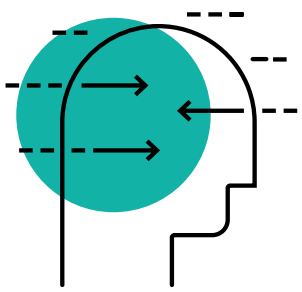
Pearson

Learning Design Principles

Minds in Mind

Active Learning, Memory & Practice



Summary

What are Pearson's Learning Design Principles?

Our Learning Foundations describe the optimal conditions for learning and reflect the learner experience we hope our products will create. We do this by incorporating our Learning Design Principles.

Each of our Learning Design Principles goes into detail about a key principle, supporting product design and marketing by describing:

- the research that informs the principle
- why it matters in learning
- how we can apply it in practice

Our portfolio of Learning Design Principles will continue to grow over time.

Welcoming Experience
- Motivation & Mindset
- Social & Collaborative Learning

Minds in Mind
- Developing Understanding
- Attention & Cognitive Load
- Active Learning, Memory & Practice
- Desirable Difficulty & Scaffolding
- Feedback for Learning

Learning Behavior
- Self-Regulated Learning & Metacognition

Purposeful Design
- Objective Design
- Assessment & Evidence-Centered Design
- Personalized Learning & Adaptive Systems
- Authentic Learning

Learn Anywhere
- English Performance Standards
- Digital & Virtual Learning

Active Learning, Memory & Practice

Learners who simply try to retain information frequently find they can't remember it when they need to. Plus, it feels boring trying to memorize everything. How can we help make learning more engaging and robust?

Active learning is any instructional technique that gets learners to go beyond just receiving information and to create responses, connections, inferences, questions, and ideas that are meaningful to them. When learners engage in this way, they are more engaged and more likely to learn.

Sometimes people hear 'active learning' and think it means when learners physically move about as part of an activity. While this can be a part of active learning, focusing on activities can distract from an effectively designed learning instance. Instead, the focus should be on actively engaging learners' minds.

Active learning is thought to benefit learners:

- by encouraging them to construct their own understanding, leading to richer, more interconnected schemas
- by supporting engagement, which can help the learner maintain attention and support motivation

Why it matters

Too often, instructional materials present content for learners to passively receive, even though this is not likely to be effective. When learners engage in active learning, they use their time more efficiently while also feeling more connected to their peers and the content.

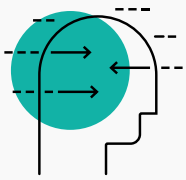
When designed well, active learning typically leads to better learning and deeper understanding on a variety of tests, from simple recall to conceptually rich performance activities.

By understanding how to tailor learning experiences for the kinds of knowledge targeted, designers of learning experiences can choose the most appropriate type of active learning activity.

Impact

When we successfully incorporate this principle into learning experiences, we can have an impact on these learner outcomes:

- learners are engaged, because they are prompted to construct their own understanding and make connections to their own knowledge
- learners develop a flexible repertoire of learning strategies because learning activities have been tailored to knowledge types
- learners are more fluent with facts and more able to apply rules, because they have practiced retrieving them
- learners co-create new knowledge via peer interaction
- learners develop deeper and more lasting understanding of the content they have learned because they have encoded it meaningfully



Active Learning, Memory & Practice

The big ideas

1

To learn more deeply, learners need opportunities to **generate and construct** their own understanding.

I can explain this in my own words.

Depending on the content to learn, I study in different ways.

2

Different kinds of learning activities are better suited for promoting certain kinds of learning outcomes. The best activity depends on the **type of knowledge** to be learned, and the **thinking process** that best gets you there.

3

Learning is successful when a learner can recall what they need, when they need it. **Aligning instruction with how memory works** helps achieve that goal.

Making my studying more like a quiz helps me remember this later.

4

Making learning more active can help make **deeper connections** and build **richer understanding**.

This helps me understand by seeing how it connects to other ideas and what I already know.

Big Idea 1

Deepen cognitive engagement

To learn more deeply, learners need opportunities to generate and construct their own understanding.

What it feels like for learners

I can explain this in my own words.

Everyone has experienced learning materials that simply provide information and expect you to remember it. This is not a particularly effective approach. Research has found that getting learners to be more active in the learning process is beneficial.

The key is to make things not just 'hands-on,' but 'minds-on'. This is because the benefit comes from building better networks of knowledge (or schemas) in learners' minds, which only happens when learners engage in **constructive learning**.

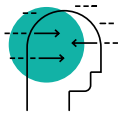
The ICAP (Interactive, Constructive, Active, Passive) framework categorizes learning experiences based on the amount of knowledge-building involved. ICAP is useful for instructional design because it lists what learner need to do to gain each level of cognitive engagement.

