Synthesis of Research & Pedagogical Recommendations

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| **Finding/Implication** | **Pedagogical Recommendation** |
| “The greater coherence of the literature assessing structure building suggests that a more fine-grained approach that focuses on individual differences in underlying cognitive processes, rather than general aptitudes, and implements instructional methods that target those processes may be more fruitful in producing robust interactions between learner ability and learner-directed activities” ([Pasher, McDaniel, Rohrer, & Bjork , 2008, p. 115).](https://www.softchalkcloud.com/lesson/files/Tq1VBK9LSReJi2/Debunking%20Learning%20Styles.pdf%22%20%5Ct%20%22_blank)  | Teachers should spend more time helping students construct knowledge and synthesize information presented in various forms, then manipulate that information (i.e., create analogies, write stories that relate that information to their lives, create and defend mnemonic devices, etc.). |
| “[[L]earning experiences](http://www.edutopia.org/neuroscience-brain-based-learning-neuroplasticity) *do* help the brain grow, [emotional safety](http://www.edutopia.org/neuroscience-brain-based-learning-emotional-safety) *does* influence learning, and [making lessons relevant](http://www.edutopia.org/neuroscience-brain-based-learning-relevance-improves-engagement) *can* help information stick. The trick is separating the meat from the marketing” (Bernard, 2010a). | Educators should not trust the latest and greatest packaged curriculum to teach their students for them. Trying researched and vetted curricular approaches that match an educator’s delivery style is essential. |
| “Researchers Lisa Blackwell of Columbia University, along with Kali Trzesniewski and Carol Dweck of Stanford University, published a study in the journal *Child Development* in 2007 that found that both morale and grade points took a leap when students understood the idea that intelligence is malleable” (as cited in Bernard, 2010b). | We should absolutely teach this idea to students and reinforce it regularly in order to “Break[] through those neuro-mythological barriers that paint intelligence as predetermined [and to] ease students' minds and encourage them to use their brain” (Bernard, 2010b). |
| “If a student acquires new information that's unrelated to anything already stored in his brain, it's tough for the new information to get into those networks because it has no scaffolding to cling to. Effective teaching helps students recognize patterns and put new information in context with the old -- a crucial part of passing new working memories into the brain's long-term storage areas” (Bernard, 2010c). | It is important, especially when introducing new content, to “Tak[e] the time to brainstorm about what students already know and would like to learn about a topic” (Bernard, 2010c). KWL charts work for this, as do posted and running flip chart notes that demonstrate the connections between ideas  |
| * Children’s brains first notice repetition; they notice deviation later.
* Dopamine rushes result from learning new things, unless a child’s brain is not stimulated or is subjected to fear too often. In that case, dopamine rushes begin to release in relation to avoidance of challenge and learning; this is referred to as chronic under-activity.
* Olfactory stimuli can push the brain to consider specific information during deep sleep, which significantly improves the ability to recall that information and use it later.
* Theory: practice strengthening control of the prefrontal cortex in order to overcome the emotional reactions stimulated by the amygdala can improve learning.

(“How the Brain Learns”, 2003).  | Educators faced with students who consistently and even defiantly underperform should evaluate those students’ educational histories. If the students have consistently experienced negativity and failure, their brains may have re-wired to avoid challenges. Educators should approach these students with that in mind and with strategies that can help them begin to experience positivity in relation to challenges. Discussing what may be happening in the students’ brains with them may be a step toward helping them to strengthen their prefrontal cortexes and take back control of their learning. |
| * Social-emotional learning changes the brain.
* Neuroplasticity: The brain is built to change in response to stimuli
* Behavioral intervention is more effective than biological intervention in terms to manipulating brain function and structure.
* Emotional regulation makes the brain stronger and the body healthier because it lowers cortisol, a hormone produced during times of stress.
* Anxiety interferes with the working memory.
* Emotional threat can hijack the same systems we historically used to avoid dangerous physical threats.

