

# the learning sciences

## 10 KEY INSIGHTS & PRACTICES FOR EDUCATORS

### Introduction to the Learning Sciences

Are you looking to learn what scientists have discovered about how people learn, and how to apply this information to your work in a school or classroom?

Neuroscience research has shown that learning in the brain happens in three phases: encoding (transforming experience into long-term memory), consolidation (storing and maintaining information over time) and retrieval (accessing information when needed). Additionally, researchers have discovered that the environment in which students learn, including the physical space as well as social and emotional factors, can impact learning.

Digital Promise and the Institute for Applied Neuroscience have teamed up to synthesize findings from the growing field of learning sciences research into 10 key insights about how people learn, along with suggestions for how to apply this information to classroom practice.



### How to Use the Cards

This set of cards was developed with busy educators in mind. These cards can travel with you as a tangible reminder while you experiment with applying the learning sciences in your work with students, teachers, and education leaders. Each card has a front and a back. The front contains one of the learning sciences insights and the back contains a brief explanation of what the research shows as well as some tips on how to apply the insight in practice.

In order to assemble the cards, first print out this PDF double sided. Use cardstock or thick paper to create sturdier cards. To cut them out, line up your paper cutter or scissors with the black lines.

Applying learning sciences research in practice can involve trial and error. We recommend that you work with an instructional coach, or with group of your peers, to create a plan. Start small by focusing on one insight at a time. Gather data along the way, and get your students involved!

The cards are meant to be an introduction to the Learning Sciences, not a comprehensive review of the field. For links to additional research and resources, check out [Introduction to the Learning Sciences](#).

### Share your Journey

How are you applying the learning sciences? What strategies are you trying? What's working so far? What questions do you have for researchers or other educators?

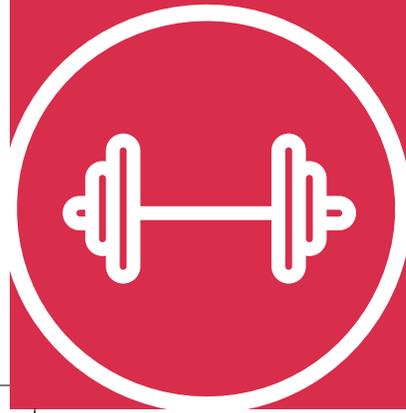
Use the hashtag #researchatwork to share your learning sciences stories on social media, or email them to [research@digitalpromise.org](mailto:research@digitalpromise.org). Digital Promise will feature educators at different stages in experimenting with learning sciences research on its social feeds.

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Spacing out learning,  
and interweaving  
different content,  
strengthens learning.



Communicating high  
expectations and  
keeping learners at the  
edge of their mastery  
helps each student reach  
their potential.



Students learn well  
when they feel safe  
and connected.



Students' physical  
well-being, including  
nutrition, sleep, and  
exercise, impacts  
learning.



## Insight

To foster deeper learning, the learning process needs to be productively difficult. Learning is like sports: while practice is not always fun and drills can be difficult, a deliberate training process leads to improvement. Having students work at the edge of their mastery while maintaining high expectations pushes them past their current abilities, engages the brain deeply, and lays the foundation for strong learning.

## In Practice

Be upfront about the frustrations that can come with productive struggle. Teach students how learning works (including the connection between effort and learning) so they can understand how challenging their brains supports deep learning.

Use language like "I believe you can do this" to communicate high expectations and encourage students to persist through challenges. This language also reassures them that this is a desirable difficulty and that real learning is happening!

Strategies that work for advanced learners may not work for all students; differentiate lessons in order to provide learners at all levels with appropriate supports.



## Insight

The same amount of content taught or studied but spaced over time can dramatically improve learning and retention. Additionally, switching between different content (e.g. different types of math problems) requires increased effort for students (a desirable difficulty) and can highlight when different strategies are most appropriate. All these factors can produce more durable learning, in turn allowing students to more flexibly access what they learn in later situations.

