

Learning Design Principles



A Toolkit for
Evidence-Based Learning Design

Edited by Katherine McEldoon, PhD

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What are the Learning Design Principles?



The Learning Design Principles are an accessible point of entry to the learning sciences that can enable application into the learning engineering process at scale, accelerating our impact as a field.

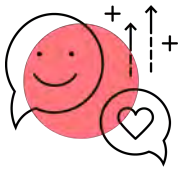
The Learning Design Principles are concise learning science research summaries paired with actionable design implications, along with expected outcomes and equity guidelines.

As a set, they attempt to model optimal conditions for learning, and reflect the learner experience we hope to create.

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

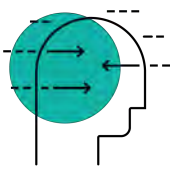
- the research that informs the principle
- why it matters in learning
- how we can apply it in practice

This portfolio is a starting point, initially built to serve a commercial digital learning context. It is designed to expand and grow.



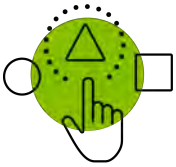
Welcoming experience

- Motivation & Mindset
- Social & Collaborative Learning



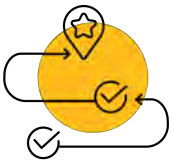
Minds in mind

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



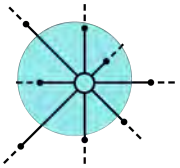
Learning behavior

- Self-Regulated Learning & Metacognition



Purposeful design

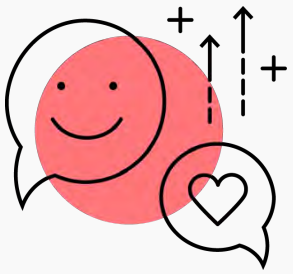
- Objective Design
- Assessment & Evidence-Centered Design
- Personalized Learning & Adaptive Systems
- Authentic Learning



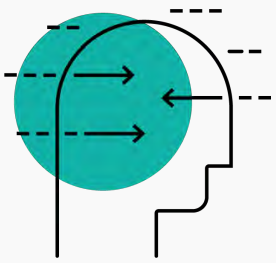
Learn Anywhere

Digitial Learning Principles
--> Digital & Virtual Learning
Discipline-Specific Guidance
--> English Performance Standards
Insights by Learner Segment

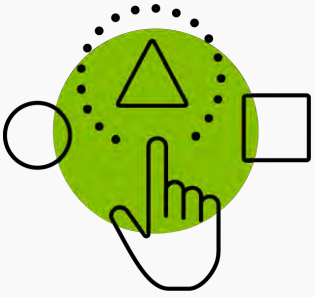
Learning happens best when...



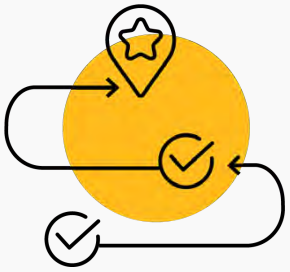
Learning is a welcoming experience



It's built for how minds learn

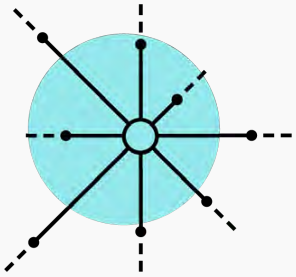


It supports good learning behavior



There is purposeful outcomes-focused design

Great learning can happen anywhere



Learners feel confident, positive, and encouraged.

They value the goal they're working towards.

Learners feel like they belong. They are included, connected, and collaborative in their learning network.

Learners are supported in learning and challenged by the content.

They have many opportunities for high quality practice.

They put in the effort it takes for deep learning that lasts.

Learners know what they know, what they don't, and have a toolkit of learning strategies that work for them.

Learners enact good learning behavior. When there's a gap between intention and action, we support them with tools for effective behavior change.

The learning environment is enabled for outcomes.

As the learner progresses, they are one step closer to achieving the outcomes that matter.

We can measure it. We can prove it.

The learning experience is optimized for how it will be delivered, the content, and the learner.



Learning is a welcoming experience

Learning is engaging, positive, and maybe even a little fun (even when it's hard)

Learners believe they can succeed and are motivated to achieve their goals

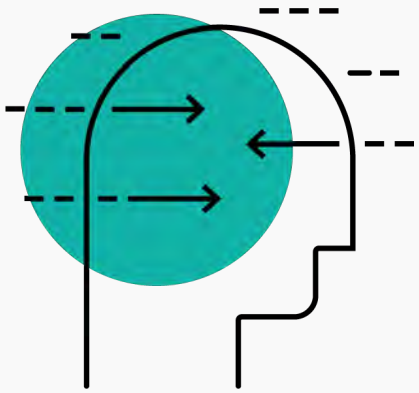
Learning is inclusive & social, and is best done with and alongside others

Motivation & Mindset

1. Sparking interest
2. Demonstrating value & relevance
3. Building confidence
4. Focusing on growth (mindset)
5. Fostering a sense of belonging
6. Offering autonomy

Social & Collaborative Learning

1. Our natural social tendencies
2. Learning by observing
3. Feelings of belonging
4. Ways of working together
5. Frameworks for collaboration
6. Teaching and learning with virtual others



It’s built for how minds learn

Learning happens best when minds are supported and challenged

Learners build on existing knowledge, learn through ample guided practice and build well-organized mental models

They actively make meaning and flexible connections in increasingly authentic settings

Learners build meaningful, connected, and at-the-ready “usable” knowledge.

Attention & Cognitive Load

1. Guiding attention
2. Minimizing distraction
3. Managing cognitive load
4. Engaging attention

Developing Understanding

1. Activate Prior Knowledge
2. Develop knowledge and skills
3. Deep and connected knowledge
4. Feedback and reflection

Desirable Difficulty & Scaffolding

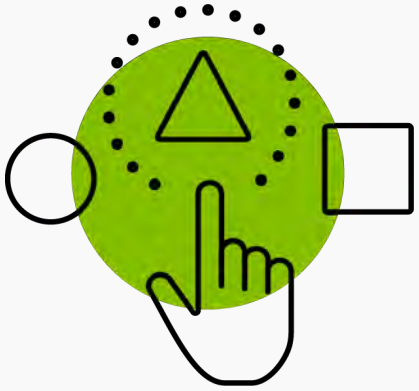
1. Desirable difficulty
2. Start with support
3. Fade out support
4. Exploratory problem-solving, sometimes

Active Learning, Memory & Practice

1. Deepen cognitive engagement
2. Tailor activities to knowledge types
3. Maximize memory
4. Strengthen sense-making

Feedback for Learning

1. Timely feedback
2. Non-threatening feedback
3. Information for learning
4. Feedback channels
5. Developing self-regulation



It supports good learner behavior

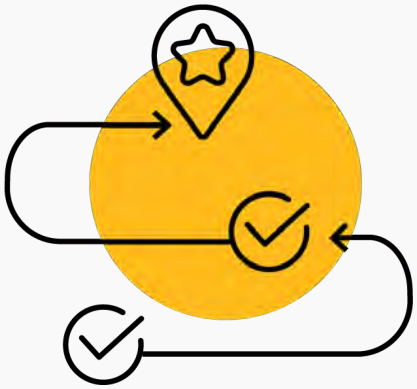
Good learners not only gain content knowledge, but they also take charge of their own learning and gain insights into their own learning process.

They are aware of what they know, what they don't, and what they need to do to get there

We support learners in making good decisions with their time to get the most out of their learning experience

Self-Regulated Learning & Metacognition

1. The self-regulated learning cycle
2. The forethought phase
3. The performance phase
4. The self-reflection phase



There is Purposeful Design

Instructional Alignment ensures a laser-focus on the right stuff

Learning objectives and purposeful instruction moves the learner forward on the outcomes that matter

Personalized learning helps achieve a meaningful real-world relevant goal

Objective Design

1. Supporting backwards design
2. Creating strong objectives
3. Two-level objective hierarchies
4. Guiding assessment and instruction
5. Setting expectations for learning

Functional Prerequisites for Efficacy-Infused Product Development

Assessment & Evidence-Centered Design

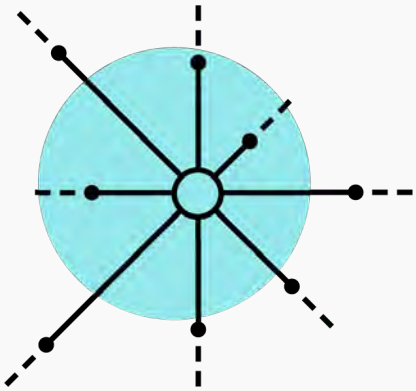
1. Design for purpose
2. Domain model
3. Learner model
4. Task model
5. Evidence model
6. Valid, reliable, and fair assessment

Personalized Learning & Adaptive Systems

1. Degrees of personalization
2. Knowledge and skills personalization
3. Interest personalization
4. Caution around learning styles
5. Research-supported personalization factors
6. Guided choice

Authentic Learning

1. Real-world relevance
2. Instruction before practice
3. Modeling
4. Authentic practice
5. Self-directed problem-solving
6. Stepping into the community



Great learning can happen anywhere

The learning experience is optimized for how it will be delivered, the content, and the learner

And we have guidance on how to make that happen in different contexts.

Digital & Virtual Learning

1. Audio
2. Video
3. Digital reading (ebooks)
4. Games & virtual worlds
5. Simulations
6. Mobile learning
7. Immersive learning

English Performance Standards

1. Standards as goals and measures
2. Standards as a starting point
3. Standards are probabilistic



Learning is a welcoming experience

Learning is engaging, positive, and maybe even a little fun (even when it's hard)

Learners believe they can succeed and are motivated to achieve their goals

Learning is inclusive & social, and is best done with and alongside others

Motivation & Mindset

1. Sparking interest
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Social & Collaborative Learning

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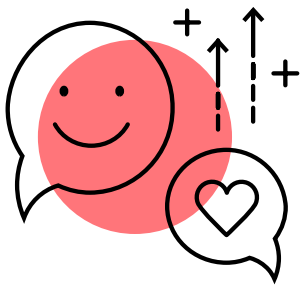
Learning Design Principles

Welcoming Experience

Motivation and Mindset



Summary

Motivation and Mindset

When learners don't believe that learning is worth the effort, or don't value the outcome they're working towards, they won't be motivated to persist and achieve their potential.

How can we help learners achieve the motivation and mindset needed for lifelong learning?

Motivation is the driving force that gives direction and purpose to behavior. It is the willingness to exert effort in pursuit of a goal or outcome.

There are several theories of motivation. Taken together, they can help explain the role motivation plays in directing behaviors, as well as the factors that influence learners' experience of motivation.

- **Expectancy-Value Theory** explains how motivation is impacted by expectations of success in a learning context and the perceived value of the task. It suggests interventions to increase learners' expectations of success, such as challenging and scaffolded tasks, and to increase the perceived value of the task by connecting learning goals to learners' interests, relevance and career goals.
- **Intrinsic motivation** refers to the drive to engage in an activity because it is interesting or enjoyable, while **extrinsic motivation** refers to engaging in an activity to earn a reward or avoid a punishment. While both types of motivation can drive engagement and persistence in tasks, effects on learning are especially robust when learners are intrinsically motivated.
- **Self-Determination Theory** emphasizes the importance of autonomy, competence, and relatedness in promoting motivation and engagement in learning, suggesting that when learners feel a sense of control and choice over the task, feel competent and capable, and feel a sense of belonging and relatedness to the task, they are more likely to be motivated and engaged in learning.
- **A growth mindset** is the belief that abilities can be developed through effort and hard work, and that challenges and mistakes are opportunities for growth and learning. This mindset is important for learning as it encourages learners to persevere through difficulties, take risks, and learn from mistakes, which can lead to better motivation and learning outcomes.

Why it matters

Motivation is critical for supporting engagement and positive learning outcomes. Learners self-reporting higher levels of motivation have been associated with a wide range of positive learning outcomes, including engagement, persistence, effort, learning, and retention.

Motivation can be influenced by various factors, and small changes in learning environments can have powerful impacts on learning outcomes. Understanding motivation can help educators create learning environments that encourage engagement and success for their students.

Impact

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

- learners enjoy what they are learning, because they have opportunities to exercise choice, work with peers, and connect learning to their personal interests
- learners perceive content as relevant to the real world because they are supported in articulating how they can use that knowledge outside of the learning environment
- learners are confident in their ability to learn because they are prompted to set specific, short-term goals
- learners exert appropriate effort and persist through difficulty, because they are provided with timely feedback that allows them to track their progress toward learning goals
- learners attain proficiency, because they are served appropriately challenging tasks



Motivation and Mindset

The big ideas

1

Interest sparked by elements of the learning experience can engage learners, but deeper **individual interests** motivate them to **apply effort and persevere**.

This is interesting, so I want to do more of it.

I get why I'm learning this and how I could use it.

2

Learners are motivated when they believe that their learning is **valuable and relevant** to them personally.

3

When learners **believe** they are competent and can achieve their goals, they usually do. Experiences of succeeding and achieving goals help **build confidence**.

The more I try, the more I learn, the more I grow.

4

Helping learners **focus on growth** and reaching their own goals **encourages persistence** and aids success.

I succeeded on the last task, so I think I'll succeed on this one.

I belong here, so I'm not going anywhere.

5

Learners are more **motivated** when they **feel connected** to others and to the learning environment.

6

Learners are more **motivated** when they have a sense of **autonomy**, but for learning to be effective, they need support with their choices.

I feel in control of what I'm learning.

Big Idea 1

Sparking interest

Interest sparked by elements of the learning experience can engage learners, but deeper individual interests motivate them to apply effort and persevere.

What it feels like for learners

This is interesting, so I want to do more of it.

When learners are interested in a topic, they are more likely to actively seek out and engage with the material, which can lead to deeper understanding and retention. They are more likely to persist despite difficulties, which can lead to greater mastery and achievement.

Interest can be pre-existing, or it can be sparked by the situation.

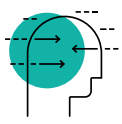
Sparked interest is initial, temporary interest that is triggered by a learning environment or experience. It is often dependent on external factors and may dissipate as the external factors change. It is often characterized by feelings of surprise, enjoyment, or curiosity, and can be thought of as a form of situational interest.

Existing interest, on the other hand, is interest that a person already has prior to a learning experience. It is often deeply rooted and personal, based on a person's values, goals, or previous experiences. It often leads to deeper engagement, persistence, and motivation in a task or subject.

If a learner is not already interested about a topic, their interest can be developed by sparking situational interest and nurturing it over time into sustained interest, by:

- connecting the learning material to the learner's personal interests and values
- facilitating collaborative work for peer interaction and the exchange of ideas
- offering opportunities for learners to explore and discover new information
- providing expert models to demonstrate relevance
- allowing learners to choose to re-engage with the topic by offering opportunities for choice and autonomy

Transitioning from situational to sustained interest is not a one-time event; it's a continuous process that requires ongoing support and scaffolding. Sustained interest is never guaranteed, and may vary depending on the learner's personal interests and background.



See this Learning Design Principle: Developing Understanding



See this Learning Design Principle: Personalized Learning and Adaptive Systems

What it means for designing learning experiences

- Spark situational interest with:
  - novelty
  - surprise or confusion (which triggers curiosity)
  - enjoyment
  - links to something they are already interested in
- Develop interest by transitioning from situational to individual interest, by:
  - frequent exposure to the situational interest topic
  - connecting to something personally meaningful, such as collaboration, or the learner's existing interests and values
  - displaying and modeling interest and involvement in the topic
  - enhancing positive feelings about the topic by connecting to relevance, competence, and self-concept
  - enhancing challenge, curiosity, and choice
- Personalize to existing individual interests
  - Provide content material and tasks that are personally meaningful and interesting to learners.

Big Idea 2

Demonstrating value and relevance

Learners are motivated when they believe that their learning is valuable and relevant to them personally.

What it feels like for learners

I get why I'm learning this and how I could use it.

Value and relevance are essential components of learning according to expectancy-value theory, and have been the focus of many studies. Demonstrating the value or relevance of learning to learners has strong effects on their engagement, achievement and persistence.

Value can be thought of as:

- utility value: how useful will this be in my life?
- attainment value: how important is it to do well on this?
- intrinsic value: how much do I enjoy this?
- cost: how much will doing this limit my access to other things?

Relevance can be thought of as:

- relevance to a learner's career (similar to utility value)
- relevance to the learner as a person (more like intrinsic value)

Interventions that aim to increase perceived value or relevance have produced robust effects on engagement, achievement, and persistence. Utility value interventions are particularly effective, as they highlight the usefulness of targeted content to the learner's future and career.

This is more effective when learners make these connections for themselves, rather than being told what is relevant or valuable by someone else.

Utility value can be supported by prompting learners to write about the relevance and usefulness of course material in their own lives, or even by providing testimonials about utility value.

These interventions are especially helpful for:

- learners with lower prior achievement
- learners with lower expectations of success
- learners from groups that are traditionally under-represented in higher education



See this Learning Design Principle: Authentic Learning

What it means for designing learning experiences

- Highlight the importance and usefulness (utility) of content and activities
  - Make relevance apparent.
  - Lessen the perceived cost of the learning activity.
- Build in opportunities for learners to see how their learning is useful and relevant
  - Reflect on the usefulness (utility) of what they're learning.
  - Generate their own ideas about how they might use it in the future.
- Provide personalized contexts around learning material to increase relevance and interest.

Big Idea 3

Building confidence

When learners believe they are competent and can achieve their goals, they usually do. Experiences of succeeding and achieving goals help build confidence.

What it feels like for learners

I succeeded on the last task, so I think I'll succeed on this one.

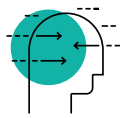
Self-efficacy is the belief in one's ability to successfully complete a specific task or goal. It is a strong predictor of persistence, achievement, and effort.

Confidence is sometimes used informally to describe general competence beliefs or task-specific self-efficacy.

Learners gain confidence (and motivation) when they experience success or believe they can succeed. Learning experiences can build learners' confidence in a few ways.

- **Goal setting**
  Set appropriately challenging, specific, short-term goals. When learners achieve their goals, they will experience success and gain evidence that they can succeed.
- **Mastery experiences**
  When a learner experiences succeeding or improving on a challenging task, they gain evidence that they have overcome a challenge. This makes them more confident that they can overcome the next challenge, too.
  - The most powerful way to build self-efficacy
  - More likely to occur if the task is appropriately challenging (i.e., in the learner's Zone of Proximal Development)
- **Watching peers succeed**
  If a learner does not have enough prior knowledge for a mastery experience, showing others like them succeeding is also helpful.
- **Verbal encouragement**
  Can be effective, but a learner's own experiences of success or failure are more powerful.
- **Reframing emotions**
  A learner's physiological responses to a learning environment, such as stress or anxiety before an exam, can influence their self-efficacy; techniques for emotional reframing designed to address these responses can reduce their impact.

High confidence and self-efficacy are helpful for learning, but are not enough on their own. Learners must also value what they are learning (see Big Idea 2) and feel like they belong (see Big Idea 5).



See this Learning Design Principle: Desirable Difficulty & Scaffolding



See this Learning Design Principle: Self-Regulated Learning & Metacognition

What it means for designing learning experiences

- Encourage setting achievable short-term goals, so learners have an opportunity to experience success
  - Set achievable goals.
  - Support learners towards goals.
  - Acknowledge and reflect on goal achievement.
- Provide experiences with success for the learner, aka mastery experiences
  - Provide appropriately challenging activities.
  - Support learning with clear guidance and feedback.
  - Provide opportunities to acknowledge and celebrate success.
- If a learner cannot experience success directly, provide alternative experiences to build their self-belief through:
  - peers
  - encouragement
  - emotional reframing

Big Idea 4

Focusing on growth (mindset)

Helping learners focus on growth and reaching their own goals encourages persistence and aids success.

What it feels like for learners

The more I try, the more I learn, the more I grow.

Goals

Learning is most effective when the learner's goal is to understand the content thoroughly. This is known as a mastery goal.

- The purpose of a **mastery goal** is to develop competence, gain skill, and do one's best.
  - associated with interest, optimism, self-regulation, and persistence
  - use better study strategies, deeper learning and transfer
- The purpose of a **performance goal** is to demonstrate one's superior competence by outperforming others.
  - predicts performance but can also be associated with anxiety
  - more shallow learning strategies

Mindsets

Mindset refers to the set of self-perceptions, attitudes, or beliefs that people hold about themselves, which influence the way they handle situations. When it comes to learning, there are two types of mindset.

Fixed mindset: the belief that talents are innate and unchangeable, that abilities in a domain are innate, and that you are either good at something or not.

A learner with a fixed mindset will avoid challenging activities and mastery goals.

Growth mindset: the belief that ability can be developed through hard work, good strategies, and input from others, and that abilities in a domain are the result of practice and effort. Research suggests that individuals with a growth mindset tend to have better motivation and learning outcomes.

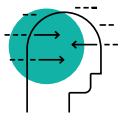
- supports achievement by influencing the learner's goals, strategies, beliefs, and attributions
- encourages learners to see challenges as opportunities for growth and learning, rather than as threats to their abilities
- promotes willingness to take risks, persevere through difficulties, and learn from mistakes

We can influence a learner's mindset and goals:

- indirectly, through the learning environment and how we structure tasks (structuring lessons around experimenting and building understanding, for example)
- directly, by teaching them about growth mindsets and fixed mindsets, and their effects on learning

Try saying:

- "Each new kind of problem you try grows your math brain"
- "You said 'I'm not a math person' — did you forget the 'yet'?"
- "That feeling that math is hard? That's your brain growing"



See these Learning Design Principles:
Desirable Difficulty & Scaffolding
Feedback for Learning

What it means for designing learning experiences

- Learning for understanding is the ultimate goal, and learning is a process of improvement
  - Experiences should focus on mastery, learning, and understanding course and lesson content.
  - Avoid focusing on performance or grades at the expense of true understanding.
  - Use task, reward, and evaluation structures that promote mastery, learning, effort, progress, and self-improvement standards more than social comparison or norm-referenced standards.
- Encourage a growth mindset, where learning can be accomplished with effort, and mistakes are learning opportunities
  - Frame challenges and incorrect answers as a part of the learning process and not indicators of the learner's ability.
  - Support the idea that one can achieve with enough effort. Intelligence and ability is not fixed.
- Provide feedback that reinforces improvement, growth, and effort, not ability

Big Idea 5

Fostering a sense of belonging

Learners are more motivated when they feel connected to others and to the learning environment.

What it feels like for learners

I belong here, so I'm not going anywhere.

Relatedness (learners' feelings of connection with teachers and peers) is a key component of motivation according to Self-Determination Theory.

Belonging is the degree to which learners feel connected to the people in their environment and that their contributions are valued and important.

Academic belonging includes:

- positive emotions toward the learning environment and one's role in it
- positive relations with peers and teachers
- the energy and willingness to get involved in the environment in a meaningful way
- an ability to adjust and adapt to situations or other people

Learners who feel like they belong believe more in their own competence. They engage, persist, and make more of an effort, and are more likely to stay in class. They have better mental wellbeing, and achieve better learning outcomes.

Multiple factors in a learning environment, including instructors, peers, and instructional activities, can influence learners' experiences of relatedness and belonging. Instructor support and positive personal characteristics have the biggest influence on belonging.

Learning environments can foster a sense of belonging by:

- making learners feel valued and supported
- offering autonomy (see Big Idea 6)
- fostering peer relations



See this Learning Design Principle: Social & Collaborative Learning

What it means for designing learning experiences

- Create a psychologically safe environment where all members feel a sense of belonging
  - Organizational and management structures should encourage personal and social responsibility and provide a safe, comfortable, and predictable environment.
  - Encourage inclusion and respect.
  - Ensure there is no stereotype threat.
- Foster a sense of relatedness and belonging among learners by:
  - making them feel valued and supported
  - offering opportunities for autonomy
  - fostering peer relations
- Support potentially marginalized learners through a focus on values and goals
  - Establish a sense of belonging by focusing the learners on their values and goals, thus reinforcing their sense that this learning and community is for them.