(“Neuroscience of Social, Emotional, and Academic Learning”*,* n.d.).   | Again, educators must be cognizant of the appropriate interventions for students who appear defiant but may be struggling against powerful amygdala reactions. These students are not lost causes; the brain’s neuroplasticity ensures that brain chemistry can and does change in response to experience. Thus, presenting students with positive, meaningful experiences may begin a significant change. Students who often experience failure, then, should be presented with situations at an accessible level, then challenged only slightly more until success is again experienced. This process should be repeated sequentially until students feel comfortable working at an appropriate level in class.. |
| “Even feelings like embarrassment, boredom, or frustration -- not only fear -- can spur the brain to enter the proverbial "fight or flight" mode” (Bernard, 2010d).  | Educators must remember to avoid sarcasm and negativity, and to instead spend time creating positive routines and a welcoming atmosphere (Bernard, 2010d; “How the Brain Learns”, 2003). |
| * “Chronic stress can alter the connections among neurons that allow us to communicate -- the basis of memory storage and retrieval -- and control emotional responses.”
* “The stress of boredom increases with the students' frustration of inadequate opportunities to connect to content through their curiosity, strengths and interests. The ultimate remedy will be revising excessive grade-level curriculum expectations by creating more opportunities for enduring understanding through discovery and student-centered learning.”
* “Using metacognition and strategy development skillsets, we can guide students through the experience of developing the executive function of their neural networks, which are most actively maturing during the school years, and help them recognize the benefits of metacognition. In short, we can build their abilities to master stressors such as boredom” (Willis, 2013).
 | Educators should contextualize lessons and activate prior knowledge (Willis, 2013) in order to relieve boredom and inspire curiosity. Thus, overloading students with decontextualized vocabulary, for example, and expecting them to memorize those words bores students and does not inspire internalization of the content. In courses that are vocabulary heavy, then, educators should not only approach the vocabulary in a more meaningful, contextual way; they should also discuss metacognition with their students and teach them strategies to overcome the boredom that stops studied material from entering their long-term memories (Willis, 2013).  |
| Feedback is “among the top 10 influences on achievement” (Hattie, J. & Gan, M., 2011, p. 249). | Teachers should provide timely, insightful, and helpful feedback both while students work and after they turn it in.  |
| * “A major key to unlocking the power of feedback is to ensure the cues are responsive to the task performed and that…these cues consider the situational and personality attributes of the receiver” (Hattie, J. & Gan, M., 2011, p. 254).
* The four levels of feedback:
1. Task level: corrective feedback, addresses content specifically
2. Process level: feedback that provides “task processing strategies and cues for information search”
3. Self-regulation level: feedback that inspires the learner “to engage further in the task”
4. Self level: personal praise

(Hattie, J. & Gan, M., 2011). | Teachers should avoid over-use of self-level feedback (Hattie, J. & Gan, M., 2011) and should instead focus their feedback on analytical evaluation of what was produced by the student. Feedback should consist of confirmation and praise of what was accomplished well and specific suggestions for how to improve in the areas not completed as effectively. This feedback should be provided via discussion, and students should be asked to explain it in their own words and reflect on their learning as well as the next steps to take. |
| Inert knowledge is book knowledge without experience with implementation. It is “deficient” because (1) learners are unable to “encode the general rules or principles”; (2) “learners may not…notice[] relevance of the known problem solutions”(Renkl, A., 2011, p. 272) | Too many students remain subjected to learning experiences that develop inert knowledge and only present that knowledge in the form of an exam that reveals more about students’ abilities to memorize than depth of content knowledge. Students have to use what they learn. Renkl (2011) argued that it is “necessary to elicit explanations from…learners” (p. 273) as a means of overcoming the deficiencies of inert knowledge development (Renkl, A., 2011).  |
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| * Children learn aggressive behaviors through modeling.
* “It was once widely believed that seeing others vent aggression would drain the viewer’s aggressive drive. …[E]xposure to aggressive modeling is hardly cathartic” (Bandura, A., n.d.).