## In Practice

Break up the teaching of concepts over multiple classes, revisiting the key concepts during subsequent sessions (sometimes called 'spiraled' teaching).

Intermix the content you teach. Reach back to prior concepts when you teach new ones.

Encourage your students to break up their studying of a topic into multiple days or weeks, studying the information more than once and allowing a good amount of time in between study sessions.



## Insight

Learning will be impaired if students' basic physiological needs are not met. Students with good overall physical well-being have better cognitive skills than when they are in poor condition. Aerobic exercise can transiently improve the brain's plasticity and can increase hippocampal volume (a key part of the brain involved in learning new information). Sleep is critical for solidifying learning from the day, and is one of the most important (and easiest) ways to strengthen learning. Basic nutrition is also important for brain health.

## In Practice

Students need plenty of daily movement and exercise, including recess and PE.

Teachers can educate parents about the effects of the blue light from digital screens on children's sleep quality and can recommend putting devices away at least an hour before bed.

Students can boost their test performance by putting some sleep between learning and the test!



## Insight

When students feel that they are part of a positive, supportive learning community, this can reduce anxiety, allowing them to focus on learning. Building stable, trusting relationships with students supports their self-worth and promotes their sense of belonging.

## In Practice

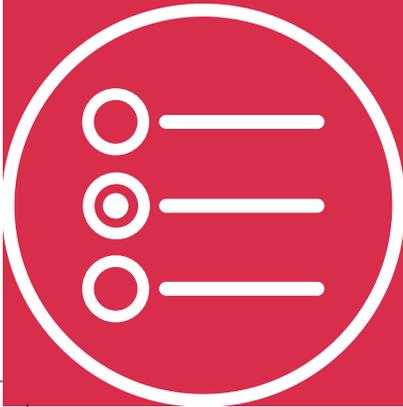
Create a classroom environment that nurtures positive peer relationships. Foster peer-to-peer interactions through well-designed cooperative learning activities and by modeling positive, constructive language.

Explicitly teach social and emotional skills, like empathy and kindness, and help students practice using them in multiple contexts.

Use trauma-informed practices, such as teaching coping skills and building caring relationships between teachers and students. These benefit all students.



Retrieval practice strengthens memory and helps students flexibly apply what they learn.



The entire environment, from space to temperature to lighting, can affect learning.



Thinking deeply about the to-be-learned material helps students pay attention, build memories, and make meaning out of what they are learning.



Students are more motivated to learn when they are interested, have a sense of autonomy, and understand the purpose behind what they are learning.



## Insight

Elements of the physical environment can play a role in determining whether the classroom will be conducive for focus and learning. Exposure to sunlight, as well as views of nature from the classroom, has been shown to boost student achievement, well-being, and behavior.

## In Practice

Incorporating flexible furniture -- lightweight or on wheels -- can support flexible instructional goals and gives students choice in where they work to empower them to take responsibility for their learning.

Try to keep the temperature between 68 and 74 degrees Fahrenheit so students are comfortable and able to focus. No thermostat? Have blankets and small fans for students to use.

If your classroom has less natural light than you'd like, replacing your lighting with blue-enriched or full-spectrum bulbs can improve students' cognitive performance.

No windows with views of nature? Take your class for walks outside or have plants or posters of nature in the classroom to get some of the benefits of nature.



## Insight

Retrieval activities, like self-testing and low-stakes quizzing, that ask students to practice remembering the information they've been taught by retrieving it from their long-term memory actually change the nature of memory by strengthening the path to memory and enriching the memory itself. In this way, retrieval practice leads to stronger and more enduring learning.

## In Practice

Encourage students to use self-tests to assess what knowledge is not easily retrieved and to flag for more retrieval practice. Flashcards can be a useful self-testing tool.

Teach students to pause during studying to try to recall key ideas.

Make quizzes low-stakes, predictable (not pop!), simple, and quick. Having students generate questions for quizzes can be doubly beneficial!