Big Idea 6

Offering autonomy

Learners are more motivated when they have a sense of autonomy, but for learning to be effective, they need support with their choices.

What it feels like for learners

I feel in control of what I'm learning.

Like belonging, autonomy is a core component of motivation. Choice leads to greater engagement, interest, perceived value, persistence, enjoyment, perceived competence, perceived autonomy, and learning outcomes. A sense of autonomy can increase motivation, but choices must be scaffolded to support effective learning.

Learners tend to feel like they have more autonomy when they are given:

- some choice over how or what they learn (often regardless of instructional relevance)
- A rationale for why they should do certain tasks

Offering autonomy to support motivation

- Choice is motivating when learners see the options as relevant, not too complex, and congruent with their interests and culture; and see themselves as capable of making the choice.
- Instructionally relevant choices need to be scaffolded, as learners are often not aware of their own learning progress or what will be most effective for them. Guidance or shared control can provide the support learners need to make productive choices.
- Choice can be a way to personalize content to learners' interests.
- Rationales are most effective when they present the value in terms of mastery, not performance, and do not appear controlling.



See this Learning Design Principle: Personalized Learning & Adaptive Systems

What it means for designing learning experiences

- Give learners interest-driven, instructionally irrelevant choices
  - Superficial, instructionally irrelevant choices can be sufficient to improve motivation.
  - Choice is an opportunity to link to learner interests and relevance.
  - Support autonomy and choice to align with interest and relevance.
- If giving learners instructionally relevant choices, provide support
- If no choice is given, offering a rationale can still help support autonomy

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Help all learners experience success by providing support on self-regulation strategies specific to the domain or task (e.g., 'Use the 5-step process to write an essay or solve an equation'). Structuring lessons around experimenting and building understanding can help build mastery and therefore motivation
- Learning environments or tasks, such as taking a test, can have barriers and/or induce stress that negatively impacts confidence. Include support for access and/or self-regulation to help reduce these stressors

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Set appropriately challenging and specific short-term goals that can be completed in manageable, chunked intervals. These actions can build a learner's motivation to learn and efficiently schedule learning around their daily life

Identity

The combination of dimensions that define who learners are to themselves and others

- Self-efficacy and motivation can be affected by learners' perceptions of past performance and stigma due to stereotypes. Create psychologically safe learning environments where all learners feel a sense of belonging
- Encourage development and content teams to include prompts that support the ideas that one can succeed with enough effort, and that intelligence and ability is not fixed

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Work with learning designers and engage with individuals from various cultural backgrounds to create and offer learners authentic, real-world scenarios and choices to elicit relevance, interest, and engagement
- Design learning components that provide variety and diversity to support motivation

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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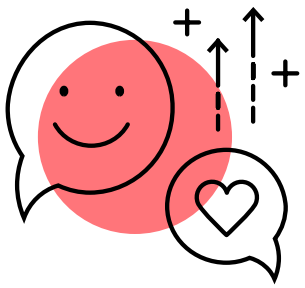
Learning Design Principles

Welcoming Experience

Social & Collaborative Learning



Summary

Social & Collaborative Learning

Human beings are naturally social. We're wired to respond to the people around us. How do we tap into these natural instincts to improve learner outcomes?

Social learning is when learning takes place in a social setting, and learners learn by observing other people in the setting. Social settings can be places, like classrooms, or digital environments. The nature of the environment, the composition of the group, and the requirements and complexity of the task can all affect learning.

Collaborative learning is when groups of about 2–6 learners intentionally work, negotiate, decide, and/or construct knowledge together to reach a complex common goal. This often requires well-structured goals and well-defined responsibilities to be effective. Collaborative learning naturally involves elements of social learning, so the two concepts are inextricably linked, and it's important to understand both.

Social learning can happen when learners are:

- observing others
- interacting with others
- learning directly from others
- teaching others

When interacting with others, learners have opportunities to co-construct, develop, stress-test, and deepen their knowledge.

Why it matters

- Social learning can increase feelings of belonging, motivation to learn, and engagement with the learning experience, all of which can support learning achievement.
- True collaborative learning leads to better learner outcomes than cooperative, competitive, or individualistic learning.
- Collaboration is inherent in nearly all professional work and most models of 21st-century skills feature collaboration as a key skill for workforce readiness. This means that being able to collaborate effectively sets learners up for career success.

Impact

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

- learners are motivated to learn because they are learning as part of a wider group
- learners experience a sense of belonging because group norms ensure everyone feels welcomed and included
- learners trust their peers because psychological safety is established within the group
- learners co-construct knowledge and learn through observation because interaction and peer modeling are encouraged
- learners are able to apply their knowledge because tasks are sufficiently challenging to require collaboration



Social & Collaborative Learning

The big ideas

1

Because humans are social animals, we naturally **pick up on social cues** and learn from others in social settings.

I am tuned into and enjoy being with others.

I can learn new things by watching others do it, then practicing it myself.

2

People can learn to do something by **watching others** and trying it out on their own.

3

When learners **feel they belong** in the learning environment, they are more motivated to learn.

I belong in this group, so this learning is for me.

I can learn things by collaborating that I might not manage alone.

4

There are lots of different ways to learn together. The **more collaborative** learning is, and the more learners can construct new knowledge together, **the better**.

I have guidance on how to best work with other people.

5

Explicitly agreeing **ways of working** together up front leads to better collaborative learning.

6

Many of the benefits of social learning can still take place when the **other participants are virtual**, rather than human.

Learning from a virtual person still feels natural.

Big Idea 1

Our natural social tendencies

Because humans are social animals, we naturally pick up on social cues and learn from others in social settings.

What it feels like for learners

I am tuned into and enjoy being with others.

- **Humans typically enjoy social interaction**
  We are naturally alert and sensitive to social information, the majority of which is communicated non-verbally. It makes sense for learning experiences to work with, rather than against, learners' natural social tendencies.
- **Humans automatically learn from watching others**
  Learning from watching others is effective in in-person observational learning; may be impaired in remote learning, where learners may have reduced access to other people's facial expressions or gestures; and does not work as well in asynchronous learning.
- **Humans automatically match their attention to others**
  Children and caregivers match their attention automatically. This "joint attention" is important for language learning and social cognition development. Social attention cueing helps learners focus on the most important parts of the environment and also helps build rapport.
- **People are inherently curious and enjoy learning**
  This natural motivation can be affected by feelings of autonomy, competence, and relatedness. A social learning environment can help or hinder feelings of relatedness, increasing or decreasing learners' natural motivation — which then affects learning.

What it means for designing learning experiences

- Offer opportunities for social interaction when appropriate to increase engagement
  - Evaluate the potential positive benefits of social interaction carefully in terms of the objectives before incorporating social learning elements.
- Make nonverbal cues (e.g., facial expressions, gestures) accessible during online learning whenever possible
- Present clarity around how social interaction is being used in the learning experience
- Increase feelings of relatedness by offering opportunities for empathy and for emotional peer support
- Be mindful of social learning of undesired behaviors

Big Idea 2

Learning by observing

People can learn to do something by watching others and trying it out on their own.

What it feels like for learners

I can learn new things by watching others do it, then practicing it myself.

Social learning occurs through watching, trying, seeing how others react, and learning. People can learn socially from many sources.

- **People can learn by observing good examples, or models**
  A model can be a live demonstration, direct visual or verbal instruction, or a symbolic model — such as a movie, story, TV program, social media content, or an example of how someone else solved a problem. Learning from models is more efficient than trial and error.
- Learning by observing involves 3 phases:
  - **Watch:** Learners observe the model and pay attention to the relationship between the model's actions and the outcome
  - **Try:** Learners emulate the model's behaviors and compare themselves to peers when possible
  - **Learn:** Learners reflect on their performance through self-observation (becoming aware of their own behavior), self-judgement (assessing their performance against goals or standards) and self-reaction (responding to their assessment by changing their thinking or behavior). Learners can make it their own by adapting their behavior and going beyond emulating what they initially observed

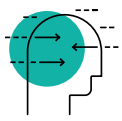
We are strategic and rational about **who** we observe and emulate in order to learn, and **when**.

Who we imitate:

- the majority
- people with a track record of success
- people we see as being like us

When we imitate:

- when we've attempted the behavior ourselves without success
- when learning it on your own would be too hard
- when we feel uncertain



See this Learning Design Principle:
Attention & Cognitive Load

What it means for designing learning experiences

- Draw learners' attention to key features of a learning situation or behavior
- Give direct instruction to support learning of more complex behaviors
- Foster transferable learning by encouraging emulation (goal-directed imitation) rather than blind imitation of a model's actions
- Offer low-stakes environments for learners to try out new behaviors and make (and learn from) errors, and opportunities for learners to recall what they have learned
- Encourage individuals to compare their performance to the model, and consider how they might improve
- Leverage peer feedback, particularly when there are limited instructional resources and there are clear goals and guidelines for feedback
- Provide models that learners are likely to emulate
- Provide models when learners are likely to look to them

Big Idea 3

Feelings of belonging

When learners feel they belong in the learning environment, they are more motivated to learn.

What it feels like for learners

I belong in this group, so this learning is for me.

The benefits of collaborative learning are heightened when members of the group feel they **belong** and are **psychologically safe** together.

Belonging is the degree to which learners feel connected to the people in the learning environment that their contributions are valued and important. It is the feeling that you fit in and are accepted, needed, and are a part of the group. Humans need to feel like they belong.

In education, belonging is related to achievement. This may be especially important for under-represented learners, and at transitional times like the first year of college.

Psychological safety is when a group of individuals share the belief that it is safe to take interpersonal risks. A psychologically safe learning experience leads to learners:

- respecting each other's knowledge and skills
- being respected for being themselves and saying what they think
- having positive intentions in interpersonal interactions
- engaging in constructive conflict
- feeling comfortable taking risks
- focusing on the group's collective goals rather than on their own protection

Intentionally formed **learning communities** can foster a sense of belonging and provide a rich environment for social learning.

A **learning community** is an environment where learners work together as active agents in their own learning, co-constructing knowledge and supporting one another. Compared to traditional, didactic learning environments, learning communities foster stronger feelings of belonging.

A **community of practice** is a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way. Communities of practice promote learning by providing models for new members to emulate, and an evolving body of social and academic knowledge.



See this Learning Design Principle: Motivation & Mindset

What it means for designing learning experiences

- Foster feelings of belonging in learning experiences, especially when learners are in a time of transition
  - Design experiences to support coordination among individuals in achieving a group goal.
  - Design experiences that provide expectations and diversification of both roles and responsibilities.
- Foster psychological safety through:
  - supportive leadership behaviors, supportive organizational practice, and shared team rewards and collective responsibility
  - inclusion and participation of all learners such as underrepresented, neurodiverse, shy or socially anxious students, or those learning in a non-native language
- Intentionally structure groups or communities to support belonging and social learning
- Support potentially marginalized learners through a focus on values and goals
  - Establish a sense of belonging by focusing the learners on their values and goals, thus reinforcing their sense that this learning and community is for them.

Big Idea 4

Ways of learning together

There are lots of different ways to learn together. The more collaborative learning is, and the more learners can construct new knowledge together, the better.

What it feels like for learners

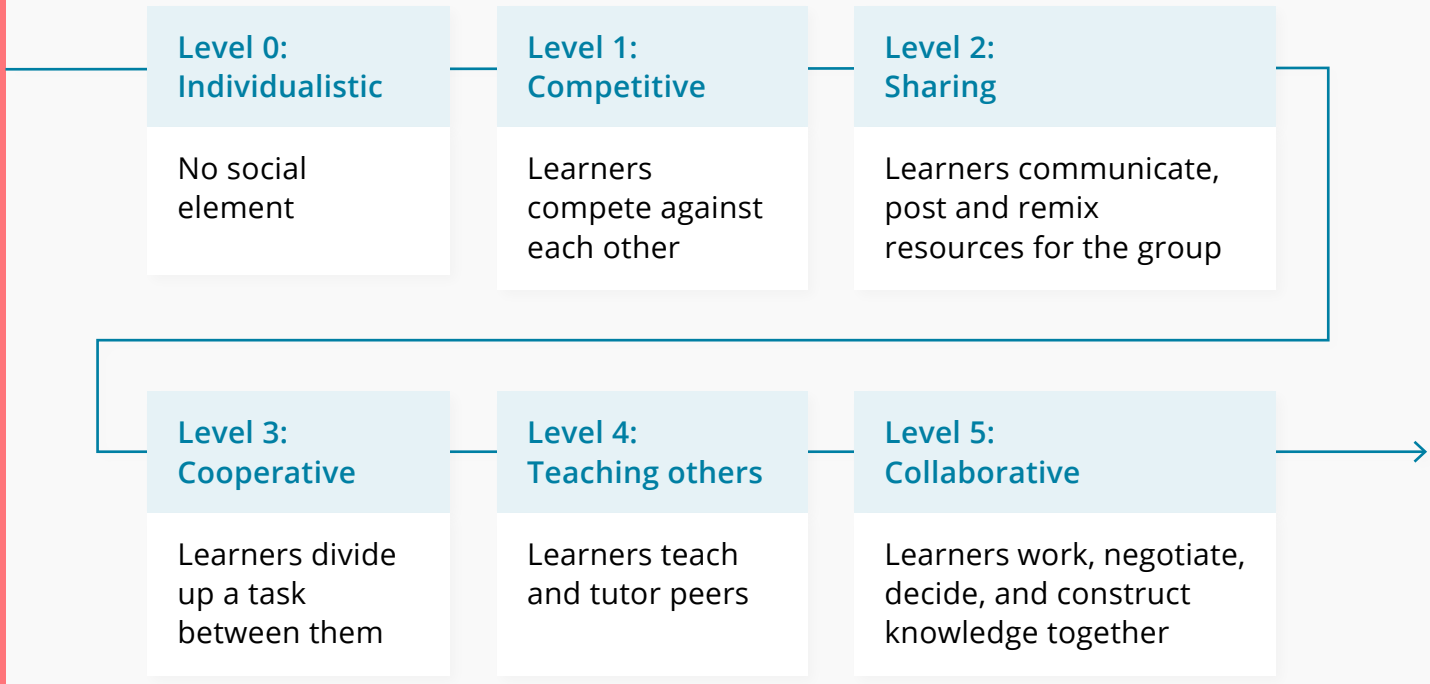
I can learn things by collaborating that I might not manage alone.

Collaborative learning incorporates more knowledge-building and positive interdependence than any other way of learning together. It also offers social, motivational, and cognitive learning benefits.

The more a learning experience encourages knowledge-building (co-generating new ideas together that no individual member could come up with on their own) and has positive interdependence (where a learner can only succeed when the group succeeds), the better its impact on learning.

Collaborative learning is most effective when **small groups (about 2-6)** of learners with **different characteristics** work together **mutually** and **equitably** to complete a **complex task**.

Though it leads to strong learning outcomes, collaborative learning is not the right format for every situation.



Ways of learning together

- **Individualistic learning:** learning independently, with no social interactions
  - Tends to be the default learning mode, particularly in Western cultures. It can be appropriate for many learning tasks.
  - It is useful to contrast this against other modes to determine what's appropriate.
- **Competitive learning:** when learners compete against each other
  - Characterized by **competition between peers** and negative interdependence.
  - Can be fun, interesting, engaging, and enjoyable — but tends to have less of a positive impact than collaborative learning.
- **Sharing:** when learners communicate, post resources for each other, and/or remix ideas
  - Can improve engagement, confidence, and critical thinking.
  - However, learners do not work together to build new knowledge or understanding at this level.
- **Cooperative learning:** when learners divide up a task and each work on their section independently
  - Many "group work" tasks in both the classroom and the workplace use this structure.
  - Lacks a complex synthesis task that requires learners to bring and build ideas together.
- **Teaching others:** when learners teach and tutor other learners
  - This is **not** collaborative learning, but it can still powerfully boost learning
  - Many of the benefits of social learning still apply when a learner prepares to teach another, even when they do not go on to actually teach them.
- **Collaborative learning:** when groups of about 2-6 learners intentionally work, negotiate, decide, and/or construct knowledge together to reach a complex common goal
  - Group members should be alike in terms of status and knowledge and engage in an even exchange of ideas.
  - Tasks should be complex, too difficult for any individual to complete by themselves, and collaboration must be a key part of achieving the objective.

Collaborative learning is most effective when there is:

- **positive interdependence:** when each member of the group believes they can only achieve their own goals if the other members achieve theirs as well
- **promotive interaction:** when members of the group encourage success in each other, such as by offering assistance or praise
- **individual accountability:** when group members are judged for their individual contributions as well as for the group's overall outcome
- **social skill:** such as communication, conflict management, establishing common ground, and building trust
- **group processing:** when members reflect on how the group is working together and whether to change their behavior or strategies

What it means for designing learning experiences

- Collaboration should be central to the learning outcome: for example, learners will successfully develop collaboration skills aligned to organizational goals through the learning experience
- Keep in mind, an individual task "made bigger" is not a well-structured collaborative learning activity
- Provide complex tasks where it is too difficult for any individual to complete by themselves, but possible to achieve by collaborating with capable peers
- Encourage knowledge-building over knowledge-telling
- Design experiences to include individual and group reflection
- Design experiences to promote group discussion
- Promote collaborative group efforts by basing rewards on the individual learning of all the members

Big Idea 5

Frameworks for collaboration

Explicitly agreeing ways of working together up front leads to better collaborative learning.

What it feels like for learners

I have guidance on how to best work with other people.

Sometimes, when learners want to maintain their status and be seen positively, and there is a lack of individual accountability, collaborative learning groups can experience:

- **dominating:** one member takes over and demands to do all the work themselves
- **free-riding:** one or more members stop contributing and leave others to pick up the slack
- **social loafing:** working together harms learning and productivity instead of improving it, and the quality of the group's work is lower than the members could achieve alone

Simply engaging in collaborative learning does not necessarily build collaboration skills. Instead, collaboration skills must be explicitly highlighted, taught, and assessed.

Collaboration skills are a combination of:

- **interpersonal skills:** conflict resolution, collaborative problem-solving, communication
- **self-management skills:** goal-setting and performance management, planning and task coordination
- **Clear expectations**
  Groups of learners will work better together, and engage less in destructive behaviors, if there are clear expectations around communication, member responsibilities, and the task itself from the start of the learning experience. Expectations can be set by an instructor or decided among the group.
- **Challenging tasks**
  The task must be challenging enough that collaboration is essential to completing it. The group members might not be motivated to work together if this is not the case.

  Groups must understand what standard their work will be held to. This could take the form of a rubric or a model assignment.
- **Group learning & metacognition**
  Group metacognition is a group's collective awareness of their progress, which allows them to optimize the way they work and achieve a good outcome.



See this Learning Design Principle: Self-Regulated Learning & Metacognition

What it means for designing learning experiences

- Determine whether the learning experience should teach collaboration skills or simply use collaboration as a tool
  - If teaching collaboration skills, highlight those skills as they appear in the tasks, and provide resources for improving those skills if necessary.
  - Include assessments of collaboration skills as part of the individual or group assessment.
- Foster psychological safety, feelings of belonging, and group cohesion to encourage mutually beneficial interactions between group members and honest communication
- Develop unique group roles centered on group processes, not specific sections of the project
- Offer opportunities for group reflection
- When providing feedback, offer individual feedback privately, and offer an opportunity for the group to respond to group feedback
- Avoid pitfalls of collaboration by:
  - fostering individual accountability as well as group accountability
  - setting clear expectations around communication, member responsibilities, and the task itself from the start of the learning experience
  - encouraging group metacognition, such as group problem-solving, or collectively evaluate the quality of the group's collaboration

Big Idea 6

Teaching and learning with virtual others

Many of the benefits of social learning can still take place when the other participants are virtual, rather than human.

What it feels like for learners

Learning from a virtual person still feels natural.

Like computer game characters, pedagogical agents use human-like gestures, natural language, and facial expressions to interact. This means they can activate many of the same benefits of social learning with humans. People tend to interact with and respond to digital and virtual characters in much the same way as we do with other people.

Agents can act as instructors, as conversation partners, or as less knowledgeable figures who need teaching (known as **teachable agents**).

Learning from a virtual other

Pedagogical agents are anthropomorphic virtual characters that serve various instructional goals in online learning environments.

Pedagogical agents can support learning by:

- individualizing instruction and offering personalized feedback
- serving as models for observational learning
- making learners feel like they belong and are welcome, by offering empathy and providing a supportive relationship
- providing non-verbal cues and gestures
- making learning fun, increasing motivation

Simply adding a virtual character to online learning is not enough to improve learner outcomes. The agent's behavior also needs to be grounded in good pedagogy.

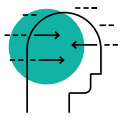
Teaching a virtual other

Teachable agents are a specific kind of pedagogical agent that can reason based on knowledge taught to them by learners.

- Since teachable agents act as a less knowledgeable partner, interacting with teachable agents can create the same learning benefits as teaching another person.
- The agent's reasoning helps the learner assess whether the knowledge they conveyed to the agent was accurate or complete.



See this Learning Design Principle:
Digital & Virtual Learning



See this Learning Design Principle:
Feedback for Learning

What it means for designing learning experiences

For a pedagogical agent to be effective:

- use the same instructional principles you would for a human instructor
- utilize naturalistic gesture, facial expression and eye gaze
- use a conversational speech style
- while agents do not have to be exactly human-like, avoid a distracting uncanny valley response
- consider modeling the agent to be similar to your learner (e.g. gender, age, ethnicity)

For a teachable agent to be effective:

- the visual representation of the agent's knowledge, which learners manipulate to teach the agent, should be clear and well structured
- the agent should be able to act independently of the learner's direct instructions
- the agent should model good learning behaviors for the learner to emulate
- resources for building the learner's own knowledge should be available within the same learning environment as the agent

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Make nonverbal cues (e.g., facial expressions, gestures) accessible during online learning whenever possible. Support learners who may not be as attuned to non-verbal social cues through direct instruction, norm-setting, and inclusive practices
- Consider that learners have varying levels of executive functions, such as those who are neurodiverse, shy or socially anxious, etc. Foster psychological safety for these learners to promote effective learning

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Consider that learners have varied levels of access to test sites, technology, and bandwidth. Provide a variety of methods to take part in social learning opportunities

Identity

The combination of dimensions that define who learners are to themselves and others

- Encourage content teams to include subject-matter and content design experts of diverse backgrounds to ensure the inclusion of meaningful models related to identity (especially historically marginalized identities) to increase relevance for emulating
- Foster feelings of belonging via learning experiences that support coordination among individuals in achieving a group goal

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Include opportunities for learners from different backgrounds to work together towards a shared goal. This can improve relationships between learners who belong to majority groups and those who belong to under-represented minorities
- Collaboration skills may differ among cultures. Account for these differences by creating guides and highlighting where and when these skills can be put to use to foster these behaviors among students with different collaborative skills

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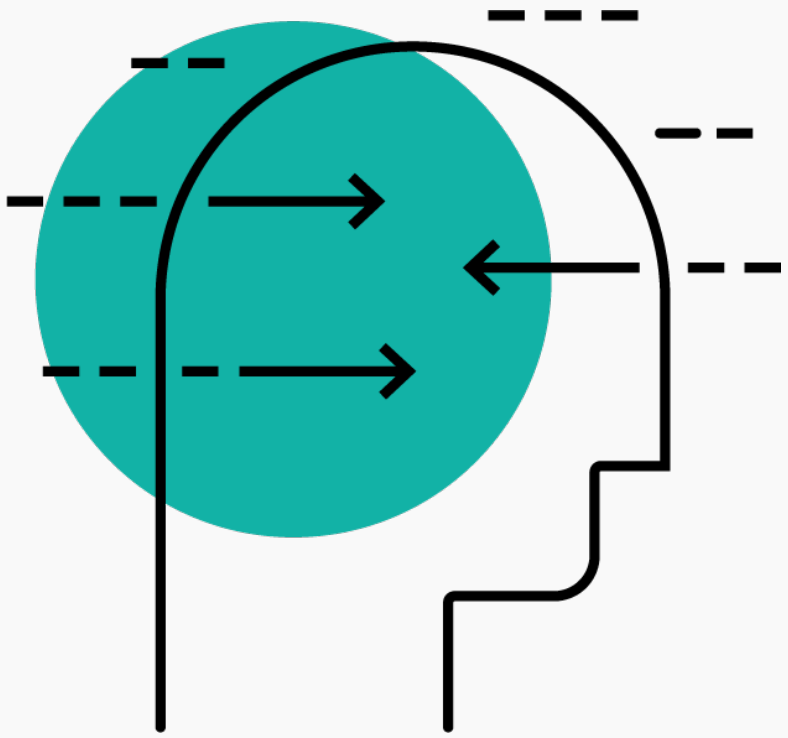


It’s built for how minds learn

Learning happens best when minds are supported and challenged

Learners build on existing knowledge, learn through ample guided practice and build well-organized mental models

They actively make meaning and flexible connections in increasingly authentic settings

Learners build meaningful, connected, and at-the-ready “usable” knowledge.