* “Teachers can use modeling to demonstrate correct behavior and encourage children to learn from observation” (Gornell, D., Janusz, A., & Pate, N., n.d.).
 | Modeling appropriate behavior is critical to working with children. It is important that educators remember not to respond to negative behaviors aggressively. This aggression does not “drain the viewer’s aggressive drive” (Bandura, A., n.d.); instead, the aggression tends to builds in both parties. Instead, teachers should demonstrate through their own actions how to remain calm in moments of tension.  |
| “Learning is all about environment interacting with the cognitive domain and leading to certain behaviors. [This is called] reciprocal determinism” (ktheuer, 2008). | Educators should “embed learning in complex, realistic and relevant learning environment[s]” and model appropriate learning behaviors that encourage collaboration and negotiation, “[s]upport multiple perspectives,,,[n]urture self awareness…[and e]ncourage ownership of learning” (ktheuer, 2008).  |
| “We tend to pay attention to things that are large in size,..out of the ordinary,…or that connect to our prior knowledge” (drjhilp, 2012).  | Teachers should consider this when making handouts/creating presentations/etc. Presenting information visually in addition to verbally allows students to process the information at different levels. Attention to aesthetic when creating the visuals could improve students’ information processing (drjhilp, 2012).  |
| “Feedback is…powerful when it engages the learner with the learning task or goal at, or above, the level where the learner is currently functioning. Thus, the challenge for educators is to provide *calibrated* [*sic*] feedback that is designed to function at the appropriate operational level of the learner” (Hattie, J. & Gan, M., 2011, p. 261).In the Edutopia.org video “Making Sure They are Learning” (2011), Sarah Kauffman demonstrates authentic assessment: she uses a skill continuum to discuss with students where they are and where to go next in terms of skill practice (Edutopia.org, 2011).  | Educators should work to make learning “visible” (Hattie, J. & Gan, M., 2011). Continuums of skill development are excellent tools for that. After feedback is provided, students should be asked to reflect via journaling/blogging/discussing via virtual discussion boards about areas of strength and areas for improvement. |

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| “Classroom goal structures reflect the purposes for learning that students perceive in classrooms. If a student perceives a mastery goal structure, the student believes that instruction emphasizes learning, improvement, and effort; if a student perceives a performance goal structure, the student believes that instruction focuses on relative ability, outperforming others, and grades. Goal structures are communicated to students through assessments, daily tasks, and discourse and instruction” (as cited in Anderson, E.M. & Dawson, H., 2011, p. 224). | Teachers should present a classroom and instruction that is mastery-goal focused. Assessments should be individual and private. Teachers should provide specific individual feedback that relates to achievement based on effort-driven improvement and offers students direction for further improvement. Daily tasks should be constructed to promote social cognitive exploration of concepts in cooperative groupings sometimes based on mixed-ability and sometimes based on interest. Teachers should be careful to speak in ways that promote exploration and effort as more important than grades and social comparison (Anderson, E.M. & Dawson, H., 2011). |
| “The mastery experience, or actually completing the task, is the most potent source [of self-efficacy]. A successful mastery experience increases self-efficacy whereas an unsuccessful mastery experience causes efficacy to drop” (Anderson, E.M. & Dawson, H., 2011, p. 225). | Teachers should do everything they can to provide students with goals they can master in order to improve their self-efficacy and thus their intrinsic motivation, provided that teachers are careful not to praise success where there is none. Helping students to set and monitor attainable short-term goals as well as long-term goals is an important strategy in this respect. The short-term goals build the students’ confidence and self-efficacy, ultimately culminating in successful achievement of long-term goals (Anderson, E.M. & Dawson, H., 2011; “No Child without Motivation”, 2006). |
