitions. With respects to different disciplines, rapid feedback has gone from a theoretical application of behavior by the psychologists, to a neurological exchange of electricity between synapses by the neurologists, and now it is becoming a teaching modality that feeds the teacher-student interactions. Through this evolutionary process, one thing has remained the same: rapid feedback yields positive results.

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<sup>9</sup> Schmidt, R. A., & Bjork, R. A. (1992). New conceptualizations of practice: Common principles in three paradigms suggest new concepts for training. *Psychological Science*, 3(4), 207-217.

<sup>10</sup> Kettle, K. L., & Häubl, G. (2010). Motivation by Anticipation Expecting Rapid Feedback Enhances Performance. *Psychological Science*, 21(4), 545-547.

<sup>11</sup> Lloyd, C., & Trangmar, R. (2012). Investigating the Implications of Hattie's (2012) Synthesis of Meta-Analyses for Teaching Higher Education in Further Education. *Teacher Education Advancement Network Journal*, 4(3).

<sup>12</sup> Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Routledge.

In an age where education is critical for a nation to thrive, educators must harness teaching methods that yield significant improvements on students' learning. With this in mind, using a method that is bolstered by brain science seems like a "no brainer." More so, if technology offers a means to efficiently provide rapid feedback during the learning process (when it is most effective), we can apply the power of previous concepts to meet current educational goals.



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