Attention & Cognitive Load

1. Guiding attention
2. Minimizing distraction
3. Managing cognitive load
4. Engaging attention

Developing Understanding

1. Activate Prior Knowledge
2. Develop knowledge and skills
3. Deep and connected knowledge
4. Feedback and reflection

Desirable Difficulty & Scaffolding

1. Desirable difficulty
2. Start with support
3. Fade out support
4. Exploratory problem-solving, sometimes

Active Learning, Memory & Practice

1. Deepen cognitive engagement
2. Tailor activities to knowledge types
3. Maximize memory
4. Strengthen sense-making

Feedback for Learning

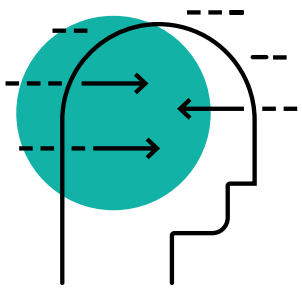
1. Timely feedback
2. Non-threatening feedback
3. Information for learning
4. Feedback channels
5. Developing self-regulation



Learning Design Principles

Minds in Mind

Attention & Cognitive Load



Summary

Attention & Cognitive Load

Learners struggle to stay engaged and focused while learning. How can we help learners avoid distraction and focus their attention on the things that matter?

Attention is a selective filter that allows sensory information from the environment to enter working memory. Attention selects information based on characteristics like how important, interesting, or new it is.

Cognitive Load is the amount of working memory ("brain power") needed to accomplish a task. Some of the functions are good for learning, and some can detract from learning.

Example: A math word problem

Tommy went to a farmers' market. He bought three red apples and four green apples. He also bought two pears and three oranges. How many apples did Tommy bring home?

- **Intrinsic load** is needed to handle the task itself, i.e., add 3 + 4
- **Extraneous load** is needed to understand everything around the task, e.g., Tommy's name, the color of the apples, distractions like the learner being hungry for lunch
- **Germane load** is needed to build understanding and solidify learning: making connections, integrating prior knowledge with new intrinsic information, filtering extraneous information

Why it matters

Good learning design can help learners pay attention to the right things by decreasing distractions and encouraging good learning practices.

- Being a good multitasker is a common misconception
- Learners need help pulling out the useful content when learning something new
- Learners can be trained to use attention wisely

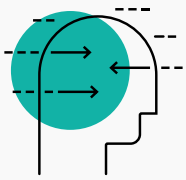
Categorizing the types of cognitive load is important for designing learning experiences, because some support learning and others get in the way. When we understand the principles of cognitive load, we can:

- identify and reduce extraneous information that may use up cognitive resources
- determine how design elements may compound and interact in the learning environment
- enhance germane cognitive load to better integrate new information into existing schemas

Impact

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

- learners are interested and motivated because their attention has been engaged appropriately by relevant content
- learners persist in their learning because they engage in manageable blocks of focused study
- learners are proficient and can transfer their learning to new contexts because the experience is focused on efficient learning experiences without unnecessary distraction



Attention & Cognitive Load

The big ideas

1

Attention can be **guided towards the important information** using design layout and formatting.

I know what I should be paying attention to.

I can concentrate on the task and what I'm learning without any distractions.

2

Distractions can pull attention away from learning. Distractions in the learning content, the environment and in our own thinking influence what we attend to and take up processing power.

3

A learner can only pay attention to a **limited amount of information** at a time, and only for so long.

I can only handle so much learning at once, and only for so long.

4

The **way information is presented** can capture a learner's attention, but can also create distractions.

This looks interesting, and I know what I'm being asked to do.

Big Idea 1

Guiding attention

Attention can be guided towards the important information using design layout and formatting.

What it feels like for learners

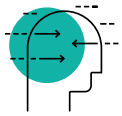
I know what I should be paying attention to.

Learners need to pay attention to learning content to gain understanding, but their attention is constantly taking in information within the environment. Because working memory has limited capacity, information is better understood when broken up into segments. This limitation also means we need to guide attention towards the important parts of the learning environment.

- Break up and chunk information
  - Working memory can store five to seven items of information at once
  - Break up information into smaller sections to guide attention through a lesson
- Use unique features to draw attention
  - Attention acts like a spotlight that scans the environment for information
  - Use formatting, like headers or words in bold, to guide attention towards key ideas
  - Use images to signal information around key ideas, and to support reading or listening to text-based information
- Prime attention by giving clear objectives
  - Connecting new information to prior knowledge requires germane cognitive load
  - Present specific objectives at the beginning of a lesson
  - Pre-train the main concepts and definitions
  - Once smaller concepts are learned, working memory can relate new complex concepts using this pre-trained knowledge



See this Learning Design Principle: Objective Design



See this Learning Design Principle: Desirable Difficulty & Scaffolding

What it means for designing learning experiences

- Present content so that it guides attention towards important information
  - Present content in user-paced segments rather than a continuous unit.
  - Chunk information to represent meaningful elements of the lesson.
- Guide attention towards important elements through presentation
  - **Provide cues** that signal how essential material is organized.
- Start the lesson with the right information
  - Connect to learning objectives to draw out relevance.
  - **Pre-train learners** to direct their attention towards the important information.



See this Learning Design Principle:
Objective Design

See these Multimedia Principles from Mayer (2020):

- **Signaling:** highlight essential words or graphics
- **Spatial contiguity:** place essential words next to corresponding graphics on the screen
- **Segmenting:** present multimedia lessons in user-paced segments

Big Idea 2

Minimizing distractions

Distractions can pull attention away from learning. Distractions in the learning content, the learning environment, and the learner themselves influence what learners attend to and take up processing power.

What it feels like for learners

I can concentrate on the task and what I'm learning without any distractions.

- **Distractions in the learning content**
  Information should be concise and purposeful. Unnecessary content in a lesson requires extraneous cognitive load. Decreasing extraneous load in the lesson means learners' attention can be focused on the important information.

  When a learner's attention is pulled in multiple directions by different streams of information, it requires effort to switch from one to another. The more complex or different each stream is, the more processing power is needed for germane cognitive load. Synchronizing the streams of information and reducing unnecessary content reduces extraneous cognitive load.

- **Distractions in the learning environment**
  Learning happens best when the learner doesn't need to multitask and isn't disrupted by distractions.

  Some learners believe that with practice, they can learn to multitask, e.g., by learning while a TV show plays or a conversation happens in the background. But this is not a skill that can be improved over time; it is a distraction that adds to cognitive load. To improve learning, learners need support to remove or avoid such distractions.

- **Distractions in the learner themselves**
  Attention operates most efficiently when the learner's physiological and psychological needs are met. For example, positive emotions and lower anxiety relate to better learning performance, whereas negative emotions and higher stress increase cognitive load.

What it means for designing learning experiences

- Organize content to avoid distractions
  - **Remove unnecessary information** that doesn't align with the objectives.
  - If possible, **avoid superfluous information** by replacing text with images.
- Recognize that distractions in the learning environment may influence attention
  - Explain to learners that **multitasking** can make performance suffer.
- Because learners may experience internal distractions, monitor and assess attention during learning
  - **Check in** with learners to assess whether basic needs are being met.
  - Carry out **comprehension check-ins** during the learning session.
  - Integrate **practice at spaced intervals** throughout the lesson to engage attention and decrease stress.

See these Multimedia Principles from Mayer (2020):

- **Coherence**: exclude extraneous material
- **Redundancy**: don't combine more modalities than needed
- **Image:** only put the speaker's image on the screenif there's a clear benefit

Big Idea 3

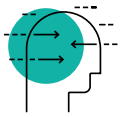
Managing cognitive load

A learner can only pay attention to a limited amount of information at a time, and only for so long.

What it feels like for learners

I can only handle so much learning at once, and only for so long.

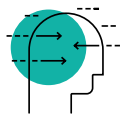
- **Working memory has limited capacity when learning new information**
  Scaffolding and sequencing new information (presenting it piece by piece) reduces the germane load needed to connect it to existing knowledge.
- **When processing power is used up, learners experience cognitive fatigue, which makes it more difficult to concentrate and easier to become distracted**
  Attention and processing power are restored by taking breaks. Spacing learning across multiple sessions depletes working memory less and improves memory retention.
- **When starting a new complex problem, learners need guidance about where to turn their attention first**
  Worked examples (step-by-step solutions to a task) guide attention towards the problem and the steps needed to reach a solution. Many different worked examples are needed for a learner to piece out the key themes. As the learner becomes familiar with the elements of the problem, similar problems can be integrated, and guidance can be faded out.



See this Learning Design Principle: Desirable Difficulty & Scaffolding

What it means for designing learning experiences

- Break up content to make sure attention is focused during the learning experience
  - **Scaffold** the learning content to guide attention and connect to prior knowledge.
  - **Isolate elements** of a problem until the learner can master each task.
- Monitor attention throughout the learning experience
  - Encourage **spaced practice** to optimize attention during learning.
  - Introduce **check-ins** during learning to encourage engagement.
- Reduce the complexity of the learning content
  - Use **guidance-fading** to guide attention towards key ideas.
  - Present **worked examples** to reveal parts of new concepts step-by-step.



See this Learning Design Principle:
Desirable Difficulty & Scaffolding

See these Multimedia Principles from Mayer (2020):

- **Pre-training:** teach the main concepts before beginning multimedia lessons

Big Idea 4

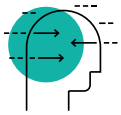
Engaging attention

The way information is presented can engage a learner's attention, but can also create distractions.

What it feels like for learners

This looks interesting, and I know what I'm being asked to do.

- **Learners' attention is engaged when they are actively learning**
  Engaging learners' attention by asking them to map, enact, draw, imagine, and explain can promote efficient and active learning patterns known as generative learning. (Active learning is often contrasted with passive learning, such as reading from a text or watching a video — it does not mean active as in physically moving around.)
- **Using informal, realistic human language during learning can improve outcomes**
  A conversational style of written information is associated with more active cognitive processing, and small changes like changing "the" to "your" result in better transfer.
- **Interactive materials can be engaging if used well**
  The most interactive, immersive experiences tend to be the most enjoyable and motivating — but also require the most processing power, potentially distracting from learning. Visualizations can aid working memory by guiding attention towards key ideas, and instructional guidance can minimize the cognitive load needed to construct the necessary frameworks to make use of a visualization.



See these Learning Design Principles:
Desirable Difficulty & Scaffolding
Active Learning, Memory & Practice



See this Learning Design Principle:
Digital & Virtual Learning

What it means for designing learning experiences

- Include learners in the learning experience
- Present learning content in a personalized way
- Be cautious when integrating immersive elements to improve engagement



See this Learning Design Principle:
Motivation & Mindset

See these Multimedia Principles from Mayer (2020):

- **Modality:** supplement graphics with narration, rather than on-screen captions
- **Generative learning:** provide opportunities to actively generate ideas
- **Multimedia:** use a combination of words and pictures, rather than pictures alone
- **Personalization:** use conversational rather than formal wording
- **Voice:** provide narration in a human voice, rather than a machine voice
- **Embodiment:** onscreen instructors should display a high level of embodiment
- **Immersion:** virtual reality is not necessarily better for learning than onscreen media

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Implement supports or other methods for learning, whenever possible, to reduce extraneous working memory and cognitive load constraints and support relevant learning processes.
- Include opportunities for learners to reflect on information to determine if they understand or need to revisit certain content.
- Utilize multimodal presentations of information to enhance encoding and learning by opening several ways to access the information (e.g., audio narration for text and vice-versa, etc.).

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Work with relevant user experience teams to include detailed but concise and clear information on how to use and navigate learning experiences.
- Add more detail to learning experiences through various digital tools (e.g., tooltip icons, hint buttons, "read more" buttons, etc.) that provide learners with the choice to engage with extra support content or not. Extra support content is meant to fill in gaps with background knowledge and prior experience with the target subject matter.

Identity

The combination of dimensions that define who learners are to themselves and others

- Make sure content is reflective of all learners and does not include material that could be deemed offensive. Engage with diverse communities and subject-matter experts to review and create content.

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Different cultures may pay attention in different ways. Balance what is available in terms of ways to engage, amount of time required, whether a narrow focus or broad overview is needed so that one single culture is not reflected in the approach.
- Make sure content is reflective of all learners and does not include material that could be deemed offensive. Cognitive load should be focused on learning.

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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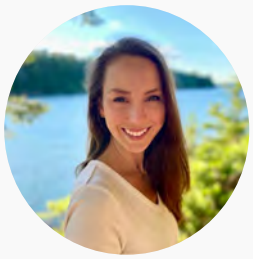

Rachel Hopman-Droste, Ph.D.

Rachel Hopman-Droste is a researcher in the Learning Research & Design team at Pearson. Rachel earned her Ph.D. in Cognitive Psychology from the University of Utah and has spent the last 10 years translating research findings related to mental processes into real world insights.



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.

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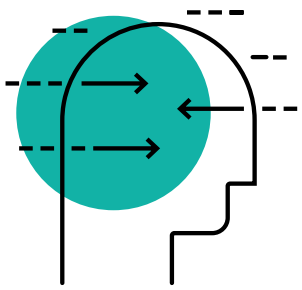
Learning Design Principles

Minds in Mind

Developing Understanding



Summary

Developing Understanding

Learners have trouble taking what they've learned and using it in the flexible, back-and-forth way that real life usually demands.

How can we make sure learners gain meaningful knowledge they can use flexibly to solve real-world challenges?

True learning happens when learners build meaningful, connected, at-the-ready, 'usable' knowledge. To do this, learners need to actively construct an accurate mental model, practice and refine it, and weave it meaningfully into the tapestry of their mind. This is what we mean by **developing understanding**.

Why it matters

Instruction that does not have thoughtful learning design can lead to disconnected knowledge, where learners can only reproduce what they've learned by rote. They don't know when to apply it in the next situation or in slightly different contexts, including situations where it is potentially applicable.

This lack of transfer from in-school to out-of school settings is a serious problem for traditional instructional approaches.

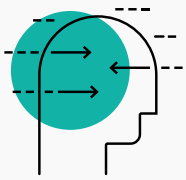
This is a distillation of the core learning process that all learners must think through in an end-to-end learning experience for robust and high-quality learning outcomes.

Introduce new content & build on prior knowledge	Develop knowledge & skills	Deepen & connect
Feedback and reflection		

Impact

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

- learners are interested and motivated by what they are learning, because the experience prompts them to connect it to what they already know
- learners persist because the experience provides opportunities for practice and timely feedback
- learners become proficient and can transfer their knowledge to new contexts, because the experience supports them to attain deep and flexible conceptual understanding
- learners apply their knowledge to real-world tasks and engage in self-directed learning, because they have had the chance to reflect on their learning



Developing Understanding

The big ideas

1

New information is best learned, remembered, and integrated in a learner's mind when it is **connected to information they already know**.

Ah ha! This is like something I already know.

2

Skills and knowledge must be practiced to **build 'muscle memory'** and take on more complex tasks.

I'm practicing, and getting faster and better.

3

Knowledge can be flexibly applied if a learner's knowledge is **deeply organized and connected**, and the learner understands the underlying concepts and can recognize when to apply what they've learned.

I'm deepening what I know. And I can make connections. I can apply what I'm learning.

4

Learners develop their understanding through **checking** their performance and **reflecting** on how they might improve. Feedback and reflection help learning stick.

I get feedback on what I'm learning and I take time to think about it. It helps me remember and makes the knowledge stay with me.

Big Idea 1

Activate prior knowledge

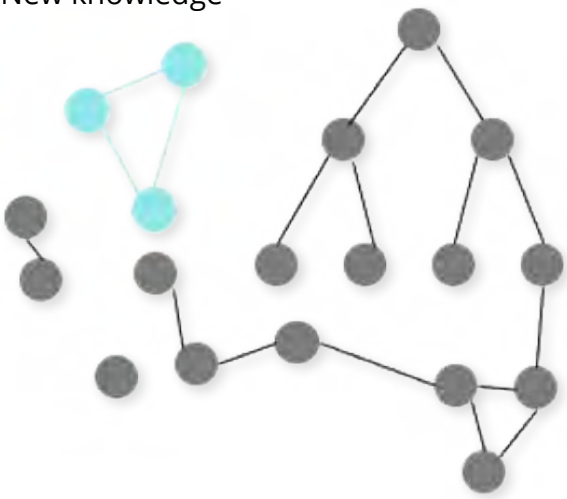
New information is best learned, remembered, and integrated in a learner's mind when it is connected to information they already know.

What it feels like for learners

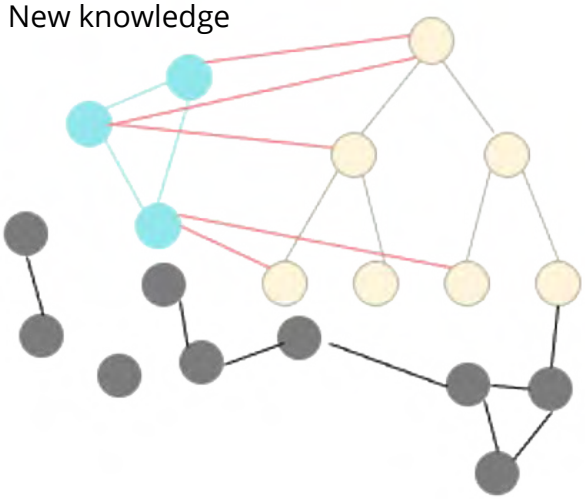
Ah ha! This is like something I already know.

- **Knowledge activation is necessary for learning**
  We construct new understanding by relating new information to what we already know.

Prior knowledge not activated
New knowledge



Prior knowledge activated
New knowledge



- **Knowledge activation jumpstarts understanding**
  When new information is taught within the context of something learners already understand, the information is easier for them to learn. Building on ideas the learner already knows "ports over" understanding from the prior knowledge. Learners can then use it to structure and incorporate the new knowledge.
- **Knowledge activation can spark curiosity, excitement, and interest**
  Getting learners excited about a topic can motivate them to learn about it more effectively. Introducing a new topic by posing a puzzling question or a contradiction can spark curiosity. When a topic is presented within a context the learner is already interested in, that interest often carries over and will motivate learning about the new topic.

- **Knowledge activation can sometimes hinder learning**

  When a learner has insufficient, inappropriate, or inaccurate prior knowledge, calling it to mind will be less helpful for understanding the new ideas.



See these Learning Design Principles:
Personalized Learning and Adaptive Systems
Authentic Learning



See this Learning Design Principle:
Motivation & Mindset

What it means for designing learning experiences

- Gauge prior knowledge
- Activate prior knowledge to jumpstart understanding
- Overcome prior misconceptions and misunderstandings
- Use prior knowledge to spark curiosity, excitement, or interest
- Deliberately connect new information to things the learner already knows and is able to do.
- Use analogies as a bridge between what a learner already knows and a new concept
- Pose puzzling questions to spark curiosity and motivate learners to learn more

Big Idea 2

Develop knowledge and skills

Skills and knowledge must be practiced to build 'muscle memory' and take on more complex tasks.

What it feels like for learners

I'm practicing, and getting faster and better.

- **Practice is necessary for expertise**
  With deliberate practice and feedback, retrieving knowledge goes from effortful to fluent to automatic. Automatic retrieval of knowledge is an important characteristic of expertise.
- **Practice starts with component skills, then complex tasks**
  Use scaffolding to focus practice on the component skills within a complex task. Then fade out the scaffolding as the learner becomes more proficient. Worked examples (which present an expert's step-by-step process for solving a problem) are effective for novice learners
- **Practice should align with the target knowledge or ability**
  Figure out the type of knowledge the learner is acquiring, and the demands on their cognitive processes. Only then can you select the best instructional activities and learning environment.

Separate complex skills...



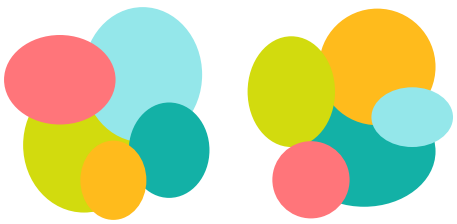
... into component skills. Practice...



... then reassemble.

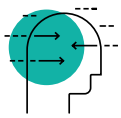


Integrate complex skills...



...into complex tasks





See these Learning Design Principles:
Active Learning, Memory & Practice
Desirable Difficulty & Scaffolding



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

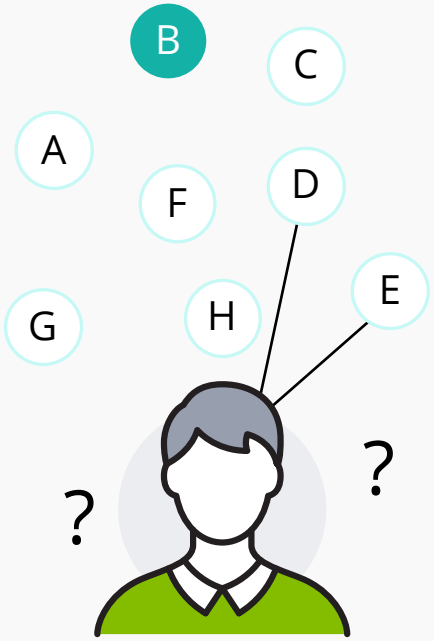
What it means for designing learning experiences

- Support deliberate practice, with feedback, to make retrieval of skills and concepts automatic
- Provide practice opportunities that are appropriately challenging
- People learn what they practice, so make sure practice tasks are aligned with the target knowledge or skill
- Provide support and scaffolds in the early stages of practice. Fade them out as the learner grows more proficient.

Big Idea 3

Deep and connected knowledge

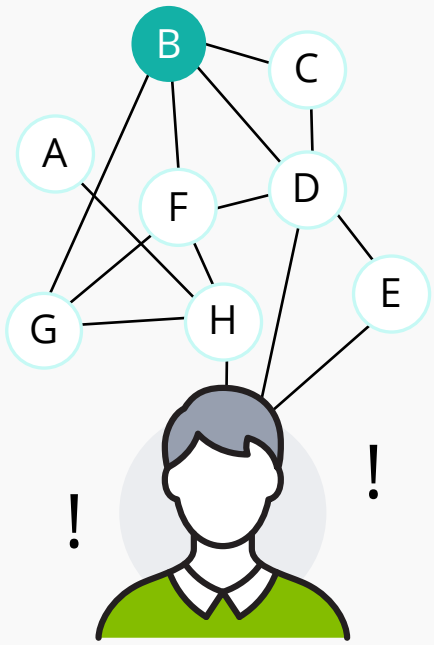
Knowledge can be flexibly applied if a learner's knowledge is deeply organized and connected, and the learner understands the underlying concepts and can recognize when to apply what they've learned.



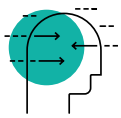
What it feels like for learners

The things I'm learning fit together into a bigger picture.

- **Deep and connected knowledge is organized around underlying concepts and meaningful structure**
  How learners organize their knowledge influences how they learn and apply what they know. Surfacing the organizing principles helps learners understand when to use their knowledge.
- **Deep and connected knowledge can be accessed flexibly**
  When knowledge is connected, there are many access routes to activating the knowledge. The more ways you can get to it, the more likely it can be recalled in the moment when it needs to be applied.