| “[W]hen social contexts support meeting individuals’ needs for autonomy, those individuals experience a variety of positive outcomes” (Anderson, E.M. & Dawson, H., 2011, p. 226). | Interactions with children should be focused on social support and feedback to improve students’ belief in their autonomous development of mastery in the area of focus. Providing specific feedback via a continuum of skill-development and training students to speak to one another in terms of skill-acquisition would support this purpose (Irving, S., 2014b). |
| “[E]xtrinsic incentives do not have to be harmful, if they are used in ways that provide students with information about their learning, and if the rewards are perceived as non-controlling” (as cited in Anderson, E.M. & Dawson, H., 2011, p. 228).  | Teachers do not have to completely abandon their classroom reward systems if they are experiencing successful gains. Revamping may be necessary, however, to ensure that rewards are supportive or the development of the learner’s drive to explore, take risks, and find enjoyment in course content (Anderson, E.M. & Dawson, H., 2011; Irving, S., 2014b; “No Child without Motivation”, 2006). |
| “Whereas expensive, large-scale interventions can certainly be delivered to enhance achievement motivation, simple changes in daily instructional practices can also have profound effects on students, both positively and negatively” (Anderson, E.M. & Dawson, H., 2011, p. 230). | Teachers should focus on implementing small changes in their classrooms in order to support motivation. For example, teachers should avoid “displaying the work of the best students” (Anderson, E.M. & Dawson, H., 2011, p. 230) because it encourages social comparison and thus diminishes the self-efficacy of students whose work is not published (Irving, S., 2014b). |
| “[E]ducators can easily affect student motivation by helping students to value certain tasks. Specifically, it is incumbent upon educators to choose tasks that perceive as being important, interesting, useful, and worthy of one’s time” (Anderson, E.M. & Dawson, H., 2011, p. 232). | It is difficult to see the world through students’ eyes in order to determine what students perceive as important and useful to their lives, but it is worth teachers’ time to have explicit discussions with students in this regard. This could increase students’ ownership of learning experiences by providing students with the opportunity to have a voice (Anderson, E.M. & Dawson, H., 2011; Irving, S., 2014b). |
| “Testing and assessment are not going to be eliminated in schools. However, the emphasis on testing can be diminished” (Anderson, E.M. & Dawson, H., 2011, p. 233). | “The negative effects of grades on intrinsic motivation can be lessened if grades are presented as informational and non-controlling in nature” (as cited in Anderson, E.M. & Dawson, H., 2011, p. 233). |
| “Results indicated that low ability students displayed greater learning when they were assigned to the heterogeneous groups” (Anderson, E.M. & Dawson, H., 2011, p. 233). | Teachers should avoid groupings by ability and should, instead, employ cooperative learning grouping according to the following “common characteristics: (a) success of the group is dependent on mutual success among group members; (b) groups are heterogeneous in composition; and (c) students must still demonstrate individual learning” (Anderson, E.M. & Dawson, H., 2011, p. 233). |
| “[S]tudies make clear that school achieve-ment [*sic*] is most properly viewed as a clustering of interrelated causal factors—cognitions (goals), self-protective mechanisms, and feelings whose relationships to one another and ultimately to school performance itself change as students progress from one achievement event to another (as cited in Covington, M.V., 2000, p. 187). | Teachers must ensure that their classrooms and curricula are designed such that students are driven by goals they set (with guidance), that students feel comfortable and do not need to expend mental energies protecting themselves emotionally, and that lessons are designed to promote incremental (but important) succession in order to build students’ confidence (Anderson, E.M. & Dawson, H., 2011; Irving, S., 2014b). |
| “The benefits of therapy were minimal for these latter two groups because the interventions did not compensate them for their particular weaknesses, whereas when a proper match between deficit and remediation was achieved” (Covington, M.V., 2000, p. 188). | Teachers must recognize that no interventions will work in a one-size-fits-all capacity. Teachers must identify the specific needs of students demonstrating any kind of difficulty and apply research-based strategies accordingly (Covington, M.V., 2000; Irving, S., 2014a; Irving, S., 2014b).  |