Low impact ⟶ **High impact**

Passive	Active	Constructive	Interactive
Receiving and storing information	**Manipulating and selecting information**	**Generating information**	**Generating information with other learners**
• reading • listening • watching videos	• highlighting • taking notes • gesturing and pointing • repeating or paraphrasing • pausing and understanding videos	• structurizing • summarizing • explaining or elaborating • reflecting • predicting • connecting • generating hypotheses • setting relationships • comparing	• discussing • arguing • defending • challenging • building on others' contributions • question and answer sessions

CREATE	**Produce new or original work:** Design, assemble, construct, conjecture, develop, formulate, author, investigate
EVALUATE	**Justify a stand or decision:** Appraise, argue, defend, judge, select, support, value, critique, weigh
ANALYZE	**Draw connections among ideas:** Differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test
APPLY	**Use information in new situations:** Execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
UNDERSTAND	**Explain ideas or concepts:** Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate
REMEMBER	**Recall facts and basic concepts:** Define, duplicate, list, memorize, repeat, state

Bloom's Taxonomy provides more detailed guidance on how to design for knowledge-building. The Remember level corresponds to the Active level of ICAP. From that starting point, the taxonomy describes increasingly complex ways to engage in **constructive learning**.



See this Learning Design Principle: Developing Understanding

See these Learning Design Principles: Objective Design Assessment & Evidence-Centered Design

What it means for designing learning experiences

- Prompt learners to generate and construct meaning, going beyond just repeating what is presented
- Existing materials probably contain opportunities to add more cognitively rich tasks. Consider ways of modifying passive content to engage learners in constructive activities
- Find ways to get learners to generate their own responses, which will improve existing schemas and form new connections
  - Changing multiple choice for fill-in-the-blank is a great start!
- When moving beyond passive learning, consider whether you'd like the instructional activity to promote active, constructive, or interactive processing, and try to build accordingly
- Pay attention to what, specifically, the learner is asked to construct, and ensure good instructional alignment for best results

Big Idea 2

Tailor activities to knowledge types

Different kinds of learning activities are better suited for promoting certain kinds of learning outcomes. The best activity depends on the type of knowledge to be learned, and the thinking process that best gets you there.

Based on what they ask the learner to do, learning activities promote particular kinds of processing, which may or may not be a good fit for the outcomes and the learner's prior knowledge.

See this Learning Design Principle: Objective Design

What it feels like for learners

Depending on the content to learn, I study in different ways.

Type of knowledge	Kind of processing
Facts Simple associations, like vocabulary words or dates	**Memory and fluency** Learning facts becomes automatic with practice, as long as it is spaced out, there is feedback, and learners generate responses
Rules Intuitive patterns that learners can use productively	**Induction and refinement** Processes like classifying and generalizing, which make clear when a piece of knowledge applies, help teach rules
Principles Explanations and reasons that tie concepts together	**Understanding and sense-making** Reasoning out loud helps learners make connections, create inferences, and build knowledge

What it means for designing learning experiences

Align the learner outcome, the kind of processing, and the instructional activities. Different instructional techniques can promote specific kinds of cognitive processes.

For facts:

- get automatic with repeated practice
- use techniques grounded in how memory works to help create chunks of knowledge

For rules:

- see patterns by comparing varied examples
- include worked examples
- use visual coordination and comparison, and feature focusing to help learners identify the underlying information to pick up on

For principles:

- explain your reasoning
- prompt for deeper reasoning
- employ collaborative learning
- use accountable talk

Learning should still be constructive. Reviewing worked examples will be less effective than asking learners to fill in missing steps in a worked example.

Big Idea 3

Maximize memory

Learning is successful when a learner can recall what they need, when they need it. Aligning instruction with how memory works helps achieve that goal.

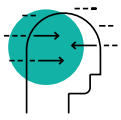
What it feels like for learners

> *Making my studying more like a quiz helps me remember this later.*

Research is clear that practicing getting information out of memory — 'retrieval practice' — helps make that memory stronger, particularly compared to techniques like re-reading.

Retrieval practice often takes the form of practice tests, and their beneficial effect on retention is sometimes known as the testing effect.

- **Retrieval practice supports learning**
  Repeated retrieval practice can help build up automatic routines and associations, which free up working memory to think about the bigger picture. Retrieval practice is especially beneficial for learning facts and simple rules, but it can support more complex knowledge as well if the practice tests match the knowledge (e.g., analyze/evaluate/apply questions for higher-level conceptual knowledge, complex rules, and principles).
- **The more challenging, the better**
  Factors that make retrieval more challenging can ultimately make the learning more robust. These factors include things like waiting longer between practice sessions, varying up some of the cues, and interleaving questions from multiple topics or domains. Interleaving is especially helpful for highlighting differences between categories or items, while massed practice helps learners notice similarities across categories or items.
- **It must be intentional**
  Practice should be deliberate: goal-driven, focused on improving specific skills, with feedback. Simply trying to retrieve is not likely to be as useful as practice that is tailored to a learner's strengths and areas to improve, followed by specific feedback, and changed adaptively based on the learner's progress.