- **Deep and connected knowledge aids knowledge transfer**
  Knowledge often gets "stuck" in the context it was learned in. The ability to apply skills learned in one context to a new context ("transfer") is an important goal of education. Connected knowledge is essential for transfer.
- **This organization around underlying concepts allows them to build connections between their understandings and see patterns across varied contexts**



See this Learning Design Principle:
Active Learning, Memory & Practice



See this Learning Design Principle:
Authentic Learning

What it means for designing learning experiences

- Surface core concepts and underlying principles, so learners can flexibly apply
- Practicing applying knowledge in different contexts allows for generalization
- Increase discrimination by using compare and contrast exercises
- Use analogies to encourage transfer
- Provide authentic practice opportunities for learners to deepen their knowledge and connect to authentic practices
- Make knowledge explicit by asking learners to explain their reasoning
- Encourage learners to explain how instances are examples of certain underlying concepts. Consider asking learners to group or organize instances by concepts, not by surface features.
- Provide opportunities for learners to practice deciding how and when they need to apply their knowledge at appropriate times.

Big Idea 4

Feedback and reflection

Learners develop their understanding through checking their performance and reflecting on how they might improve. Feedback and reflection help learning stick.

What it feels like for learners

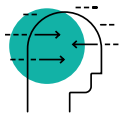
Getting feedback tells me how I'm doing, and gives me a chance to think about what I've learned.

Feedback and reflection are grist for the mill of learning. Feedback provides opportunities to gauge learners' progress and to adjust and target learning accordingly.

Formative assessment increases the efficiency of learning. It allows the instructor or learner to target their learning efforts on content they have yet to master, and to avoid wasting time and energy re-learning stuff they already know.

In addition, providing support for student reflection helps effectively manage study time, improve insight into what they need for their own learning process (metacognition), and learn more efficiently and robustly.

- Goal-directed practice coupled with targeted feedback are critical to learning
- Feedback is information to the learner on where they are now, where they need to go, and ideally, how they can improve and get there.
- Reflection helps people become self-directed learners. It supports students learning the demands of the task, evaluate their own knowledge and skills, plan their approach, monitor their progress, and adjust strategies as needed.



See this Learning Design Principle: Feedback for Learning



See this Learning Design Principle: Self-Regulated Learning & Metacognition

What it means for designing learning experiences

- Provide lots of opportunity for low-stakes formative assessment with feedback
- After providing feedback, provide an opportunity to act on it as soon as possible
- Include spaced practice and elaboration to enhance long-term performance help learners connect new ideas to what they already know
- Highlight misconceptions through feedback and providing opportunities for (self) remediation
- Collect usage and performance data on formative assessments
- Encourage reflection and scaffold self-regulated learning opportunities.

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Encourage development and content teams to provide multiple examples that account for different ways of perceiving information
- Avoid imposing time constraints on learners, and allow multiple attempts, to give learners with varied levels of self-regulation the time and comfort to learn and understand content

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Learning experiences may have media-rich examples to boost understanding, which can affect learners with limited access based on many factors. Include non-media rich equivalents that can be accessed at any time
- Create learning experiences that are in shorter, bite-sized chunks to allow learners to efficiently schedule their learning around their daily life

Identity

The combination of dimensions that define who learners are to themselves and others

- Create opportunities for learners to deepen understanding and apply learning to solve challenges in the real world — especially in relation to learners' immediate and future goals
- Whether feedback is attended to or disregarded relies on whether learners trust the source of that feedback, how feedback is delivered, and whether the learner is an active participant in evaluating the feedback and deciding how to respond to it

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Encourage content teams to engage with members of diverse cultural communities to make sure that multiple ways to deepen and apply understanding are built into a learning experience
- Present information in as neutral a way as possible, without the need for assumed cultural knowledge or background

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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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.



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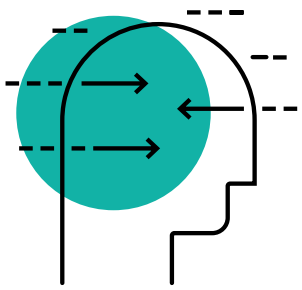
Learning Design Principles

Minds in Mind

Desirable Difficulty & Scaffolding



Summary

Desirable Difficulty & Scaffolding

Learning happens best when there is a balance of challenge and support.

Desirable difficulty is the idea that learning is most effective when it is challenging — but not too difficult. Desirable difficulty is characterized by activities that require effort, focus, and active engagement and effort from the learner (e.g., practice testing, spacing out learning).

Scaffolding is what others do to support learners through appropriately challenging tasks. It supports individuals as they 'climb' from one stage of learning to the next. This can look like hints, worked examples, just-in-time instruction, or resources.

Scaffolding should adapt to the learner's needs as they change, so it doesn't provide too much or too little help. Thus, scaffolding is often characterized by initially high levels of structure and support that adaptively fade out as the learner is able to do more of the task independently.

The sweet spot where learning is challenging, but not too challenging, is the **Zone of Proximal Development (ZPD)**. A task in the ZPD is one that the learner can't complete by themselves, but can complete with appropriate support.

The ZPD represents the level of **optimal challenge** for the learner, providing the right level of support and challenge to help them progress. Designing for optimal challenge helps to keep learners engaged and motivated, and leads to improved learning outcomes, as learners are challenged to push past their current abilities. By identifying the ZPD, educators can provide scaffolding, such as hints, worked examples or corrective feedback, that can help the learner to progress towards more advanced tasks.

More knowledgeable others such as instructors, peers, or even learning systems, can also support desirable difficulty by providing hints, modeling effective strategies, or correcting errors. This centers learning in the ZPD.

In more social and cultural contexts, scaffolding can look like **guided participation**. This is when learners jointly participate in learning with

more knowledgeable others, the experience is viewed as central to acquiring knowledge, and is adapted or contextualized for the specific learner's life circumstances.

Why it matters

Research suggests that learning within one's desirable difficulty can result in more efficient, durable, flexible, transferable learning than staying in one's comfort zone.

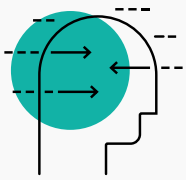
Scaffolding can support increased task fluency, mastery, learning, metacognition or even development.

When you get optimal challenge right, individuals can experience **flow**: the enjoyment experienced when a person's skills match the perceived challenges of the activity. Learners in flow can become totally absorbed in the material, lose their sense of self-awareness and time, and engage in the task for the joy of it. People do some of their best work when experiencing flow.

Impact

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

- learners feel supported in their learning and can find help when they need it, because scaffolding imparts new problem-solving procedures, provides just-in-time guidance, and/or connects to prior knowledge
- learners experience flow and persist because the content is at the optimal challenge level
- learners are prepared for challenging content because they have engaged in exploratory problem solving in a supportive environment
- learners gain independence and confidence as scaffolding is faded
- learners attain proficiency efficiently because the learning is tailored to their ability level
- learners transfer their conceptual knowledge because they can identify deep structural similarities in problems



Desirable Difficulty & Scaffolding

The big ideas

1. Learning should be appropriately challenging and take appropriate effort.

It's difficult but I can do it.

I need some help to get started.

2. At first, learners benefit from a scaffolded learning environment with high levels of structure and support.

3. As learners progress, fading out the supports is beneficial for learning.

As I get better, I need less help.

4. Sometimes exploratory problem-solving before instruction can be an effective way to induce desirable difficulty.

Grappling with a too-hard problem first prepares me for future learning.

Big Idea 1

Desirable difficulty

Learning should be appropriately challenging and take appropriate effort.

What it feels like for learners

> *It's difficult but I can do it.*

To create desirable difficulty, it is important to provide both the right type and the right amount of challenge for the learner.

- Right **type** of challenge:
  the knowledge, objectives, and procedures the learner will need to be able to apply in future. Think about how learners might apply their knowledge or what barriers they might experience in the future, and design the task with the right challenges to prepare them (e.g., if a learner will ultimately need to decide when to conduct certain types of medical exams, they should practice making those judgements during learning)
- Right **amount** of challenge:
  the difficulty of the task: challenging enough to promote learning but not so difficult that the learner can't complete the task or understand why they are failing (the ZPD). The sweet spot is roughly 85% success, 15% failure. Learning thrives here: learners can strengthen their skills and grow and build new ones, discover what works and what does not.
- Digital advantage:
  Desirable difficulty may slow progress during the formative stages of learning and make learners feel like it takes more effort, but it ultimately produces more durable and flexible learning. Keeping learners engaged is key. Digital learning environments are particularly well-suited to identifying and personalizing experiences to the learners' desirable zone.
- Effort:
  High-quality learning takes effort.
  If learning feels hard, that is a good sign that it's working. Some learners find putting in effort enjoyable and lean in, while others are fatigued and disengage. Some interpret difficulty as a signal of failure and misunderstanding. Frame effort and struggle as a natural part of learning, and encourage a growth mindset.



See this Learning Design Principle:
Motivation & Mindset



See these Learning Design Principles:
Assessment & ECD
Authentic Learning

What it means for designing learning experiences

- Identify the learner's prior knowledge level
- Design challenging, effortful activities just beyond what learners can do on their own
  - Choose difficulty intentionally and with application contexts in mind.
  - Focus on generative activities, e.g., retrieval practice, spaced practice
- Target the right balance of success and challenge (85% success rate)
- Provide scaffolding and support so they can succeed at those learning activities
- Embed formative assessment to monitor learner knowledge level
- Monitor both success rate and indicators of affective state to calibrate learning activities within the flow zone
- Monitor how the learner is feeling and provide encouragement and emotional reframing as needed. Support perceptions of competence after success
- Reinforce the idea that effort is a positive sign of learning
- Normalize struggle and support a growth mindset

Big Idea 2

Start with support

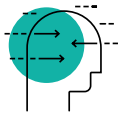
At first, learners benefit from a scaffolded learning environment with high levels of **structure and support**.

What it feels like for learners

I need some help to get started.

Novice learners lack the networks of information and mental models that experts have, making it difficult for them to understand and retain new information. Novices knowledge is context-dependent, focused on individual cases and surface-level features.

Experts think in terms of systems and underlying concepts. They can fluently categorize new information according to their existing mental models and understand how a discipline is organized, anchoring around the big ideas of the field.



See this Learning Design Principle: Developing Understanding

Scaffolding helps novices think like experts.

Key features of scaffolding include:

- learner ownership of the activity
- appropriateness of task to the student's current knowledge
- real-time adjustments to level of support based on learner's understanding
- collaboration between instructor and student
- internalization of knowledge or processes as scaffolds are removed

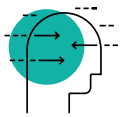
Scaffolding can be used to support conceptual, metacognitive, strategic, and motivational outcomes — so it is crucial to reflect on its purpose and use before incorporating it into learning.

There are a few common scaffolding strategies that have been studied extensively and are proven to be effective:

- **Worked examples** consist of a problem formulation, solution steps, and the final solution. They help learners learn flexible problem-solving procedures by providing novices with strategies for solving new and complex problems, and reducing the cognitive load associated with solving complex problems. Worked examples can reduce instruction time, improve performance, and guide schema development.
- **Instructional explanations**, also known as hints, are a form of just-in-time knowledge or assistance provided when learners get stuck. They have been shown to improve efficiency in learning, but they have less impact on learning gains. Hints can range from low-information cues to

more specific and detailed suggestions. with studies suggesting that the amount of time spent on low-to-intermediate hints (rather than those that give the student the answer), may be more predictive of learning. Self-explanation prompts improve self-efficacy and performance.

- **Advanced organizers** are teaching tools that help learners leverage prior experiences and knowledge to learn new information. They establish a framework to anchor new information and facilitate integrating new and existing knowledge. They can be expository or comparative, and can include graphic organizers and digital games. Research shows that advanced organizers have a small to medium effect on retention and learning, are most effective when combined with concepts and processes, and when used for science and mathematics and fact-based exams.



See this Learning Design Principle:
Developing Understanding



See these Learning Design Principles:
Personalized Learning & Adaptive Systems
Feedback for Learning

What it means for designing learning experiences

- Consider scaffolding a type of instruction embedded within problem-solving
- Provide novices with thoughtfully designed scaffolds at the start of new learning
- Minimize any split attention effects and reduce cognitive load by integrating modalities into a unified experience

- Worked examples:
  - Vary intra- and inter-example features.
  - Alternate worked examples with practice problems.
- Instructional explanations:
  - Use hints when learners are stuck.
  - Provide low-to-intermediate information level hints.
  - Consider prompting learners to self-explain before offering an instructional explanation.
- Advanced organizers:
  - Design to activate and integrate with prior knowledge.
  - Support schema development and knowledge organization around underlying concepts or processes.
  - Use for science, math, and fact-based domains.

Big Idea 3

Fade out support

As learners progress, fading out the supports is beneficial for learning.

What it feels like for learners

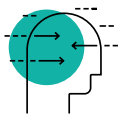
As I get better, I need less help.

Fading means gradually reducing the level of support provided.

As learners gain knowledge and skill in a particular learning context or for a specific learning task, scaffolding should be faded out to facilitate continued learning.

Just like training wheels on a bicycle or bumpers on a bowling lane, as the learner progresses, these additional supports become redundant as the learner gains relevant skills.

- **Maintaining support is not only unnecessary, but can harm learning**
  The expertise reversal effect is where support that is helpful for novices can become a hindrance for more advanced learners. This is because experienced learners have developed their own problem-solving strategies, and the additional support takes up unnecessary cognitive load. As learners gain expertise, they no longer need models on how to think like an expert — they can do that on their own.
- **Fading out scaffolding maintains optimal challenge**
  Just as scaffolding is often added to ensure that learning is not too hard, fading out can ensure that learning does not become too easy. When a task becomes too easy, learners lose out on the valuable information offered by failures. The learning task and amount of scaffolding can be adjusted to maintain optimal challenge as the learner increases in their ability level.
- **Fading promotes better cognitive outcomes**
  Research has shown that learners benefit from progressing from fully-worked examples to partial or completion examples as expertise increases.
  - Fading is more effective when the final steps of the worked example are faded out first.
  - Customized scaffolding, which incorporates both fading and adding support back in when needed, leads to better cognitive outcomes for learners doing problem-based STEM learning.
- **Fading out can aid in the transition to independent performance**
  Scaffolding is intended to be a bridge to independent performance. Transferring responsibility for learning to the learner is key. Fading out scaffolding can support self-regulated learning.



See this Learning Design Principle:
Active Learning, Memory & Practice



See these Learning Design Principles:
Personalized Learning & Adaptive Systems

What it means for designing learning experiences

- Measure prior knowledge to determine appropriate level of scaffolding
- Gradually fade or adaptively remove scaffolding once a learner can achieve some success on their own
- Embed formative assessment to monitor learner knowledge level
- Keep learning at the optimal level of challenge
- Adaptively add scaffolding back in if needed
- Providing scaffolding to learners who don't need it actually impedes learning

Big Idea 4

Exploratory problem-solving, sometimes

Sometimes **exploratory problem-solving** before instruction can be an effective way to induce desirable difficulty.

What it feels like for learners

> *Grappling with a too-hard problem first prepares me for future learning.*

Productive failure is a form of guided discovery where learners work to solve an open-ended, complex problem. The goal is not for them to achieve the right answer, but for the instructor to build off learner-generated solutions and offer additional instruction on the key concepts involved in the task.

Productive failure can prime learners to learn from subsequent instruction and guided problem-solving. It is better for promoting conceptual understanding than procedural knowledge.

Note that guided discovery should be differentiated from experiential or discovery-based learning, which have been shown to provide little benefit or even harm to student learning outcomes.

Productive failure promotes beneficial cognitive processing by:

- activating relevant adjacent schemas
- highlighting gaps in knowledge
- motivating search for deep structure
- inducing cognitive disequilibrium to motivate curiosity and attention to instruction
- prompting positive affect and engagement

To be effective, productive failure experiences must include:

1. instruction that builds on learners' solutions
2. group work as the participation structure in the problem-solving phase
3. generation of multiple representations and solutions
4. dialogue-dominant social surround facilitation in the instruction phase

Despite the name, it is not necessary for a learner to experience failure themselves in order to learn from it. Vicarious failure, where a learner studies others' incorrect solutions, can also lead to better conceptual knowledge acquisition than direct instruction.



See this Learning Design Principle: Authentic Learning



See these Learning Design Principles: Social & Collaborative Learning

What it means for designing learning experiences

- Determine whether exploratory problem-solving is appropriate given the learning goals, domain, and instructional context
- Make sure all conditions of effectiveness are met:
  - build on learner solutions
  - group work during problem solving
  - multiple representations and solutions
  - social and dialog-infused instruction
- Support beneficial cognitive processing by:
  - providing remediation and correction of initial mental models
  - highlighting gaps in knowledge
  - sparking curiosity or confusion
  - highlighting where analogies transfer fully, where they break down, and where understanding needs to be updated
- Support a positive affective environment
- Learners do not need to fail for instruction to be effective

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Consider utilizing digital learning environments that incorporate adaptive systems, so the learning material is presented at the appropriate/desirable level of difficulty in manageable intervals.
- Create task features that activate a growth mindset (e.g., rewarding effort or persistence rather than performance alone) to encourage learners to stay engaged in a task even when the effort becomes fatiguing.

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Consider including tutorials, hints, or help as a part of the scaffolding process to learn, emphasize, and connect various concepts in course material. This method will support varied levels of familiarity and background knowledge of course content and digital learning tools.

Identity

The combination of dimensions that define who learners are to themselves and others

- While failure can motivate learners to dive deep into the circumstances of the failure and extract more information to boost learning, make sure the constructive criticism/feedback will be ascribed to the task rather than to the learner themselves (and be perceived as a threat/attack).

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Make sure there is culturally relevant, authentic, and equitable representation in a learning experience.
- When relevant and possible, include scaffolding for learners to learn from and develop their own personalized strategies to achieve learning goals.

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Outcomes and impact

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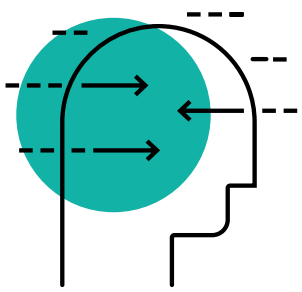
Learning Design Principles

Minds in Mind

Active Learning, Memory & Practice



Summary

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.

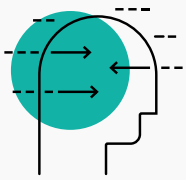
When designed well, active learning typically leads to better learning and deeper understanding on a variety of tests, from simple recall to conceptually rich performance activities.

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**.

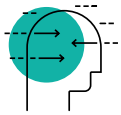
The ICAP (Interactive, Constructive, Active, Passive) framework categorizes learning experiences based on the amount of knowledge-building involved. ICAP is useful for instructional design because it lists what learner need to do to gain each level of cognitive engagement.

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.

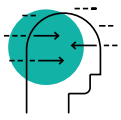
What it feels like for learners

> *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.*

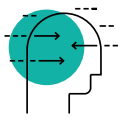
Sense-making creates knowledge, which can help learners fill in gaps, correct errors, and generalize concrete instances into rules and principles.

- **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

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Seek input from learners of different communities to make sure all learners can cognitively engage in the active learning activity as intended (e.g., that they have sufficient prior knowledge and schemas)
- Conduct interviews and/or cognitive task analyses to make sure people with different abilities can access the active learning activities as intended
- Accommodate learners with low working memory via extra practice for proceduralization. This method frees up working memory and makes retrieval of the entire series of steps easier, allowing learners to take on more complex tasks

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Present learning experiences in spaced, learner-paced segments rather than massed sessions, to allow learners to efficiently schedule their learning over time rather than cramming
- If longer blocks of study are needed, communicate estimated time commitments for blocks up front, so learners can plan their study

Identity

The combination of dimensions that define who learners are to themselves and others

- Motivate learners to actively participate in learning activities by incorporating opportunities to apply course content to solve challenges in the real world — especially in relation to learners' immediate and future goals

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Active learning experiences open the potential for collaboration opportunities. Have learners from different backgrounds work together towards a shared goal. This can improve relationships between learners who belong to majority groups and those who belong to under-represented minorities
- Induction, refinement, and sense-making instructional processes usually require learners to have enough prior knowledge to engage successfully. Acknowledge and account for the fact that background knowledge can vary for learners because prior education can vary greatly based on what is prioritized in an educational system within a culture

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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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.



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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.



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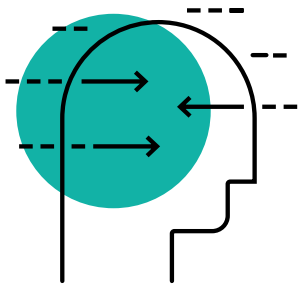
Learning Design Principles
Minds in Mind

Feedback for Learning



Summary

Feedback for Learning

Feedback is one of the most powerful ways to support learning.

At its core, **feedback** is information for learning. It contains information about a learner's performance or understanding and is used to adjust thinking or behaviour to improve learning. It can be provided by instructors, learning systems, or peers.

Feedback is an important factor in closing the gap between what a learner's current level and what they ideally need to know or be able to do.

Over time, the understanding of feedback has changed. Instead of a way to evaluate learning, it is now seen as a way to support learning; a way to provide learners with information to correct their errors and improve their understanding.

The best feedback is:

- **actionable:** it gives learners opportunities to reflect, self-regulate, and make changes
- **specific:** it is individualized, and provides information about learners' current understanding and/or performance
- **descriptive:** it avoids praise and comparison, instead conveying targeted information about ways to overcome challenges and improve in regard to task, process, and/or self-regulation
- **understandable:** it is clear and concise

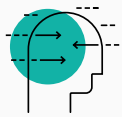
Why it matters

Feedback plays a pivotal role in helping learners achieve their goals. It supports learning by providing learners, instructors, and other stakeholders with timely, specific information about learners' understanding and performance at meaningful points during the learning experience.

Feedback has been widely studied, and the research shows a large positive effect on learner outcomes across various domains. High quality feedback, delivered appropriately, has a positive impact on learning, retention, comprehension, metacognitive skills, and overall achievement.

The effectiveness of feedback can depend on a few factors, which are useful to keep in mind when designing learning content and tools:

- content, source, and delivery of feedback
- prior knowledge and working memory of learners

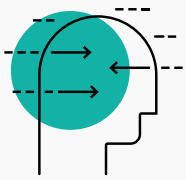


See this Learning Design Principle:
Developing Understanding

Impact

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

- learners experience feedback as helpful and supportive because it's task-focused rather than person-focused
- learners persist through difficulty because they have the support and information they need to improve
- learners use feedback to revise or correct their understanding because it is specific, descriptive, and timely
- learners provide constructive feedback to peers because they are trained and provided with models of high-quality feedback
- learners take responsibility for regulating their own learning, because they have been given the time and space to reflect on their performance and know what makes feedback effective
- learners become proficient and can transfer their knowledge to new contexts, because they have had the opportunity to practice and refine their skills



Feedback for Learning

The big ideas

1

When providing feedback, it's important to determine when the learner will best be able to utilize it to improve their learning. This may mean feedback is best provided sooner or later in the learning process.

Now that I know, I'll use this to revise my thinking.

I'm not being judged.

2

Feedback should be provided in a way that learners see as non-judgmental. It is important for feedback to be perceived as helpful and supportive.

I know what I can do to improve.

3

Feedback should help learners reflect on where they are currently and where they want to be in their learning goals, with specific steps to get there. There is such a thing as too much or too little feedback.

4

There are many ways to deliver feedback, through instructors, peers, learning systems or agents. They all have their place, so it is important to consider what makes each one effective.

I get feedback in lots of ways.

I can give myself feedback.

5

Feedback is information learners use to regulate their own learning. Self-regulated learning interventions that incorporate feedback can improve learning, self-regulated learning, and motivation.

Big Idea 1

Timely feedback

When providing feedback, it's important to determine when the learner will best be able to utilize it to improve their learning. This may mean feedback is best provided sooner or later in the learning process.