| “When excessive emphasis is placed on performance goals and success is narrowly defined as outper-forming [*sic*] others, teachers pressure students. They use controlling autocratic teaching techniques, which means relying on extrinsic rewards, allowing students little choice for how they go about learning, and threatening to withdraw emotional support as a means of control” (Covington, M.V., 2000, p. 188).“Central to creating motivational equity is the need for teachers to set the absolute standards of excellence they require of all their students and to make explicit the relationship between goal attainment and payoffs” (Covington, M.V., 2000, p. 189).  | In order to support mastery goals instead of performance goals, teachers should introduce individual, private goal-tracker sheets or technology tools that serve that function. They should spend time helping students set goals for themselves based on their own levels with each major portion of the curriculum (e.g., reading, writing, language, speaking and listening for ELA) and dedicate regular class time to monitoring and keeping track of progress toward mastery of each goal (Irving, S., 2014b).  |
| “Elementary school children who were directed to establish their own learning goals perceived failure experiences as temporary, compared with otherwise compa-rable [*sic*] subjects who adopted a competitive goal. This latter group was more likely to interpret failure as a matter of personal incompetency” (Covington, M.V., 2000, p. 190). | Teachers should avoid competitive games as reviews before tests and should, instead, use that time to encourage students to assess their goal achievement as compared to the requirements of the assessment. Teachers should also use this time to allow students to re-work and re-submit assignments in order to demonstrate developing mastery (Covington, M.V., 2000; Irving, S., 2014b).  |

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| * In constructivist classrooms, “[s]tudents…help set their own goals and means of assessment” (Thirteen Ed Online). They self-reflect and self-evaluate as well, especially during collaboration, which requires them “to reflect on and talk about what they are doing and how their understanding is changing” (Thirteen Ed Online).
* In situations that require active problem-solving, students “encounter something new [and] have to reconcile it with…previous ideas and experience, maybe changing what [they] believe, or maybe discarding the new information as irrelevant” (Thirteen Ed Online).
* Constructivists support “grounding learning activities in an authentic, real-world context, [which] stimulates and engages students” (Thirteen Ed Online).
 | Teachers should build classrooms centered on learning that requires active thinking, promotes self-evaluation of that thinking, and intrinsic motivation. Teaching students to set and monitor goals, plan and evaluate implementation, and use learning as building blocks instead of a series of non-related ideas is critical to constructivism and to learning (Irving, S., 2014b; Zombrunn, S., Tadlock, J., & Roberts, E.D., 2011). |
| Lave and Wanger (n.d.) discuss four benefits of situated cognition: (1) students learn about the conditions for applying knowledge; (2) students are more likely to engage in invention and problem-solving; (3) students can see the implications of knowledge; and (4) students are supported in structuring knowledge.  | Teachers should situate students’ thinking in authentic situations. For example, instead of teaching students to memorize the parts of the brain, provide them with a project in which they have to dissect a brain (virtual tools exist for this) and collect data in order to find the part of the brain that is malfunctioning. Situating their learning in real-world professional simulations provides purpose, and thus, motivation (Lave, J. & Wenger, E., n.d.). |
| The “coverage virus lead[s] to the incorporation of more teacher-centered practices and less student autonomy” (Loyes, S.M.M. & Rikers, M.J.P, 2011, p. 369). | We teachers have pressures to face, but we must remain devoted to student learning and not test-passing. We should do everything we can to keep our classrooms student-centered and to keep autonomy as the ultimate goal (Irving, S., 2014a). |
| Researcher Gray “emphasized the continued importance of reading as a source of information, for the reflective and critical study of personal and social problems, and as a form of vicarious experience” (Fox, E. & Alexander, P.A., 2011, p. 13).  | “21st century reading instruction should emphasize “strategic search and comprehension processes…such [as]…rapid [website] cycling through prediction, search, location, and evaluation” (Fox, E. & Alexander, P.A., 2011, p. 14)” (Irving, S., 2014a). |

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