See this Learning Design Principle: Desirable Difficulty & Scaffolding

See this Learning Design Principle: Personalized Learning and Adaptive Systems

What it means for designing learning experiences

- For learning facts and simple rules, provide ample opportunities for retrieval practice, spaced out across the learning experience
    - Spacing out retrieval to make it challenging is beneficial, but only if the retrieval is still successful. Waiting so long between sessions that retrieval fails is not helpful for learning.
- Consider where it may be appropriate to practice more than one type of content at a time. If comparing or contrasting will benefit learners, add some interleaved content
- Make practice more effective by making it deliberate: goal-driven, focused on specific skills, with tailored feedback
- Match the kind of retrieval practice to the kind of learning goal
    - For example, flashcards work great for facts, but higher-order reasoning can also be practiced if the questions are appropriate (e.g., 'Which of the three authors we studied last week would agree with the following statement…?').

Big Idea 4

Strengthen sense-making

Making learning more active can help make deeper connections and build richer understanding.

What it feels like for learners

> *This helps me understand by seeing how it connects to other ideas and what I already know.*

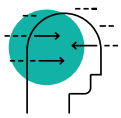
Sense-making creates knowledge, which can help learners fill in gaps, correct errors, and generalize concrete instances into rules and principles.

- **Connecting knowledge**
  When a learner's knowledge is richly connected, retrieving one idea helps similar ideas come to mind. To connect knowledge, learners must go beyond recalling information and elaborate to generate something new. While some learners do this naturally, studies have found that prompting learners to ask questions and explain concepts to themselves can be very beneficial for those that do not.
- **Learn complex rules with comparison and analogies**
  When the target knowledge is a complex rule (e.g., as in algebra, geometry, or chemistry), making comparisons can help learners understand how and when a rule applies. Analogies can support these comparisons and help learners make inferences. Learners can then practice judging when the rule applies.
- **Learn principles with understanding and sense-making**
  When the target knowledge is a principle (e.g., as in physics, psychology, or economics), ask the learner to go beyond the information presented by articulating the rationale behind it. This can involve connecting knowledge, making inferences, explaining, and arguing points.

Verbalization

Forming questions, interrogating misconceptions, providing rationales and other sense-making processes are all mediated through speech. Speaking to a teacher or a collaborator is great, and even talking to yourself is a powerful tool.

- **Prompted explanation:** carefully constructed questions can help learners focus on critical elements, uncover misconceptions, and create meaningful explanations
- **Accountable talk:** many classroom practices help learners ask productive questions, elicit explanations, and collaborate
- **Concept mapping:** learners can improve and repair their internal knowledge organization by making it visible
- **Collaboration:** working constructively with partners can improve sense-making, but research suggests that scaffolding the conversation maximizes the impact



See this Learning Design Principle: Developing Understanding

See this Learning Design Principle: Authentic Learning

See this Learning Design Principle: Social and Collaborative Learning

What it means for designing learning experiences

- Make sure learners have enough prior knowledge to build on, otherwise asking them to engage in sense-making will be less effective and may lead to frustration
- Help learners deepen and connect their understanding with appropriate sense-making activities
- Support sense-making of complex rules with instructional strategies like analogical comparison
- Support sense-making of principles with instructional strategies like prompted explanation, accountable talk, concept mapping, and collaboration

Authors

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Elizabeth Richey received her PhD in cognitive psychology from the University of Pittsburgh and has worked as a professor, researcher, and pedagogical coach. As a researcher and educator, she builds connections between research and practice in the areas of learning and motivation. Her research focuses on educational technology, motivation, example-based learning, explanation, collaboration, and belonging. Through laboratory experiments and classroom studies, she examines cognitive, metacognitive, and motivational factors that influence math and science learning from elementary school through college.

Katherine McEldoon, Ph.D.

Katherine McEldoon is a research-to-practice connector. After earning her Ph.D. in cognitive and learning sciences at Vanderbilt University and a post at Arizona State University's Learning Sciences Institute, she has worked in academia, government, and industry to ensure the best scientific insights support student learning, no matter the context. Katherine has most recently worked as Lead Learning Scientist on Pearson's Efficacy & Learning team, bringing evidence-based insights to Pearson's world of learners.

Daniel Belenky, Ph.D.

Daniel Belenky is a learning scientist with over 10 years of experience applying educational research to improve learning outcomes. He is passionate about helping learners achieve their goals, with experience designing, testing, iterating, and communicating about innovative and impactful educational experiences. He earned a Ph.D in Cognitive Psychology from the University of Pittsburgh, where his research focused on how student motivation influences learning and transfer. Dan also completed a Post-Doctoral Fellowship in the Human-Computer Interaction Institute at Carnegie Mellon University.

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