What it feels like for learners

Now that I know, I'll use this to revise my thinking.

Giving feedback in time for a learner to use it in a revision cycle is important.

Immediate feedback is better for initial learning, lower-order learning outcomes, more challenging tasks, and learners with less prior understanding.

Pros

- Guides learners during learning, easing frustration
- Allows in-the-moment error correction
- Helps learners gain proficiency in the task at hand
- Info in the feedback remembered along with problem solving
- Learning is fast and efficient
- Learners prefer it

Cons

- Does not support learning transfer
- Does not support self-regulated learning skills

Delayed feedback is better for later learning, higher-order learning outcomes, less challenging tasks, and learners with high prior understanding.

Pros

- Supports the development of self-regulated learning skills
- Delay allows learners to forget their initial error and remember the correct one
- Helps learners transfer their understanding to different types of tasks
- Provides two opportunities to study the learning content

Cons

- May not help struggling learners who need immediate support
- Still needs to be given soon enough for learning revision
- May require more time

Immediate or delayed, what makes the biggest difference is that learners use the feedback in a revision cycle. Feedback should be provided at the best moment for learners to incorporate it into their understanding.



See this Learning Design Principle: Desirable Difficulty & Scaffolding

What it means for designing learning experiences

- Timing of feedback should be based on learners' prior understanding, when learning is taking place, and learning goals
- The context of the classroom and learning domain can guide when feedback should be provided
- Provide opportunities for learners to use the feedback in a revision cycle
- Allocate instructional time to process feedback

Big Idea 2

Non-threatening feedback

Feedback should be provided in a way that learners see as non-judgmental. It is important for feedback to be perceived as helpful and supportive.

What it feels like for learners

> *I'm not being judged.*

Learners can take feedback as a critique of themselves, instead of their current performance of the task. When they find feedback threatening, learners are likely to reject the information or internalize it in a harmful way.

Therefore, feedback should be task-focused, avoiding criticism and any reference to the learner themselves.

- **Positive feedback** that includes praise can have both positive and negative impacts. It can increase intrinsic motivation, and learners see it as more helpful. If it is person-focused (not task-focused), counterintuitively, it can damage motivation and learning. If it does not provide enough information, it may not be enough to facilitate change.
- **Negative feedback** can affect learners in various ways, but the impact can be improved if learners are first told that struggling is a normal part of the process. If the feedback focuses on what the learner has done wrong, it can damage their self-esteem, resulting in them feeling defensive and ignoring the feedback.

Whether feedback is positive or negative, it needs to be straight to the point and rich with information that lets learners know how they can improve.

- **Create a supportive, psychologically safe environment**
  A psychologically safe environment helps learners be receptive to feedback. Trust between the learner and the person providing the feedback is key. Affirming that a learner is capable of achieving, and framing feedback as helping them achieve what they are truly capable of, go a long way in creating this environment.
- **Avoid activating stereotype threat**
  Stereotype threat refers to individuals' worries about their individual performance confirming negative stereotypes about groups they belong to. These learners tend to pay more attention to negative feedback, which takes away from their working memory resources needed to complete the task well. Avoid imprinting expectations on learners based on negative stereotypes.



See these Learning Design Principles:
Motivation & Mindset
Social & Collaborative Learning

What it means for designing learning experiences

- Deliver feedback in a non-threatening, supportive way
- Focus feedback on task and performance instead of learners themselves
- Use praise sparingly
- Make feedback meaningful and helpful for learners to improve learning
- Set norms for psychological safety
- Frame feedback as supportive information to help learners reach their full potential
- Reminder learners that struggle is part of the learning process
- Do not activate stereotype threat
- When providing praise, cite specific task- and performance-based reasons, such as their effort, self-regulation, or engagement

Big Idea 3

Information for learning

Feedback should help learners reflect on where they are currently and where they want to be in their learning goals, with specific steps to get there. There is such a thing as too much or too little feedback.

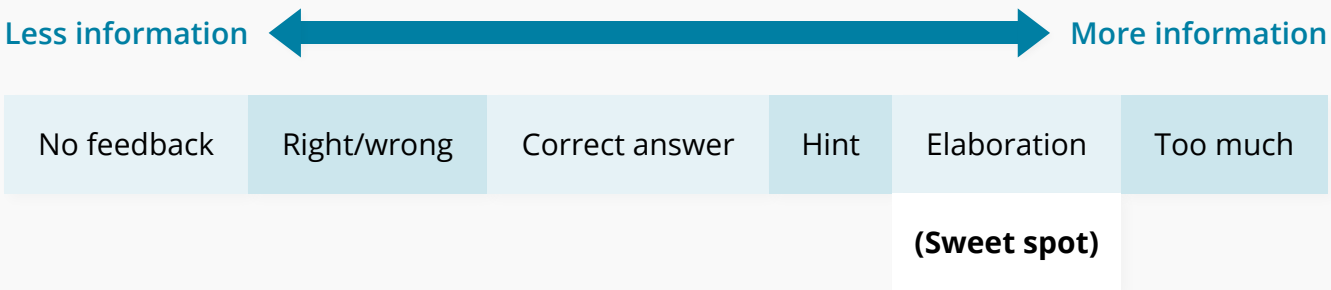
What it feels like for learners

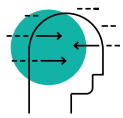
I know what I can do to improve.

- **Include actionable next steps**
  To reduce learners' uncertainty and improve learning, feedback should focus on concise, consistent, and actionable steps. In addition, providing plenty of opportunities to implement the feedback makes it more likely learners will improve their performance.
- **Provide just enough information**
  Providing no feedback at all is ineffective, because it provides no help to the learner. On the other hand, too much feedback can overwhelm learners.

Elaborated feedback explains in detail why an answer was right or wrong. It is the sweet spot because it gives learners the information they need to address their errors. It can almost be thought of as a type of supplemental instruction.

- It works better for higher-order learning outcomes, but can also be effective for lower-order outcomes
- It is most effective for learners with lower prior domain knowledge
- Learners with higher domain knowledge may find it repetitive. They can benefit from simplistic feedback that includes the correct answer
- Providing too much elaborated feedback on complex learning tasks can overwhelm learners
- Give learners ample time to create their own feedback and process what they are learning before providing feedback





See these Learning Design Principles:
Desirable Difficulty & Scaffolding
Attention & Cognitive Load

What it means for designing learning experiences

- Include multiple opportunities to assess learning with objective-aligned formative assessment items and practice activities
- Provide actionable, specific, descriptive, and understandable feedback
- Use feedback to guide learners towards next productive steps
- Provide success criteria so learners know what they are aiming for
- Highlight misconceptions through feedback and provide opportunities for (self) remediation
- Apply feedback approach based on learners' current understanding
  - Provide neither too much nor too little information
  - Give elaborated feedback when appropriate, considering learner knowledge level and cognitive load
- Support self-regulation by giving learners time reflect on their learning before providing feedback

Big Idea 4

Feedback channels

There are many ways to deliver feedback, through instructors, peers, learning systems or agents. They all have their place, so it is important to consider what makes each one effective.

What it feels like for learners

I get feedback in lots of ways.

Peer feedback feels less threatening than feedback from an authority figure. It is also a great learning opportunity for the learner providing the feedback. There are some limitations, including that the feedback may be ineffective if the peer does not know how to address errors. Peer feedback may lead to better learning outcomes, but learners are more likely to implement feedback from teachers.

The effectiveness of peer feedback is influenced by:

- whether the peer has received training — feedback is more effective when the peer is adequately trained
- types of feedback — providing both comments and grades is beneficial
- ability level — can influence whether feedback is positive or negative; feedback is most effective when the learner and peer are at the same level
- accountability — feedback is better when the peer feels the usefulness of their feedback will be graded

Pedagogical agents are digital characters that instruct learners. When well designed, they can be as effective as one-on-one or small group tutoring with humans. Feedback from pedagogical agents may improve motivation, but the findings about their effectiveness have been mixed.

When implementing pedagogical agents, consider:

- learners prefer knowledgeable and kind agents, which increases motivation
- interacting with two agents leads to better learning and motivation
- learners prefer working with an agent that is more like a peer than an authority figure

Feedback from computers is just as effective as feedback from an instructor, and learners are more likely to ask for feedback from a computer than a person.

On the other hand, learners feel that feedback from instructors is more accurate and helpful, and prompts from instructors are associated with better performance.



See these Learning Design Principles:
Social & Collaborative Learning

What it means for designing learning experiences

Peer feedback

- Provide training on how to craft and deliver feedback
- Use a scoring rubric to support peer training
- Match peers by ability level
- Make sure giving feedback is a learning experience, too

Pedagogical agent feedback

- Use the same principles as you would for instructor or peer feedback
- Consider framing the agent as a peer
- Allow the learner to ask for help

Big Idea 5

Developing self-regulation

Feedback is information learners use to regulate their own learning. Self-regulated learning interventions that incorporate feedback can improve learning, self-regulated learning, and motivation.



See these Learning Design Principles:
Self-regulated learning and metacognition

What it feels like for learners

I can give myself feedback.

Self-regulated learning is when learners are able to effectively take ownership of their learning and process feedback outside of the influence of an instructor.

Receiving feedback can help learners learn how to provide feedback for themselves. External feedback helps learners assess their own performance and determine if they need to adjust their goals and strategies. Learners that are better at monitoring their own progress are better at using the feedback they receive to achieve their goals.

Self-regulated learning can be disrupted by:

- not knowing the effective strategies to solve problems, or utilizing inappropriate strategies
- not enough motivation or time for learning
- not enough mental resources
- poor metacognitive skills, leading to difficulty analyzing performance

What it means for designing learning experiences

- Provide clear learning goals
- Support self-regulation by giving learners time reflect on their learning before providing feedback
- Encourage learners to practice self-monitoring skills
- Model quality feedback often and consistently
- Provide direct instruction on how to craft effective feedback
- Encourage teacher and peer dialogue
- Collect usage and performance data on formative assessments to support progress tracking and communicating strengths and weaknesses

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Utilize encouraging and positive feedback over negative feedback, especially for learners with low confidence or who tend to focus on negative feedback. Negative feedback can take away working memory resources learners need to complete a task well
- Promote self-regulation by allowing learners to practice their self-monitoring skills so they can keep track of how they are progressing towards their learning goals (i.e., self-assessment, self-reflection)

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Consider that learners have varied levels of access to technology. Since feedback can be delivered via various mediums, make sure learners can access this feedback through multiple avenues for easy, anytime access and review

Identity

The combination of dimensions that define who learners are to themselves and others

- Mitigate identity and stereotype threat by providing opportunities for self-affirmation; to see mistakes as learning opportunities; and to reframe anxiety as not predictive of failure
- Whether feedback is attended to relies on whether learners trust the source, how it is delivered, and whether the learner is an active participant in evaluating it and deciding how to respond

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Consider the source and nature of feedback to address cultural sensitivities, so learners ascribe it to the task rather than to themselves
- Acknowledge that learners' background knowledge can vary because prior education varies based on what is prioritized in an educational system within a culture. Keep this in mind when developing elaborated vs less elaborated feedback, to ensure its effectiveness

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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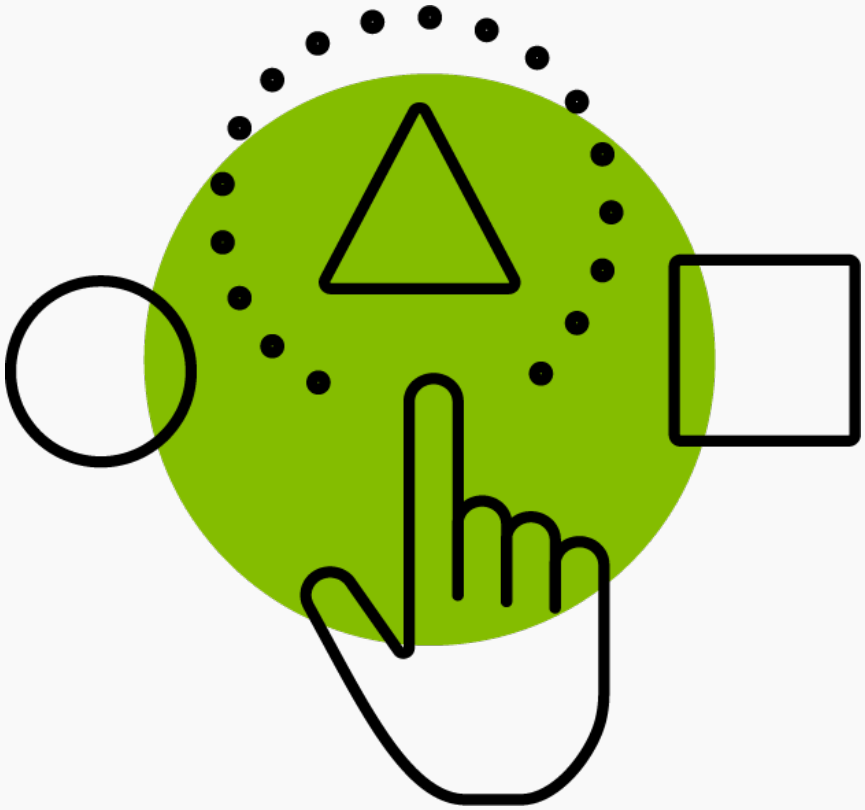


It supports good learner behavior

Good learners not only gain content knowledge, but they also take charge of their own learning and gain insights into their own learning process.

They are aware of what they know, what they don’t, and what they need to do to get there

We support learners in making good decisions with their time to get the most out of their learning experience

Self-Regulated Learning & Metacognition

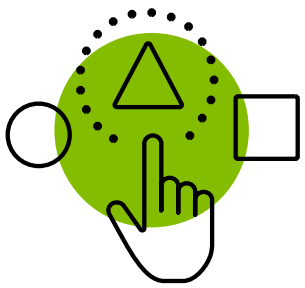
1. The self-regulated learning cycle
2. The forethought phase
3. The performance phase
4. The self-reflection phase



Learning Design Principles

Learning Behavior

Self-Regulated Learning and Metacognition



Summary

Self-Regulated Learning and Metacognition

The majority of learning is self-driven and self-managed — but learners are often poor judges of what they do and don't know, and how to close the gap with effective study strategies. How can we equip learners to more accurately evaluate their own knowledge and manage their learning?

Self-regulated learning (SRL) is when learners take charge of their own learning outside the influence of an instructor, and can do so effectively.

Metacognition means thinking about thinking. Thinking about what's going on inside your own mind, becoming aware of your knowledge, your thought processes, and monitoring and controlling those processes are all part of metacognition. To practice SRL effectively, you need good metacognitive skills.

SRL can be thought of as a series of phases:

- **Forethought phase:** learners monitor what they already know and plan accordingly
- **Performance phase:** learners monitor their actions and execute learning strategies
- **Self-reflection phase:** learners reflect on their performance and calibrate or change their learning strategies accordingly

During each phase, learners **monitor** what they know and how they're performing, and make adjustments to **control** and execute their learning strategies.

Why it matters

- Learners with good SRL skills are also effective learners and have better outcomes
- Independent learning is a necessary step on the journey to lifelong learning, which is an important part of Pearson's mission
- Most learners do not have effective SRL skills — but SRL can be taught

Impact

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

- learners are self-directed because they are supported to create SMART goals and study plans for their learning
- learners are *accurately* confident in their knowledge and skills because they check what they know and what they don't with good reflective habits
- learners persist because they are confident in their ability to learn the material and know when to ask for help
- learners are effective and efficient studiers because the learning experience combines direct instruction in study strategies with scaffolded practice
- learners master key objectives because they use effective study strategies



Self-Regulated Learning and Metacognition

The big ideas

1

Self-regulated learning involves maintaining a cycle of **monitoring and control**.

I monitor how I'm learning and adjust as needed.

I know what I need to do to reach my goals.

2

Before studying, learners should identify the gaps in their knowledge; decide the right learning level; analyze tasks; set appropriate goals; create effective plans; and prepare resources.

3

While studying, learners should continually **monitor** their progress and **control or adjust** their learning strategies as needed.

I can tell I'm making progress.

I know what study strategies to use to reach my goals.

I know when to ask for help.

4

After studying, learners should **reflect** on the content they covered, the study strategies they used, and the feedback and outcomes they achieved to decide whether to stop studying, keep studying, or change study strategies.

I know what to keep the same and what to do differently next time.

Big Idea 1

The self-regulated learning cycle

Self-regulated learning (SRL) involves maintaining a cycle of monitoring and control.

What it feels like for learners

I monitor how I'm learning and adjust as needed.

Monitoring is the metacognitive process of observing your own mind and thinking in real time, in order to assess your own learning and knowledge. (How difficult will it be to learn this? How easily could I solve a similar problem? Did I do well on the test?)

Control is the metacognitive process of making decisions about how to affect your own learning and knowledge. (When and where do I learn? What material do I focus on? What learning strategies will I use?)

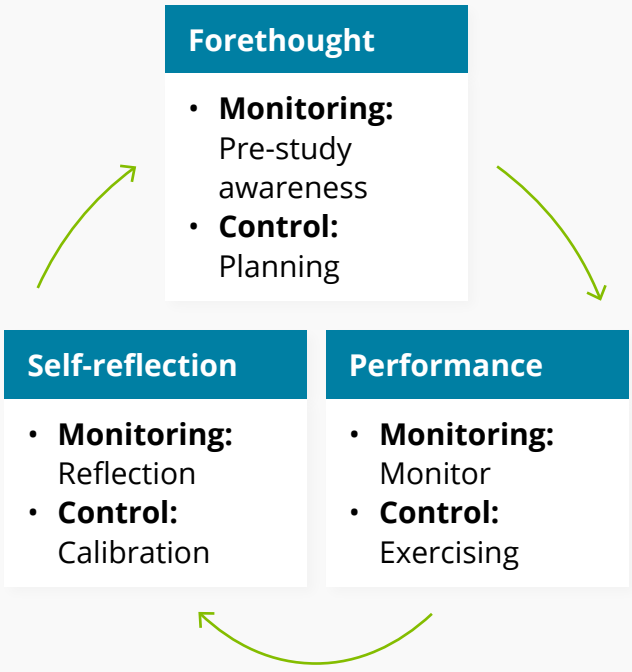
SRL is a continuous cycle of monitoring and control throughout the forethought, performance, and self-reflection stages. It's a habitual practice, not a state (which is why we don't say someone is or isn't a self-regulated learner, only that they are or aren't practicing self-regulated learning).

SRL can be taught. Teaching learners more effective learning strategies, and encouraging them to engage in reflective evidence-based practice, helps them become more effective learners who:

- are aware of what they do and don't know
- are aware of which study strategies are and aren't effective
- are strategic about studying and manage their time well
- are accountable for their own learning
- believe they can improve their knowledge and performance by studying
- set and achieve higher learning goals

What it means for designing learning experiences

- Explicitly teach the SRL learning cycle
- Scaffold in places for learners to monitor and control their understanding as they learn



Big Idea 2

The forethought phase

Before studying, learners should identify the gaps in their knowledge; decide the right learning level; analyze tasks; set appropriate goals; create effective plans; and prepare resources.

What it feels like for learners

I know what I need to do to reach my goals.

Knowing what to study

- Before studying, learners need to correctly identify what they know and what level of knowledge they need to reach. This helps them choose the right study strategies and allocate the right amount of study time
- Learners often don't know what they don't know. When they think they know more than they do, they may choose study strategies that are too difficult, or allocate too little study time
- Ask: What do I know now? Where do I want to get to? How easy or hard will it be for me to learn this?

Planning studying

- Learners need to set goals and determine which study strategies will accomplish those goals
- Effective learners set high and attainable goals and make realistic and effective plans that help them reach those goals
- In general, learners whose goals involve improving their knowledge and understanding of the topic are more motivated to learn and use better study strategies
- Poor planners may choose less effective goals and study strategies, or not plan at all. This can lead learners to start studying too late or choose ineffective strategies
- Ask: Where is the right place to start? What do I need to study? How should I study it? How long should I study for?

What it means for designing learning experiences

- Provide information about prerequisites and learning goals/objectives, to support awareness of current knowledge levels, knowledge gaps, and study planning
- When introducing a new topic, include experience(s) that:
  - activate prior knowledge and surface potential gaps (e.g., diagnostic assessments or pre-tests)
  - encourage self-reflection and monitoring of current level(s) of understanding
- Assign learners a study plan that incorporates SMART goal setting as an expectation at the beginning of the learning experience with routine reflections on goal achievement
- Train learners in effective time management techniques (set specific goals, prioritize, manage time, and structure their work day)

Big Idea 3

The performance phase

While studying, learners should continually monitor their progress and control or adjust their learning strategies as needed.

What it feels like for learners

I can tell I'm making progress.

I know what study strategies to use to reach my goals.

I know when to ask for help.

Learners should continually monitor their accuracy and understanding, and adjust their learning strategies as needed, asking reflection questions like: Have I understood his? Do I need to study it more?

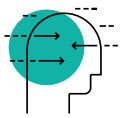
- **Learners who struggle with monitoring often overestimate what they have learned**
  They may rely on faulty cues, such as how easy it is to recall information in the moment, or have mistaken beliefs about how memory works. This can lead to overconfidence, which can make learners stop studying too early or not study at all. Learners' monitoring can be improved by teaching them which cues are and are not reliable predictors of future performance.
- **Not all study strategies are created equal**
  Study strategies based on accurate metacognitive judgments lead to more efficient learning and better learning outcomes. More effective study strategies are associated with a higher grade point average. Learners often select less effective strategies because they feel easier. More effective strategies may feel more challenging, but are actually more efficient.

More effective	Less effective
• Self-testing • Spaced practice • Self-explanation • Highlighting less	• Rereading • Restudying • Cramming • Highlighting more

To support effective metacognitive monitoring:

- **Wait:** at least a few minutes, or even a few days
- **Generate:** try to remember what you learned
- **Validate:** check your work

This helps learners by giving them an accurate sense of what they can actually remember, as opposed to what is fresh in their mind, and whether the information they can recall is correct and complete. This improves content learning and self-regulated learning skills.



See this Learning Design Principle:
Feedback for Learning
Active Learning, Memory & Practice
Desirable Difficulty & Scaffolding

What it means for designing learning experiences

- Prompt learners to reflect on their learning and adjust their study planning as needed
- Provide learners with a view of their performance to help improve their monitoring accuracy
- Teach effortful, effective study strategies
- Teach how memory works, including how it fades over time
- Help learners check the accuracy of their responses when they self-test
- Use the wait–generate–validate method
- Use recall items (e.g., short answer, fill-in-the-blank) instead of recognition items (e.g., multiple-choice, true/false)
- Provide immediate feedback on the correct answer for practice problems
- Provide opportunities to repeatedly test the same concepts under different conditions (e.g., different wordings)
- Vary the difficulty of material to be learned. Learners are more accurate judges of their learning when the material varies widely
- Provide specific, actionable, and timely feedback on practice and assessments, surfacing current knowledge and potential gaps to support reflection and goal setting
- Vary the difficulty of material to be learned. Learners are more accurate judges of their learning when the material varies widely
- Provide specific, actionable, and timely feedback on practice and assessments, surfacing current knowledge and potential gaps to support reflection and goal setting

Big Idea 4

The self-reflection phase

After studying, learners should reflect on the content they covered, the study strategies they used, and the feedback and outcomes they achieved to decide whether to stop studying, keep studying, or change study strategies.

What it feels like for learners

> *I know what to keep the same and what to do differently next time.*

After completing a learning activity:

- **Learners should reflect on both what they have learned and how they have learned it**
  This helps learners decide whether they should continue studying. Effective learners can do this on their own without external support. Learners who struggle with reflection may not do it at all or may rely on faulty cues, such as how easy it is to recall information in the moment. Learners are also quick to assume that partially remembered information is fully correct. Poor self-reflection can lead learners to stop studying too early.
- **Learners should consider how their actions did or did not support their goals and what they should do differently next time**
  They should note where they accurately predicted their performance, and where they did not, and use this to change future study strategies. Many learners recognize that they didn't do as well as they wanted but struggle to translate this knowledge into concrete plans for how to do better next time. These learners then struggle to improve their performance over time.