## Insight

The level of a student's interest has been shown to be a powerful influence on learning. Additionally, when students have a sense of control over their own learning, and the opportunity to set goals that are not only personally meaningful but also have the potential to benefit the world, their intrinsic motivation improves. As a result, they are more likely to persist longer at academic tasks and to process information more deeply. Motivation does not replace the important foundational importance of helping a learner engage in behaviors that help them encode, consolidate, and retrieve memories. Likewise, engagement should be directed toward the actual material to be learned.

## In Practice

Support interest and autonomy by providing some level of choice. Allow students to choose their own books to read or to select their preferred format to complete an assignment. Offering a limited number of options (3-5) is often the most motivating.

Invite students to generate purposeful, self-focused goals such as, "gain skills I can use in a job to help others," and learn material to "become an educated citizen that can contribute to society." Doing this encourages students to develop an internal drive for learning and find meaning in mundane schoolwork.

Create tasks and projects that challenge students to write and design for authentic audiences and purposes, including projects that help their local community or are connected to a cause they care about.



## Insight

When students are invited to think deeply about subject matter, they can better build strong memories. Deep thinking and a focus on making connections also allow students the time to make meaningful connections between the material, their own lives, and the world around them. When students see how material relates to their lives and interests as well as other concepts they already know, they have frameworks for understanding the material more easily and can learn it more deeply.

## In Practice

Introduce strategies, such as see-think-wonder and claim-support-question, to guide students' thought processes and to encourage active engagement with content.

Ask increasingly complex questions that require students to build connections between the content you're teaching and their background knowledge or other topics of interest.

When presenting new material, ask students to identify and summarize important points, including their own perspective on the ideas they selected. Invite them to discuss their ideas with a partner.



Learning is a process that involves effort, mistakes, reflection, and refinement of strategies.



Collaboration and social interaction can be powerful learning experiences because they encourage deeper processing and engage the 'social brain.'



## Insight

Students are highly tuned to social dynamics and research shows that certain collaborative and relational interactions can drive learning. Harnessing this social drive in the classroom can take students further than they can go alone. Working collaboratively towards a common goal, rather than dividing a project into parts that can be done individually, encourages students to discuss, think about ideas they might not have considered, and learn more than they would if working individually.

## In Practice

Promote collaboration and exchange of ideas by structuring projects to require shared learning and co-creating rather than splitting tasks.

Encourage students who are working on teams to get to know one another to better understand each other's perspective. As students build stronger relationships with fellow team members they can move beyond superficial questions to ones that are deeper and more challenging.

Ask students to take the perspective of others (e.g. of the people who you are teaching about in social studies or literature) to help students tie the learning to themselves and to a broader perspective.

Having students prepare to teach is a powerful way to engage the social brain, whether or not they end up teaching the material! Teaching others often benefits the tutor the most, so be sure to give all students the chance to be tutor as well as tutee, or to compare notes on the lessons they prepare.



## Insight

Learning is a continual process that leads to the development of new knowledge as well as changes in existing knowledge. Helping students understand that many aspects of learning, including strategy and effort, are under their control fosters students' beliefs in their own agency to learn. When students see failure as an opportunity to find out what they do not know (and adjust their learning strategies accordingly), rather than as an indication of self-worth, they are more likely to persevere. Students may also appreciate learning more about the processes that other insights in this series explain.

## In Practice

Provide feedback that focuses on the process and helps students see both the productive effort and the effective strategies they used. Encourage students to employ a growth mindset by reminding them of their progress while supporting them to work through challenges.

Foster an environment where mistakes and failure are fodder for reflection and positive discussion, so students feel supported and safe to learn from mistakes. Use discussion questions to reframe failure as fodder: Have you ever felt proud of making a mistake? Have you ever discovered something new after making a mistake?

Frame assessments as opportunities for students to show themselves what they know and can do at that given moment versus a diagnostic that labels them.