What effective self-reflection looks like

- Actively reflecting on performance
- Basing those reflections on accurate information
- Noting where they did and did not accurately judge their learning
- Using this information to inform future study and performance

What it means for designing learning experiences

- Explicitly prompt learners to reflect on their performance versus their expectations
- Encourage learners to think about what study strategies did/did not work for them
- Provide constructive item-level feedback on learners' performance
- Provide aggregate feedback dashboards aligned to objectives
- Allow learners to incorporate feedback and correct their work
- Provide a way for learners to revise their study plans to prepare for the next test/ assignment

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Include direct instruction and scaffolding in learning environments to help learners self-regulate their learning. Opportunities to experience effective study strategies and helpful feedback can help learners make better study decisions.
- Self-regulated learning relies on executive functioning skills such as working memory, impulse control, and flexibility. Include additional supports or scaffold to practice self-regulated learning, especially for learners with less well-developed executive functioning skills.

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Include information about learning goals and objectives, along with pre-requisite details. Learners can identify their current familiarity of background knowledge and identify knowledge gaps.

Identity

The combination of dimensions that define who learners are to themselves and others

- Work with learning designers to carefully craft questions used to prompt metacognitive judgments. Poorly designed questions could activate stereotype threat for some learners, which can have a detrimental effect on their mental state and performance.

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Recognize that terminology around self-regulated learning can be complex. Include prompts to teach learners the language needed to think and talk about their experience with learning without the need for assumed cultural knowledge or background.
- Consider the source and nature of feedback to ensure that cultural sensitivities are addressed, so learners can use feedback as constructive criticism (rather than as a threat/attack) to ask questions and increase confidence.

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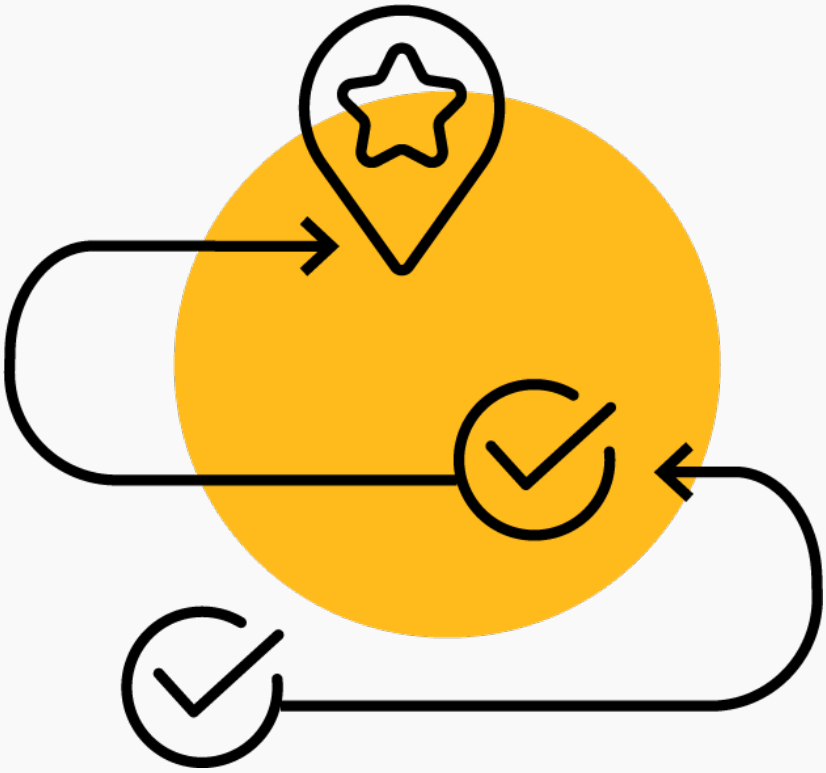


There is Purposeful Design

Instructional Alignment ensures a laser-focus on the right stuff

Learning objectives and purposeful instruction moves the learner forward on the outcomes that matter

Personalized learning helps achieve a meaningful real-world relevant goal

Objective Design

1. Supporting backwards design
2. Creating strong objectives
3. Two-level objective hierarchies
4. Guiding assessment and instruction
5. Setting expectations for learning

Functional Prerequisites for Efficacy-Infused Product Development

Assessment & Evidence-Centered Design

1. Design for purpose
2. Domain model
3. Learner model
4. Task model
5. Evidence model
6. Valid, reliable, and fair assessment

Personalized Learning & Adaptive Systems

1. Degrees of personalization
2. Knowledge and skills personalization
3. Interest personalization
4. Caution around learning styles
5. Research-supported personalization factors
6. Guided choice

Authentic Learning

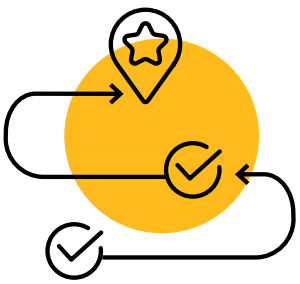
1. Real-world relevance
2. Instruction before practice
3. Modeling
4. Authentic practice
5. Self-directed problem-solving
6. Stepping into the community



Learning Design Principles

Purposeful Design

Objective Design



Summary

Objective Design

Our learners need to understand what they'll know and be able to do as a result of their learning experience.

We need to be able to show that our products are soundly built, using objectives to guide a design process that ensures the integrity of the learning experience.

Objectives articulate what success should look like after a learning experience, describing what the learner will know or be able to do. Objective design is the practice of articulating a comprehensive and accurate set of objectives for a learning experience.

The term "objectives" isn't what matters. It's the idea that matters. A learning experience could call them "knowledge components" or any term that supports learners and reflects the intended outcome of the experience.

Why it matters

Objectives are the backbone of any effective learning experience. They are the learning goals we aim to achieve and guide the design of both assessment and instruction.

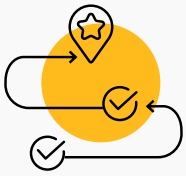
A learner experience designed around objectives solves many challenges:

- **Validity & credibility:** when learners engage with assessment and content aligned to well-designed objectives, learners, instructors, and institutions trust us
- **Roadmap for effective design:** objectives are the starting point for designing assessments and instruction that achieve learning goals, and for making sure we spend our development resources wisely
- **Efficient & aligned design:** we make the learner experience more efficient by making sure all instructional goals and objectives are properly taught and assessed, and there is no extraneous content
- **Measurable impact:** objectives help us understand learners' progress, report on impact, and improve our learning experiences

Impact

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

- learners understand learning goals and what “good” looks like, because objectives clearly describe learning targets and performance expectations
- learners persist in their learning, because they can get frequent feedback on their progress against their learning goals
- learners meet their goals and master objectives because instruction and content are aligned to objectives



Objective Design

The big ideas

1

When we **create the objectives first**, they form a foundation for designing the learning experience. Instruction and assessment aligned to the objectives support learners to achieve their learning goals.

I understand where my learning will take me.

I know precisely what I'm going to learn and how much progress I've made.

2

Well-designed objectives are **clear and measurable**, and taken together they reflect what learners should know or be able to do by the end of the learning experience. Aligning objectives to an external framework can increase reliability, validity, and applicability of the learning experience.

3

Two-level objective hierarchies are essential to learning experiences that equip learners to achieve **complex learning goals**.

I know where to focus my studies and what I need to do to be ready for high stakes assessments.

5

Objectives can help a learner decide if a learning experience is relevant and valuable for them, increasing transparency and motivation and learning. They can improve trust by **informing learners up front** what will be required and what support will be available.

I know what my learning will cover and what I will achieve at the end of it.

I'm confident my learning has been designed to help me achieve my goals.

4

Because they are learning goals, objectives **drive assessment and instruction design**. This helps learners progress towards the objectives and allows us to make inferences about the performance of learners and learning experiences.

Big Idea 1

Supporting backward design

Creating objectives first forms a foundation for designing the learning experience. Instruction and assessment aligned to the objectives support learners to achieve these learning goals.

What it feels like for learners

I understand where my learning will take me.

Traditional design starts with the content to be covered, the textbook to be used, or the test to be passed. Backward design turns this around, starting with goals or learning objectives instead of topics to be covered. Backward design leads to more effective learning experiences.

- Backward design has been shown to improve learning
- Backward design has been found to improve instructors' preparation and excitement
- Backward design allows learning experiences to reach all levels of student ability, creating a richer, more inclusive experience



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

What it means for designing learning experiences

- Start with defining what learners should know and be able to do by the end of the learning experience
- Then create objective-aligned formative and summative assessments
  - Each learning and enabling objective should be assessed, and each assessment should match the cognitive process level of the objectives
- Finally, create objective-aligned content to help learners successfully complete the assessment
- Content should match the cognitive process level of the aligned objectives

Big Idea 2

Creating strong objectives

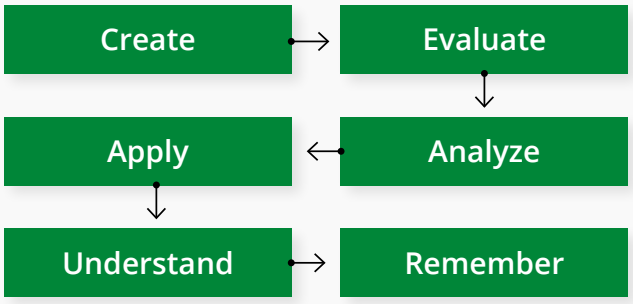
Well-designed objectives are clear and measurable, and taken together they reflect what learners should know or be able to do by the end of the learning experience.

What it feels like for learners

I know precisely what I'm going to learn and how much progress I've made.

Strong objectives:

- explicitly specify observable knowledge, skills, or attributes a learner will achieve as part of the learning experience, based on relevant sets of standards or external frameworks
- reflect the specified measurability attributes while explicitly stating the learning goals
- reflect the appropriate level of the learning



Cognitive process levels

What strong objectives look like:

clear statements

discrete | achievable

aligned to the right cognitive process level

observable | measurable

derived from existing frameworks if possible

There is no "right" number of objectives. Aim for enough objectives to articulate what it means to be successful in that specific unit, course, or module.

Taken collectively, strong objectives should describe success for the entire learning experience, comprehensively articulating what a learner should know and be able to do at the end of the experience.



See this Learning Design Principle: Active Learning, Memory & Practice

What it means for designing learning experiences

- Consider relevant external frameworks that objectives might align to
- Make sure objectives are clear, discrete, aligned, achievable, observable, and measurable
- Make sure objectives are clear statements that learners will understand
- Make sure objectives collectively describe:
  - success
  - what a learner should know and be able to do at the end of the experience
- For existing content:
  - identify and remove extraneous objectives, content or assessments
  - make sure assessments are aligned to an objective and content

Big Idea 3

Two-level objective hierarchies

Two-level objective hierarchies are essential to learning experiences that equip learners to achieve complex learning goals. **Enabling objectives** give learners the foundational knowledge they need to succeed at more complex **learning objectives**.

Learning objectives are broad, course-level goal statements describing what learners will know, think or be able to do by the end of the learning experience.

Enabling objectives are granular, lesson-level goal statements describing the foundational knowledge learners need to succeed with the related learning objective. They tend to be less cognitively complex than learning objectives.

What it feels like for learners

I know where to focus my studies and what I need to do to achieve my learning goals.

- **Two-level objective hierarchies help learners build understanding**
  Having two levels of objectives — foundational and complex — helps make sure assessment and instruction are properly sequenced and scaffolded. When learners are taught foundational enabling skills step-by-step first, they achieve greater understanding of the more complex holistic task.
- **Two-level objective hierarchies support personalized learning**
  A two-level objective hierarchy isolates foundational enabling skills, allowing us to measure learners' progress and diagnose specific misunderstandings. This enables a personalized approach to instruction. For example, if a learner achieves enabling objective 1, but not 2, an instructor can use that information to target support for that learner.



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

What it means for designing learning experiences

- Design objectives to follow a two-level hierarchy
- Design enabling objectives at a lower cognitive process level than the learning objective level
- Make sure enabling objectives outline the foundational knowledge, skills, and abilities needed to achieve the learning objectives
- Support each learning objective with two or more enabling objectives

Big Idea 4

Guiding assessment and instruction

Because they are learning goals, objectives should drive assessment and instruction design. This helps learners progress towards the objectives and allows us to make inferences about the performance of learners and learning experiences.

What it feels like for learners

I'm confident my learning has been designed to help me achieve my goals.

Aligning objectives, assessments, and instructional content at both levels of objectives is essential for learning, the design of learning, and the measurement of learning. Multiple sources show that instructional alignment has a significant, measurable positive impact on learning.

Instructional alignment is part of backward design.

- It allows us to make accurate inferences about what a learner knows and is able to do
- It offers clear insight into learning design, which can improve trust and transparency
- It can support learning, relevance, credibility, marketability, metadata, and curation strategy
- It ensures we are spending development budgets wisely

What it means for designing learning experiences

- First, write objectives to accurately define success
- Then, use objectives to drive assessment design
- Finally, use objectives to drive instruction development, to ensure assessment success
- Explicitly link and tag assessment and instruction elements to objectives — both within and across learning experiences, at both the learning objective and enabling objective level



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

Big Idea 5

Setting expectations for learners

Objectives can help a learner decide if a learning experience is relevant and valuable for them, increasing transparency and motivation and learning. They can improve trust by informing learners up front what will be required and what support will be available.

What it feels like for learners

> *I know what my learning will cover and what I will achieve at the end of it.*

Having clearly articulated, accurate objectives better engages learners, improves performance, increases student gains, and promotes deep learning.

When assessments (formative and summative) and instruction (including images, videos, graphs, case studies, etc.) are aligned to objectives, learners can see the relevance of all content.

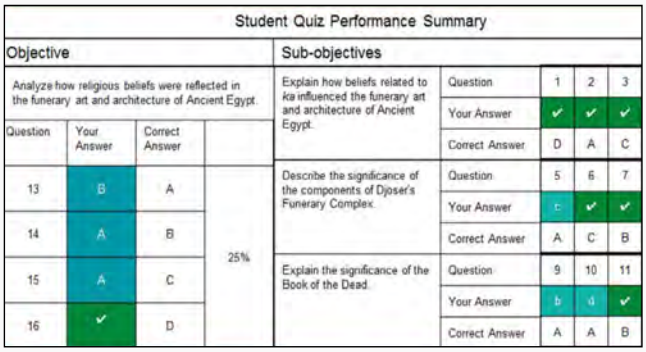
Consider presenting specific objectives at the beginning of each lesson. This can establish relevance for learners and set expectations appropriately. One study found that when objectives are presented first, learners devote more processing power to learning material, spend more time reading, and show greater recall.

What it means for designing learning experiences

- Visually represent relevant objectives at the start of a unit before learners commit to the learning experience
- Consider a dashboard for learners to reflect and track their progress, organized by objective
- Place the relevant subsets of objectives before formative assessment elements to aid knowledge compilation, solidify learning, and remind learners of relevance

Example

In this performance dashboard mock-up, learners and instructors **analyze performance** based on assessment items **aligned** with both the learning and enabling objectives (here called objectives and sub-objectives).



Student Quiz Performance Summary

Objective				Sub-objectives				
Analyze how religious beliefs were reflected in the funerary art and architecture of Ancient Egypt.				Explain how beliefs related to *ka* influenced the funerary art and architecture of Ancient Egypt.	Question	1	2	3
					Your Answer	✔	✔	✔
Question	Your Answer	Correct Answer			Correct Answer	D	A	C
13	B	A	25%	Describe the significance of the components of Djoser's Funerary Complex.	Question	5	6	7
14	A	B			Your Answer	c	✔	✔
15	A	C			Correct Answer	A	C	B
16	✔	D		Explain the significance of the Book of the Dead.	Question	9	10	11
					Your Answer	b	d	✔
					Correct Answer	A	A	B

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Make sure that objectives are presented in an accessible way (consider text alternatives, color contrast checks, etc.)
- When crafting objectives, allow for flexibility in order to meet students where they are, while still encouraging development and growth

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Plan for multi-level objective hierarchies (e.g., learning objectives and enabling objectives) to account for differences in experience and prior knowledge
- Identify what additional support is needed to help learners with different experience levels (e.g., with technology and/or the subject matter) achieve the objectives

Identity

The combination of dimensions that define who learners are to themselves and others

- Encourage content teams to include subject matter experts and content design experts from diverse backgrounds, to make sure objectives are crafted in an inclusive, relevant, and meaningful way for learners of different identities

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Consider whose lens has determined what learners should be able to know and do
- Use these considerations to inform engagement with experts within specific communities and cultures, to account for different learning goals
- Identify the variety of literacies and languages that are needed to meet the objectives of a learning experience and build in additional support to enable members of various cultures with different levels of literacy to experience success

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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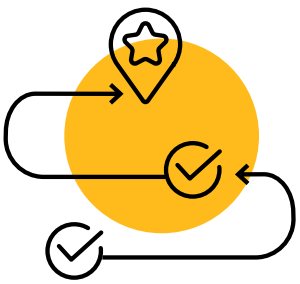
Learning Design Principles

Purposeful Design

Assessment & Evidence-Centered Design



Summary

Assessment & Evidence-Centered Design

For learners to become confident they've mastered the knowledge and skills they need, learning experiences need to be efficient and targeted. Targeted learning experiences rely on accurate assessments of where each learner is.

How do we design accurate assessments that reliably capture these essential insights about learners?

Assessment is any activity that enables us to make inferences about a learner's knowledge, skills or abilities. More than just end of unit tests, assessments can diagnose, support or evaluate learning.

Evidence-centered design (ECD) is a four-component framework for designing assessments to reveal meaningful information about learning and to support learning through effective instructional design.

ECD framework

Domain model

Questions it answers: What knowledge, skills, and abilities are we interested in?

Example: Full list of objectives from a course

Learner model

Questions it answers: What knowledge, skills, and abilities from the domain model do we want to track learners' proficiency in?

Example: A single objective, e.g., 'learners evaluate conflicting historical information'

Task model

Questions it answers: What activities will provide evidence for the learner model?

Example: Tasks aligned to an objective, e.g., reading passage stimulus with open-ended response; scenario with selected-response items; persuasive essay prompt

Evidence model

Questions it answers: What specific behaviors can we observe in the activities that inform the learner model?

Example: Learner behaviors resulting from a task, e.g., recognition of and response to conflicting evidence

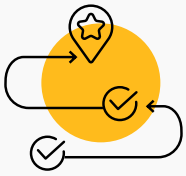
Why it matters

Well-designed assessments can:

- support learning by providing accurate, rich and effective feedback and insight on status and progress
- strengthen the accuracy of claims made about learning status and progress
- support clear ways to measure learner outcomes
- show mastery or achievement in a valid and reliable way

Evidence-centered design is a framework for creating assessments that:

- enable valid inferences about knowledge, skills, and abilities
- go beyond traditional assessment activities (e.g., simulations instead of multiple choice)
- can cope with complex and innovative measurement needs



Assessment & Evidence-Centered Design

The big ideas

1

Assessments can diagnose, support, and evaluate learning. It's essential to design assessment **with the purpose in mind** to make sure assessment provides valid evidence.

Assessments let me check my knowledge level. They also give me feedback while I'm practicing, and I trust them to help me figure out whether I'm on track.

I can tell that the specific thing I'm about to learn is a part of the wider field I want to get better at.

2

The starting point for ECD is the domain model — a clear **lay of the land** of the learning domain that helps plan effective instruction and gives an accurate idea of a learner's knowledge level.

3

Showing and tracking the development of understanding in a domain, or **learner proficiency**, over time is needed to target instruction design and personalized learning. This is the learner model.

I can track where I'm proficient and what I still need to learn.

By doing this task, I can find out if my learning is on track.

4

Learning tasks or activities reveal evidence about what a learner knows and can do. Tasks should be **designed to capture evidence** of success, or learner behavior that reflects the desired objective or outcome. This is the task model.

5

All the ways a learner could respond to a task count as evidence and provide **insights into their proficiency** and understanding. This is the evidence model.

The way I respond to this task provides insights into my understanding and abilities.

I can trust the assessment to measure what I know and what I need to learn.

6

Assessments should consistently and accurately **measure what they claim to**. A reliable, valid, and fair assessment means we can make sound claims about learning.

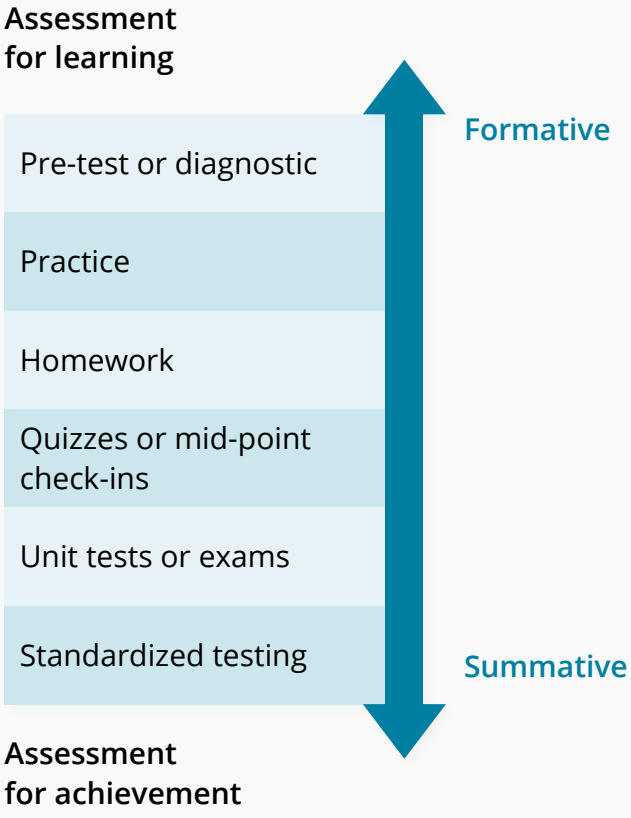
Big Idea 1

Design for purpose

Assessments can diagnose, support, and evaluate learning. It's essential to design assessment with the purpose in mind to make sure assessment provides valid evidence.

What it feels like for learners

Assessments let me check my knowledge level. They also give me feedback while I'm practicing, and I trust them to help me figure out whether I'm on track.



- **Diagnostic assessment** evaluates a learner's proficiency before learning and pinpoints areas for instruction. It points towards corrective interventions or indicates the learner is ready to move on.
  - **Purpose:** To find out where a learner is before starting a new learning experience
- **Formative assessment** provides opportunities for learners (and instructors) to gauge progress, receive feedback, and adjust accordingly.
  - **Purpose:** To support learning during instruction
- **Summative assessment** is a chance for the learner to demonstrate that they know what they're doing by applying knowledge or skills
  - **Purpose:** To determine mastery or achievement
- Formative and summative assessments are designed the same way, but serve different purposes

What it means for designing learning experiences

- Make sure assessment types are based on the purpose of the assessment and the nature of the learning objectives and skills — diagnostic, formative, summative, performance, self, etc.

All assessments should include:

- domain model with objective hierarchy
- assessment items aligned to it
- task, evidence, and learner models
- confirmation of the reliability and validity of items

Diagnostic assessment:

- placed before instruction
- items cover the range of skills, abilities, and difficulty levels
- decision-making accuracy of diagnostic confirmed

Formative assessment:

- placed within and between instruction
- design content for learning, not simply measuring
- incorporate a range of complexity depending on objectives and location in learning
- use primarily to pinpoint misunderstandings and provide feedback
- provide performance information (i.e., scores) to the instructor and/or to guide subsequent instruction

Summative assessment:

- placed after instruction
- make sure all learning objectives are assessed with at least two assessment items
- incorporate a range of complexity based on objectives
- use primarily to measure learners' proficiency level
- provide performance information (i.e., scores) to the instructor so they can evaluate and regulate their subsequent learning, and potentially improve instructional content

Big Idea 2

Domain model

The starting point for ECD is the domain model — a clear lay of the land of the learning domain that helps plan effective instruction and gives an accurate idea of a learner's knowledge level.

What it feels like for learners

> *I can tell that the specific thing I'm about to learn is a part of the wider field I want to get better at.*

A domain is an area of performance, such as calculus or management. Domains consist of many subsets of knowledge, skills, and abilities.

The domain model articulates the knowledge, skills, and abilities that define success. This is important because it defines what we can assess in learners. A domain model is built of objectives or external frameworks, or both. They consist of dependencies and are hierarchical.

When beginning evidence-centered design, be clear on what domain you are trying to assess and what general claims you want to make about the learner and their learning.

What it means for designing learning experiences

- Identify either a subset of learning objectives or external frameworks or topics that are important within the domain
- Use input from appropriate subject matter experts. Ask:
  - What is important about this domain?
  - What work, tasks and situations are central in this domain?
  - What knowledge representations are central to this domain?
  - What objectives, behaviors, constructs, and attributes do we need to measure for evidence?
- Create a domain model, which can simply be an organized list of knowledge and skills or objectives
  - Include enough detail to diagnose and pinpoint learner challenges.
  - It can also represent misconceptions or affective states
- Organize this list of learning objectives or external frameworks hierarchically and articulate dependencies



See this Learning Design Principle: Objective Design

Big Idea 3

Learner model

Showing and tracking the development of understanding in a domain, or learner proficiency, over time is needed to target instruction design and personalized learning. This is the learner model.

What it feels like for learners

I can track where I'm proficient and what I still need to learn.

The learner model is a mathematical model of how learner proficiency changes over time. It maps or is a subset of the domain model. It is important because it answers the question: 'What exactly are we measuring?'

The learner model could look like:

- a subset of learning objectives and associated enabling objectives
- a subset of topics from an external framework
- a specific set of skills pertinent to a specific job-related task

The learner model is populated with specific learner data, and can then be used to make valid claims about a learner's proficiency in these objectives or skills

What it means for designing learning experiences

- Determine which parts of the domain model you want to track, assess and represent to learners
- Explore different ways of scoring learners' proficiency (e.g., percent correct or a more sophisticated method)
- Explore how proficiencies will be presented to learners in a dashboard
- Create the assessments based on the learner model
  - The task model and evidence model will fuel the learner model
  - The more detailed we want to get, the more instances of assessment we need — a minimum of three assessment points for each objective/skill
  - How can we structure the variables based on weights, difficulty, and dependencies?

Big Idea 4

Task model

Learning tasks or activities reveal evidence about what a learner knows and can do. Tasks should be designed to capture evidence of success, or learner behavior that reflects the desired objective or outcome. This is the task model.

What it feels like for learners

> *By doing this task, I can find out if my learning is on track.*

The task model specifies the tasks or activities that will prompt behaviors associated with the learner model, which allow us to make inferences about learners. It is important because it answers the question: How do we measure learning?

The task model can vary in its complexity, from simple selected response items to authentic simulations, with different trade-offs. The chosen task(s) must appropriately prompt and reveal evidence of learning.

Tasks can be simple as multiple choice or complex as navigating through a virtual world. Task models can look like:

- select-response questions
- writing assignments
- driving exams (real on-the-road or simulated)

What it means for designing learning experiences

- Design a set of tasks or activities to reveal evidence of what a learner knows or is able to do (i.e., that will prompt behaviors associated with the learner model)
  - The behaviors you specify in a task (i.e., the evidence) must be reliably measurable and clearly linked to one or more learner model variables
  - Tasks must reveal evidence that is granular enough to inform inferences about students
- If using selected response items, make sure there is more than one item per learning objective
- Select tasks that align with the purpose of the learning experience (e.g., a driving task to assess driving ability, recall items to assess knowledge of facts)
- Make sure evidence can be collected with the selected task models with current capabilities available
- You may need several task models to adequately meet the needs of the learning experience

Big Idea 5

Evidence model

All the ways a learner could respond to a task count as evidence and provide insights into their proficiency and understanding. This is the evidence model.

What it feels like for learners

The way I respond to this task provides insights into my understanding and abilities.

The evidence model lists all the behaviors prompted in a task and assigns weights to the learner model variables. It is important because it answers the questions:

- How do we measure it?
- What behaviors should reveal different levels of the objectives or competencies we're interested in?

Evidence models provide detailed instructions on how we should update our information about the learner model variables given learners' work on tasks. They contain two parts:

- evidence rules, describing how observable variables summarize a learner's performance in a particular task from the work they produced for that task
- measurement model, providing information about the connection between learner model variables and observable variables

What it means for designing learning experiences

When creating an evidence model, consider:

- What specific behaviors can we observe in the activities that inform the learner model?
- Can we align these behaviors with explicit skills or objectives in the learner model?
- What capabilities are necessary to capture observations, behaviors, performance?
- Have all behaviors relevant for each learner model claim been identified?

Example: driving exam

Learner model variable	Behavior	Score	Proficiency
Applies the stopping rules of driving	Completely stops at stop sign	1	50%
	Slows down when seeing yellow light	0	
Can accurately steer a car	Slows down before the corner	0	50%
	Passes cars with 2 feet distance	1	

The behavior column contains the evidence model claims: i.e., behaviors directly linked to learner model variables. Evidence scores are assigned to each claim, and the learner model is updated with proficiency scores.

Big Idea 6

Valid, reliable, and fair assessment

Assessments should consistently and accurately measure what they claim to. A reliable, valid, and fair assessment means we can make sound claims about learning.

What it feels like for learners

I can trust the assessment to measure what I know and what I need to learn.

Validity

- the degree to which evidence and theory support interpretations of test scores entailed by proposed uses of tests
- e.g., if the questions in a written driving test use lots of compound sentences, the test may end up testing reading comprehension rather than driving knowledge; this is not a valid assessment of driving knowledge

Reliability

- the consistency of such measurements when the testing procedure is repeated on a population of individuals or groups
- e.g., if a driving test takes place in a town where there's traffic during rush hour, tests that take place at midday and at rush hour will be quite different; this is not a reliable task for measuring driving performance

Fairness

- the degree to which an assessment produces similar results for different people, free of bias
- e.g., if a written driving test includes contexts that certain learners might find sensitive or not have as much knowledge of, this might not be a fair assessment of driving knowledge

What it means for designing learning experiences

Validity & reliability

- Ensure psychometric validity and reliability, use pre-existing instruments if available
- If claims and/or decisions will be made about learners based on the assessment data, consider conducting validity and reliability research, especially if high-stakes

Fairness

- Use assessment that supports learning and reflection, including formative assessment with feedback
- Design assessments that are open and linked to clear criteria (rather than relying on competition with others)
- Include a range of assessment strategies so that all learners have a chance to perform well

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Make sure assessments of all types are accessible and have been tested using a range of assistive technologies. If an assessment is inaccessible, learners in need of accessible materials and technologies will be unable to demonstrate what they know.
- Encourage assessment creators to include strategies in formative assessments for putting insights about one's learning into manageable and actionable steps.

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Make sure the technology required is responsive (works on any device) and accommodates low bandwidth.
- Make sure learners are familiar with navigating the assessment in the environment it is being delivered in. Make sure there is time for learners to walk through each available technology before the assessment.

Identity

The combination of dimensions that define who learners are to themselves and others

- Mitigate identity threat for members of historically marginalized communities by providing opportunities for self-affirmation; to see mistakes as learning opportunities; and to reframe anxiety as not predictive of failure.

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Encourage assessment developers to integrate options within the diagnostic to not privilege specific language and literacy skills if these are not what is being measured (e.g., if an assessment is not testing writing, allow learners to verbally respond to open-ended questions).
- Supply necessary background knowledge and micro-opportunities for skill-building, because prior education can vary greatly based on what is prioritized in an educational system within a culture.

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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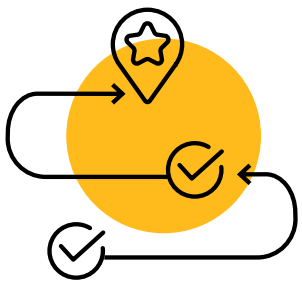
Learning Design Principles

Purposeful Design

Personalized Learning & Adaptive Systems



Summary

Personalized Learning & Adaptive Systems

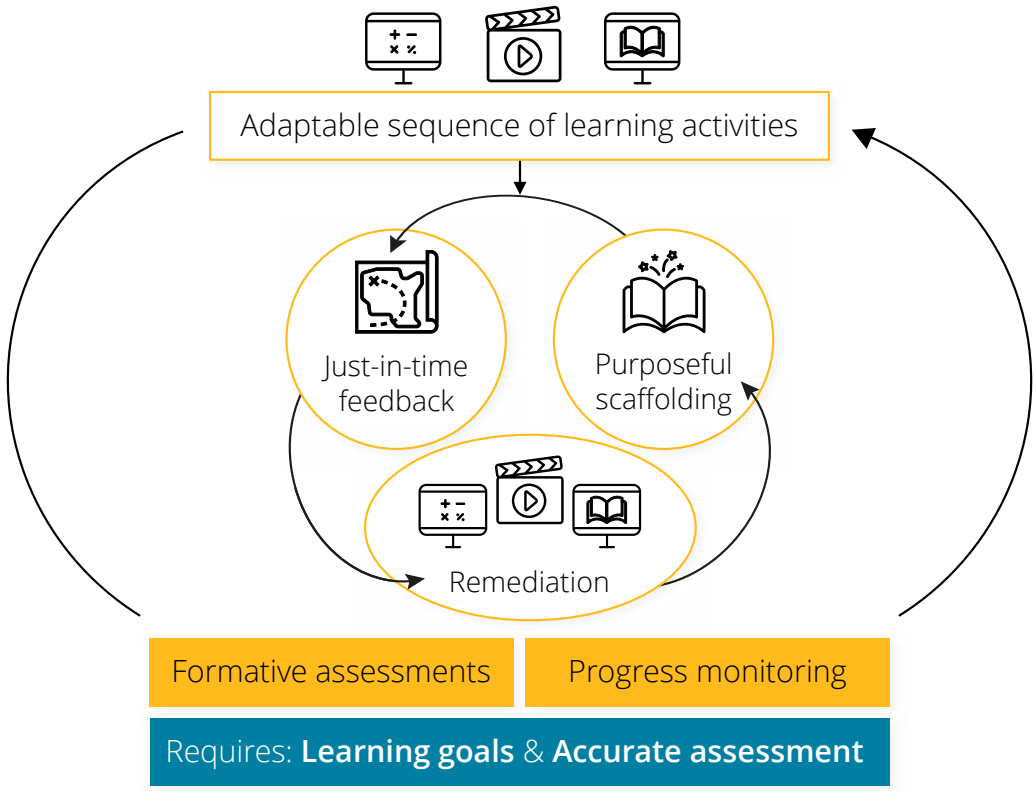
Learners can struggle to understand where they are in their learning journey, what their unique needs are, and where to focus to achieve their goals.

How can more personalized experiences help learners achieve more?

Personalized learning is the customization of components of a learning experience, such as instruction and assessment.

Digital personalized learning attempts to scale up the benefits of one-on-one human tutoring. In digital environments, personalization is usually achieved with adaptive systems. **An adaptive system is a system that changes its behavior in response to its environment, informed by data captured from the environment**.

Adaptive systems can provide personalized learning at scale by



assessing learners' current skills and knowledge, providing feedback and content, and then consistently monitoring progress using learning algorithms that provide real-time updates and the necessary tools to improve student learning. The result is a supercharged learning experience that focuses and adjusts with learners throughout the experience.

Why it matters

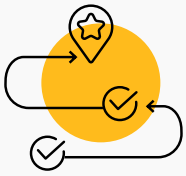
When learning experiences are personalized, learners tend to be more engaged with the content, learn more effectively and efficiently, and experience opportunities to develop self-regulated learning skills.

When learning experiences use adaptive systems, we can provide personalized learning at scale; learning can be self-paced, flexible, with immediate feedback, scaffolding support, and just-in-time delivery; and learners are encouraged to take ownership of their learning.

Impact

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

- learners have a positive learning experience because adaptation provides the right content and experience at the right time
- learners are motivated and enjoy learning because they have opportunities to exercise choice
- learners use good study habits, apply appropriate strategies and help-seeking behaviors, persist, and self-manage because they are supported by scaffolding, hints, and nudges
- learners achieve proficiency on key objectives efficiently, because the learning experience assesses their proficiency and offers content at the right difficulty level



Personalized Learning & Adaptive Systems

The big ideas

1

There are degrees of personalization, and **some methods are more effective** than others. Compared to experiences that aren't personalized at all, personalized learning environments can improve learning.

I need the right learning experience at the right time.

I can't do this easily, but I will be able to figure it out with hints and support.

2

Learning experiences that are **personalized to learners' knowledge and skills** are more efficient and effective than learning that is not.

I am interested — and my knowledge about the topic might help me think about the problem.

3

Learning experiences that are **personalized to learners' interests** can support greater motivation and learning.

4

Personalizing content to match learning styles **does not** support learning or motivation.

I think I'm an auditory learner, but that does not mean I will learn more from an audiobook than an e-text.

I still learn something even when I go in feeling down or distracted.

5

Personalizing content according to **non-cognitive factors**, such as affective states and identity, can sometimes improve learning.

6

Providing learners with **guided choice** in their learning experience can enhance motivation, autonomy, and self-directed learning.

I feel in control of my learning through the choices I am making, but I have guidance to make effective choices.

Big Idea 1

Degrees of personalization

There are degrees of personalization, and some methods are more effective than others. Compared to experiences that aren't personalized at all, personalized learning can improve learning.

What it feels like for learners

I need the right learning experience at the right time.

There are different types and degrees of personalization. These vary based on the capabilities and constraints of the adaptive system being used.

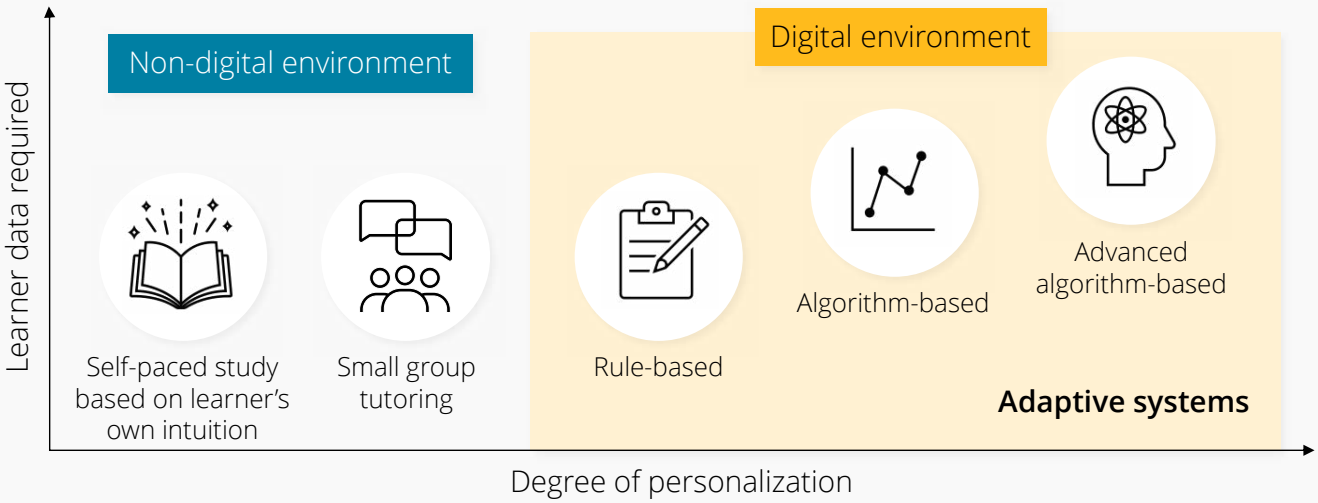
- **Rule-based** personalization uses a decision tree or set of rules leading to several different pre-set learning paths.

  For example: Learners complete a pre-test to identify their current learning needs. Based on the result, they are each assigned to one of four pre-determined learning experiences, each of which comes with a different level of content and support.

- **Algorithm-based** personalization periodically updates the learning experience based on data collected at various intervals during the experience itself.

  For example: A check-in test midway through a chemistry lesson determines that a learner has grasped the pH scale, but is still struggling with acid–base reactions. The system adapts the learning path to provide more instruction and practice on acid–base reactions.

Personalized learning continuum



- **Advanced algorithm-based** personalization uses learner data collected and updated in real-time to change and adjust the learning experience as it happens.

  For example: A system captures behavioral, assessment, and learner metrics in real-time and uses them to inform the order in which activities appear to each learner. The system could take the form of a game, simulation, or highly interactive learning experience.

Personalization can happen at different places in the learning sequence.

- **Lesson-level** personalizes the selection of learning paths, interest customization, or topic sequencing (e.g., course suggestions or branching). It is based on individual or aggregate historical learner data.
- **Task-level** personalizes the next task/problem, or the instructional support within specific steps of the task/problem (e.g., feedback at different problem-solving steps). It is based on individual learner data.



See this Learning Design Principle:
Assessment & Evidence-Centered Design
Objective Design

What it means for designing learning experiences

- Create domain and learner models to identify what level learners are at and what content is appropriate
- Make sure you have enough data about the learner for accurate personalization
- When modeling learners' knowledge, acknowledge that understanding develops over the course of a lesson
- Consider personalized learning at the lesson level and/or task level

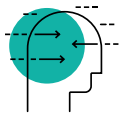
Big Idea 2

Knowledge and skills personalization

Learning experiences that are personalized to learners' knowledge and skills are more efficient and effective than learning that is not.



See this Learning Design Principle: Assessment & Evidence-Centered Design



See this Learning Design Principle: Desirable Difficulty & Scaffolding

What it feels like for learners

I can't do this easily, but I will be able to figure it out with hints and support.

- **Knowledge and skills personalization is highly effective when done right**
  Many meta-analyses have found that personalization based on knowledge level leads to strong, positive effect sizes across different age groups, learning systems, domains, and comparison conditions.
- **Personalize to provide the support they need, and take it away when they don't**
  Learners who do not need no support learn less when it is provided. Support should be adaptively reduced as learners progress.
- **Knowledge and skills personalization requires us to model learners' knowledge**
  Learners' knowledge is not static; it changes as they learn. We should go beyond pre-tests and use models that track what learners know as they progress so we can increase and decrease the level of challenge accordingly.

What it means for designing learning experiences

- Assess learners' prior knowledge and experience
- Provide learning experiences that are appropriately challenging, and provide support when needed
- Include ongoing formative assessment
- Consider personalizing learning based on common misconceptions
- Create domain and learner models to identify what level learners are at and what content is appropriate
- When modeling learners' knowledge, acknowledge that understanding develops over the course of a lesson

Big Idea 3

Interest personalization

Learning experiences that are personalized to learners' interests can support greater motivation and learning.

What it feels like for learners

I am interested — and my knowledge about the topic might help me think about the problem.

- **Interests can provide helpful context**
  Interesting contexts can provide concrete grounding for abstract concepts, creating more ways of accessing and understanding new content.
- **Interests can develop and lead to learning gains**
  Interests can be pre-existing (individual), or sparked by a situation (situational).
  - **Individual interest** is enduring and often carries with it positive feelings, stored knowledge, and personal value. Individual interest typically emerges after repeated experiences of situational interest.
  - **Situational interest** is sparked by the learning environment or features of the content and can fade quickly. Situational interest can be developed into a sustained Individual interest over time with repeated and varied exposure. Personalization can lead to sustained individual interest.
- **Interest personalization should be based on self-identified interests**
  Interest personalization should be driven by the interests that learners themselves identify, not by assumptions based on their identities. Personalization that builds on stereotypes can be harmful to learners' engagement and motivation as well as their identities and agency.

What it means for designing learning experiences

- Base interest personalization on learners' self-identified interests and not on assumptions
- Contextualize the learning content to the learner's pre-existing interests in a light-touch, superficial way
- Transition from situational to sustained individual interest through repeated and novel exposure
- Cultivate sustained interest in a domain through repeated learning experiences superficially personalized to learners' interests
- Consider deeper personalization only if the learners' interests are also specific and deep

Big Idea 4

Caution around learning styles

Personalizing content to match learning styles does not support learning or motivation.

The term "learning style" refers to the popular but unsupported idea that different people learn best in different ways, and that learning is most efficient and effective when learning environments are personalized to match each learner's learning style.

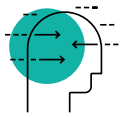
What it feels like for learners

> *I think I'm an auditory learner, but that does not mean I will learn more from an audiobook than an e-text.*

- **No rigorous evidence for learning styles**
  There is relatively little rigorous research that finds benefits of personalizing learning based on learning styles. In fact, most studies do not find a learning benefit from this form of personalization. At best, matching instruction to learning styles or preferences does not affect learning; at worst, it hurts learning.
- **Priority for better researched principles**
  Basing learning experiences on learning science principles, rather than the neuro-myth of learning styles, is more likely to optimize learning outcomes for all learners. Using less effective methods of instruction because of a learner's preferred learning style could be detrimental. Instead, choose stronger learning science principles to design around.



See this Learning Design Principle: Motivation & Mindset



See this Learning Design Principle: Active Learning, Memory & Practice

What it means for designing learning experiences

- Avoid trying to measure meaningful learner factors using existing research into learning styles; most measures of learning styles have poor reliability and validity and are likely not effective for measuring meaningful learner factors
- Avoid personalization based on learning styles
- Choose better supported learning principles to guide instruction
  - There is limited high-quality empirical evidence investigating the effects of personalizing learning experiences based on learning styles.
  - What evidence there is generally shows no benefits to learning outcomes.

Big Idea 5

Research-supported personalization factors

Personalizing content according to non-cognitive factors, such as affective states and identity, can sometimes improve learning.

What it feels like for learners

I still learn something even when I go in feeling down or distracted.

Many factors can potentially be used to personalize learning experiences. The three supported by the most rigorous empirical research are:

- **Learner affect:** Learning systems can detect and respond to affective states like boredom, confusion, or frustration, but results have been mixed, with no clear indication that particular learners benefit more.
- **Gaming the system:** This is when learners take advantage of a learning environment to reach correct answers without engaging cognitively with the content. Personalization can be used to shift learners out of this behavior.
- **Identity:** While there is potential for personalization based on identities or experiences, there currently is very little rigorous empirical evidence testing the value of this.

What it means for designing learning experiences

- Determine methods to detect the personalization factor (e.g. affect or gaming)
- Consider personalization based on affective states, e.g.:
  - personalize to boredom by providing prompts to pay attention
  - personalize to confusion or frustration by providing supportive and empathetic messages
- If gaming is detected, provide suggestions to learners to slow down, or reminders that gaming does not help real learning
- Do more research when considering other personalization factors
- Monitor learner perceptions along with learning gains to ensure overall effectiveness
- Validate effectiveness with careful early-stage research and user testing

Big Idea 6

Guided choice

Providing learners with guided choice in their learning experience can enhance motivation, autonomy, and self-directed learning.

What it feels like for learners

I feel in control of my learning through the choices I am making, but I have guidance to make effective choices.

Choice can increase learners' motivation and performance. However, while many students like having choices, others report higher stress or feeling overwhelmed by academic choice, and learners are often not accurate judges of what they know or what learning practices will be best for them. To reduce these negative effects, provide information to guide learners' choices.

- **Progress information can help learners make instructionally effective choices**
  One study found students learned better with an intelligent tutoring system that let them choose problems, but only when the system provided guidance on what problems to choose based on the students' progress.
- **When allowed to choose when to ask for help, learners may request help too often or not often enough**
  An adaptive system that provided feedback about this behavior led to learners being more likely to request help only when it was appropriate.
- **Choice can be beneficial for all learners; but if a learner makes unproductive choices, it can disrupt other effective learning processes**
  To avoid unproductive choices, make choices educationally irrelevant; or when choices are educationally relevant, provide guidance to help learners make productive choices.
  - **Educationally irrelevant choices (e.g., naming a character)**
    Better for learning, because the learner gets the motivational benefits of making a choice, but still get the most effective learning experience, as determined by the system.
  - **Educationally relevant choices (e.g., deciding which problem to tackle next)**
    Less good for learning, because although learner gets the motivational benefits of making a choice, they may choose a problem that is too easy or too hard, resulting in less effective use of learning time.



See this Learning Design Principle: Self-Regulated Learning & Metacognition



See this Learning Design Principle: Motivation & Mindset

What it means for designing learning experiences

- Provide superficial, educationally irrelevant choices
- If you provide instructionally relevant choices, provide learners with guidance to help them make productive decisions and avoid feeling overwhelmed
  - Provide progress information and guidance on different options
  - Make it easy to seek help
- Instructionally relevant choices can build students' self-regulated learning skills and help them make better choices even once the support is removed

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Consider personalized learning approaches that utilize adaptive systems, so the learning material is presented at the appropriate level of difficulty in manageable intervals.
- Utilize UDL On Campus: Media & Materials (cast.org) to personalize learners' education by providing more choices to access, comprehend, and demonstrate mastery of course material.

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Make sure all media and/or representations of content are available in other formats and are mobile friendly to account for differences in access to resources like the internet or a desktop computer.
- Take a mobile-first design approach and prioritize cross-platform functionality. Optimizing the user experience across platforms will give learners the freedom to vary the platforms they use and choose what is best based on their available resources without sacrificing quality.

Identity

The combination of dimensions that define who learners are to themselves and others

- Avoid assumptions about interests based on identity. Rather, ensure broad representation of interests.
- Use asset-based approaches (e.g., value essays or value questionnaires) to uncover what learners know and can do. These approaches value that every community has strengths, which helps learners who may have experienced being stereotyped or stigmatized.

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Include guides for students to learn from and develop their own personalized strategies to achieve learning goals.
- Create multiple measures to measure mastery. Sometimes language and/or literacy barriers could result in incorrect answers. A variety of measures can allow learners to choose the best way to demonstrate mastery.

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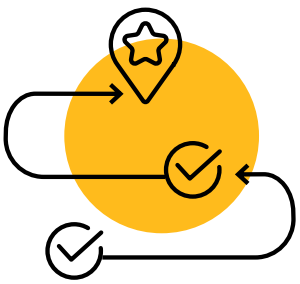
Learning Design Principles

Purposeful Design

Authentic Learning



Summary

Authentic Learning

Learners can struggle to see the relevance of what they're learning and how it applies to the real world.

How can we put learning in context to help make it stick for learners?

Authentic learning is where learners become immersed in problem-solving within realistic situations, resembling the contexts where the knowledge they are learning can be realistically applied. It's the difference between learning about physics and learning to be a physicist.

Authentic learning scenarios include:

- **Authentic tasks** that have real-world relevance and utility, are appropriately complex, and allow learners to select appropriate levels of difficulty or involvement
- **Authentic learning environments** where learners engage with the content to be learned in a simulated, realistic environment so that they can practice working with it in a similar way to how a professional would in the field

Why it matters

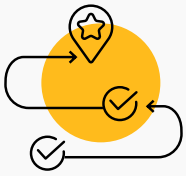
When the content is relevant, learners are motivated to learn. When they learn to navigate a realistic setting, they achieve better outcomes.

It also addresses the knowledge transfer problem. Usually, transferring knowledge learned in one environment to another is hard. But when the learning environment resembles the new situation (i.e., is authentic), it makes the transfer easier. Authentic environments include the same complexity, situations and cues learners will face in the real world, and allow learners to practice while receiving support.

Impact

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

- learners enjoy what they are learning and are motivated, because they see the content as relevant and connected to realistic practice
- learners persist through difficulty because they receive direct instruction before attempting authentic problems, so they know enough to reduce frustration and can self-direct their own learning
- learners build and refine mental models for problem solving, after reviewing a range of models
- learners can transfer their learning to new situations and contexts, because they have constructed mental models via realistic practice



Authentic Learning

The big ideas

1

When learning experiences are explicitly linked to achieving a **real-world goal**, learners find them more meaningful and so are more engaged and motivated.

I get why I'm learning this.

2

When learners understand the **underlying concepts** and rationales, they can make better use of practice in an authentic environment.

I understand why we're doing things this way, and I've been taught enough that I can make good use of my practice time.

I see what it looks like when it's done right.

3

Models and demonstrations help learners learn what good performance looks like (and what it doesn't).

4

Practicing in **authentic scenarios** with real-world problems prepares learners better for real-world tasks.

When I use this in the real world, I'll know what I'm doing.

5

Learning authentic tasks happens best when learners tackle **ill-defined problems**, **craft their own path** to a solution, and **reflect** to become good self-directed learners.

How I tackle these tasks is up to me.

6

Genuinely taking part in a **community of practitioners** hones the knowledge and **habits of mind** needed to join that community for real.

I see how to work with others to get things done.

Big Idea 1

Real-world relevance

When learning experiences are explicitly linked to achieving a real-world goal, learners find them more meaningful and so are more engaged and motivated.

Showing learners the relevance of what they're learning helps them understand why they are learning; makes the learning meaningful; and motivates them to learn.

What it feels like for learners

> *I get why I'm learning this.*

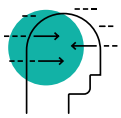
- **Real-world relevance motivates learners**
  Research indicates that explaining to learners why they are learning helps them connect their learning to the real world. When learners can see how the content matters, learning becomes more meaningful and learners are motivated to learn.
- **Real-world relevance aids learning**
  When learners expect to use what they are learning in the real world, they find it more valuable. And when they believe what they are learning is valuable, they are more motivated, persist longer, and learn more.

What it means for designing learning experiences

- Explicitly explain how the content being learned is relevant to the real world
  - When learners know that the content they are learning will help them later in life, they will be more motivated to learn
- Have learners explain how the content is relevant to them
  - Potentially even more useful than telling them how the content is relevant; when students have to define relevance for themselves, they may discover how the content is relevant specifically to themselves
- Give learners problems to solve that are similar to problems professionals solve in their work
- Center content and skills around authentic problems to solve



See this Learning Design Principle:
Motivation & Mindset



See this Learning Design Principle:
Developing Understanding

Big Idea 2

Instruction before practice

When learners understand the underlying concepts and rationales, they can make better use of practice in an authentic environment.

Learning is more effective when learners have sufficient knowledge before practicing or performing themselves. Providing students with key information first allows for more effective exploration of the authentic environment.

What it feels like for learners

I understand why we're doing things this way, and I've been taught enough that I can make good use of my practice time.

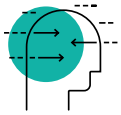
- **Using direct instruction**
  Learning is more effective and efficient when students receive direct instruction before engaging with authentic environments. Learners need a base of knowledge to effectively engage in authentic learning tasks.

  As learners master the necessary skills and concepts, they combine them in more complicated and sophisticated ways. Eventually, they can apply their skills in an authentic learning environment.

  A meta-analysis of different studies found that these effects were robust across different situations (Stockard, et al., 2018).
- **Using exploratory problem-solving**
  In tightly controlled scenarios, it can be beneficial to have learners engage in exploratory problem-solving tasks before direct instruction. These activate relevant prior knowledge, partially build learners' understanding, and increase motivation and curiosity. These tasks must be carefully designed to be effective, though, and in general, direct instruction is more robust and consistent across learners.

What it means for designing learning experiences

- Provide direct instruction on underlying skills and principles first
- Ensure learners have sufficient foundational knowledge to effectively engage in problem solving
- Explicitly link back to concepts from instruction (especially when these skills are not readily apparent to the learners, e.g., soft skills)
- Explain different philosophies or schools of thought and how they interact with the underlying conceptual framework



See these Learning Design Principles:
Developing Understanding
Desirable Difficulty & Scaffolding

Big Idea 3

Modeling

Models and demonstrations help learners learn what good performance looks like (and what it doesn't).

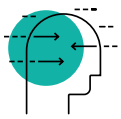
What it feels like for learners

I see what it looks like when it's done right.

- **Learning from models is efficient and effective**
  Observing how others complete a task before attempting the task themselves is effective and efficient, especially for novice learners. Compared to learning through trial and error, learning through modeling — where another person (usually an expert) solves the problem in front of learners while describing their process — is more efficient and less likely to lead to negative outcomes.
- **Modeling is more beneficial when varied**
  Multiple models with varying scenarios and performance quality (including incorrect solutions) are more beneficial than a single, 'ideal' model.
- **Combine with problem-solving**
  Interspersing modeling or examples with problem-solving allows learners to refine their mental models before attempting to solve problems themselves.
- **Modeling includes cognitive apprenticeships**
  Cognitive apprenticeships are like traditional apprenticeships, except learners learn cognitive skills. Learners observe an expert completing the task, then attempt the task with expert support. Over time the expert fades out support until learners can act independently. Experts help learners develop conceptual models which serve as a basis for developing self-monitoring skills. Cognitive apprenticeship is the underlying model used to design intelligent tutoring systems, which have been found to consistently outperform traditional instruction.



See this Learning Design Principle: Social & Collaborative Learning



See this Learning Design Principle: Desirable Difficulty & Scaffolding

What it means for designing learning experiences

- Provide a demonstration or have an expert practitioner model the behavior
- Models should be scaffolded with a think-aloud of the process that explicitly labels skills
- Modeling can take the form of a live demonstration or expert-level performance (ideally with commentary or a talk-aloud on how they did it); direct verbal/visual instructions; worked examples; or a symbolic model, such as a movie or a story
- Include opportunities for the learner to try it out, reflect and compare their performance, and integrate it into their regular behavior
- Use a wide range of models of varying quality, including models of what not to do

Big Idea 4

Authentic practice

Practicing in authentic scenarios with real-world problems prepares learners better for real-world tasks.

Learning is grounded in the context in which it was learned. Authentic learning environments match the professional context and so promote learning and transfer.

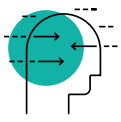
What it feels like for learners

When I use this learning in the real world, I'll know exactly what I'm doing.

- **Authentic practice helps learners connect practice to the real world** Transferring abstract knowledge to a novel context is difficult. To help learners build connections, the learning process should make its relevance to the real world explicit.
- **Authentic practice aids transfer when grounded in real-world situations** Grounding learning in a real-world situation improves the likelihood that knowledge will transfer. Authentic learning environments do not need to exactly match the real-world context to be effective, but the constraints of the task should be authentic, and learners must suspend disbelief to accept the environment as realistic. Authentic learning involves learners solving real-world problems presented as complex real-world activities.

What it means for designing learning experiences

- Provide learners with opportunities to practice with authentic tasks that mimic the real-world complexity and demands (e.g., simulations, teamwork)
- Provide support during practice by integrating formative assessment and feedback throughout the activity
- Guide learners through nuances, relevant cues, and boundary conditions relevant to the context
- Consider learning activities that result in real world deliverables
- Allow ample time (days/weeks) for learners to solve problems, like how professionals complete long-term projects



See this Learning Design Principle: Developing Understanding

Big Idea 5

Self-directed problem-solving

Learning authentic tasks happens best when learners tackle complex, ill-defined problems, craft their own path to a solution, and reflect to become good self-directed learners.

Learning experiences should support them in becoming authentic practitioners and so build self-directed learning, authority, and knowledge of disciplinary norms.

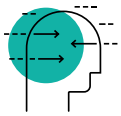
What it feels like for learners

How I tackle these tasks is up to me.

- **Self-directed problem-solving involves ill-defined problems with multiple solutions**
  Authentic learning activities are open to multiple interpretations and allow for multiple perspectives. Learners explore the environment and develop their own objectives, approaches, and solutions. They feel supported by the instructor and able to ask questions. Instructors fade support over time while learners define a path to a solution.
- **Self-directed problem-solving involves learners defining their own approaches**
  Instructors support learners in developing metacognitive skills through modeling and prompts. Learners engage in self-reflection throughout the experience to evaluate their current learning process, changing their process if they determine it will not help them reach their goal.



See this Learning Design Principle: Self-Regulated Learning & Metacognition



See this Learning Design Principle: Desirable Difficulty & Scaffolding

What it means for designing learning experiences

- Provide complex problems that can be solved or approached in multiple ways
- Provide ill-defined problems with multiple possible solutions
- Provide a mix of relevant and irrelevant information for learners to sort through
- Allow for and support independent, self-directed learning
    - Allow learners to determine the tasks and sub-tasks needed to complete the activity
    - Provide opportunities for learners to ask clarifying questions
    - Provide learners with scaffolded guidance
    - Provide opportunities for learners to self-reflect and adjust learning strategies as needed

Big Idea 6

Stepping into the community

Genuinely taking part in a community of practitioners hones the knowledge and habits of mind learners needed to join that community for real.

What it feels like for learners

I can take on real tasks and learn from people more advanced than me what I need to do, and how I need to do it.

- **Legitimate community participation hones knowledge and habits of mind**
  Learning how to act as a member of a community is just as important an outcome as learning knowledge and skills. Participating in authentic but appropriately-sized tasks bolsters both outcomes.
- **Participation as a path to learning**
  The community's practices form a "curriculum" which the learner can learn by participating. Learners must have access to arenas of mature practice to effectively learn. To go from newcomer to seasoned practitioner, one must learn: what to do, how to behave, what to create, and what activities, people, communities and sources of knowledge are valued.

  Situating authentic learning tasks within authentic communities helps learners acquire the practices and habits of mind of full and mature participants. Participation helps learners develop their identity as true participants in the domain. This can increase motivation and satisfaction, and provide a deeper sense of the value of participating.



See this Learning Design Principle: Social & Collaborative Learning

What it means for designing learning experiences

- Provide access to a mature authentic community of practice, so learners can learn different ways to accomplish meaningful tasks
- Have learners act as part of the practitioner community by doing genuine tasks (more than observation)
- Provide instruction, guidance and reflection opportunities alongside these tasks
- Sequence learning activities appropriately
  - Conceptualize the whole task before executing specific parts
  - Early tasks should be short and simple, with small cost for errors
  - Increase task complexity and diversity over time
- Provide access to the help resources and informal networks that real practitioners use
- Provide peer or near-peer support and feedback
- Support self-directed learning by encouraging learners to verbalize their knowledge and thinking, and engage in comparison, reflection, and exploration

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Make sure each mode of presentation is descriptive and informative from an accessibility standpoint, so all learners can grasp course material, regardless of the modality they learn from
- Seek input from learners of different communities to understand what authentic learning looks and feels like from their perspective

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Authentic practice and environments often require media-rich examples, which can affect learners with limited access based on many factors. Include non-media rich equivalents that can be accessed at any time.
- Include tutorials, hints, or help throughout the learning to support varied levels of familiarity and background knowledge of authentic digital learning.

Identity

The combination of dimensions that define who learners are to themselves and others

- Encourage content teams to include subject matter experts and content design experts from diverse backgrounds to ensure the inclusion of meaningful authentic learning environments related to identity and real-world role models of historically marginalized identities.

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Work with learning designers and engage with individuals from various cultural backgrounds to understand what approaches result in successful goal-setting and authentic learning.
- Consider the source and nature of feedback to make sure that cultural sensitivities are addressed, so learners can use feedback as constructive criticism (rather than as a threat/attack) to ask questions and improve learning.

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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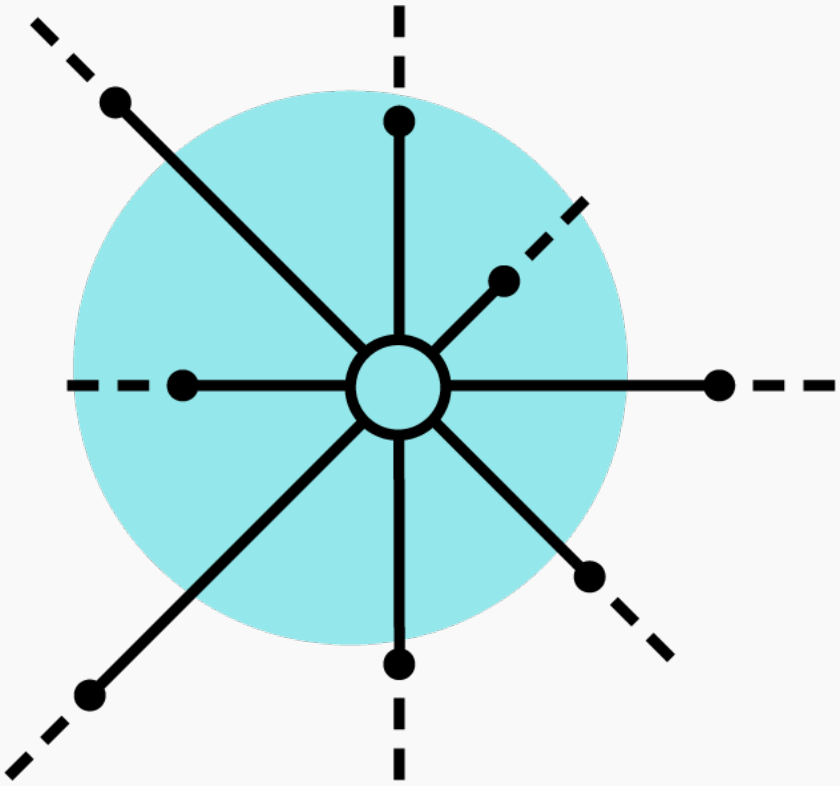


Great learning can happen anywhere

The learning experience is optimized for how it will be delivered, the content, and the learner

And we have guidance on how to make that happen in different contexts

Digital & Virtual Learning

1. Audio
2. Video
3. Digital reading (ebooks)
4. Games & virtual worlds
5. Simulations
6. Mobile learning
7. Immersive learning

English Performance Standards

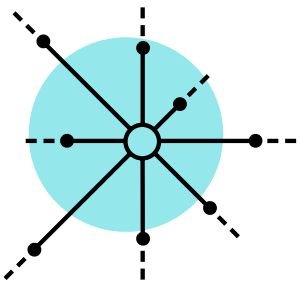
1. Standards as goals and measures
2. Standards as a starting point
3. Standards are probabilistic



Learning Design Principles

Learn Anywhere

Digital & Virtual Learning



Summary

Digital & Virtual Learning

Technology can be a powerful delivery method for high quality learning. Each tool has a unique set of affordances that can be leveraged to contribute to the creation of a well-designed learning experience.

How do we thoughtfully align learning goals and how digital or virtual tools might help learners achieve those goals?

Digital learning is any learning facilitated by technology. Each technological tool has specific advantages that can contribute to a well-designed learning experience.

The SAMR (substitution, augmentation, modification, redefinition) model helps us think about how much a use of technology adds to a learning experience, as opposed to just replicating the analog experience.

		EXAMPLE	
R	**Redefinition** Digital technology enables an entirely new experience	Students work on an interactive simulation to build a nuclear reactor	TRANSFORMATION
M	**Modification** Digital technology is used to redesign an existing experience	Instead of studying a static diagram of a physics concept, students watch a video and predict what happens next	
A	**Augmentation** Digital technology substitutes for analog technology, but with a functional improvement	A diagram on a digital computer displays labels when students click its various parts	ENHANCEMENT
S	**Substitution** Digital technology substitutes directly for analog technology, with no functional improvement	Displaying a diagram on a digital projector instead of an overhead projector	

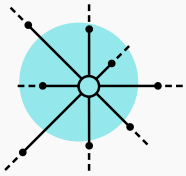
Why it matters

- Integrating digital tools in the classroom can provide new ways to learn, foster more autonomous learning, facilitate access to information, and promote collaborative efforts among students
- Well designed digital and virtual learning can be more flexible, cost-effective, targeted and personalized, accessible, and inclusive of varying learner types
- Technology can remove time and location constraints on learning
- When well-designed, digital learning experiences can have a positive impact on learning gains and other important outcomes such as motivation, intellectual openness, work ethic, conscientiousness, and positive core self-evaluation
- Learning that interacts with the learner, allowing them to define the parameters of the experience and track progress, enables successful goal-directed behavior

Impact

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

- learners can more easily access learning materials on the go
- learners are motivated to continue learning because digital technologies feel engaging, game-like, and fun
- learners perceive content as relevant to the real-world because immersive environments allow authentic practice
- learners experience intellectual openness because they can observe, interact with, and build trust with peers
- learners build a more robust understanding of the concept because they engage multiple sensory modalities



Digital & Virtual Learning

The big ideas

1

Delivering information as **audio** can support learning by freeing up learners' working memory.

I can listen to my material on any device, on the go.

2

Videos can support learning as long as they are closely aligned with objectives.

Videos let me see and hear my learning experiences.

3

Ebooks can support learning by using interactivity and multimedia to encourage active learning.

While I read on my digital device, I can interact with content to look up info and take notes.

4

Games and virtual worlds can support learners and learning in many ways, especially when combined with traditional instruction.

I get to learn via a playful medium of games that have clear goals, feedback, and simulations of problems to solve.

5

Simulations can support learning by providing authentic experiences of tasks and environments that learners could not experience otherwise.

I get to engage with an environment rooted in my physical reality, but include parameters of a different world.

6

Mobile devices can support learning by empowering learners to learn when and where they want.

I can access many types of services on the go from my mobile device.

7

Immersive virtual environments can support learning in many of the same ways as games, but with more complete suspension of disbelief.

I get to experience a new environment, be fully present in it, and interact with it in a variety of ways that removes me from physical reality.

Big Idea 1

Audio

Delivering information as audio can support learning by freeing up learners' working memory.

What it feels like for learners

> *I can listen to my material on any device, on the go.*

Audio-based learning tools include podcasts and audiobooks, usually focused on specific topics supplemental to learning goals.

Learners process audio information through their auditory–verbal "channel", leaving the visual–pictorial channel free or able to attend to complementary information. Each channel can only take in and process so much information, so leaving one of them free can be beneficial for a learner's working memory capacity.

Audio can support learning by offering:

- **ubiquitous and easy access:** many portable devices support audio, so learning is not constrained to one location
- **low cognitive load:** audio can supplement and reinforce traditional reading; and free up working memory, so learners can engage in deeper thinking and cognitive processing of the material
- **cost effectiveness:** audio learning tools are not very expensive to create
- **static content:** learners can listen to learning audio as often as needed

This means audio technology may be best suited for:

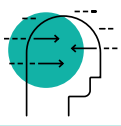
- supplemental instruction to let learners review material they missed or did not understand in class
- language learning, since most of the tasks needed for success focus on auditory discrimination elements

Evidence of effectiveness

- Including podcasts in education materials improves learners' perceptions of their learning gains (Taylor, 2009; Anzai, 2007)
- Podcasts can foster a sense of community among learners and encourage dialogue in remote online courses (Nie, Armellini, Harrington, Barklamb, & Randall, 2010; Lee, McLoughlin & Tynan 2011)
- Learning from a screen can reduce learning and comprehension. Ebooks activate both the auditory–verbal and visual–pictorial channels, while audiobooks and podcasts, which activate only one channel at once, have seen positive results

Drawbacks and considerations

- Most research about podcasts in learning has only been with learners in high schools and beyond
- Learners are less likely to treat a podcast as a "real" reading assignment; they may listen passively as they engage in other tasks, which could dilute its effectiveness
- It can be hard to know where one is in an audiobook or to go to a location easily, compared to a physical book
- Since audiobooks have no visual breaks at the end of pages, it is harder to stay focused for a long amount of time



See this Learning Design Principle: Attention & Cognitive Load

What it means for designing learning experiences

- Include prompts that engage the learner and help focus attention, such as “Let’s recap the key points…”
- Use audio as a supplemental tool and clearly convey how it can help learners comprehend and review other material
- Consider using audio controls (rewind, fast-forward, pause) to increase user control
- Make sure content is available on a versatile platform to allow for ubiquitous access

Big Idea 2

Video

Videos can support learning as long as they are closely aligned with objectives.

What it feels like for learners

Videos let me see and hear my learning experiences.

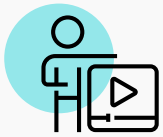
Videos combine elements such as music, graphics, and narration, to communicate information in an engaging, representative, and meaningful way.

In learning, videos are usually:

- recordings of lessons
- live video calls
- recordings of supplemental events

One of the main ways humans learn is through the visual–pictorial "channel". To support learning, videos should be visually appealing and intuitive to understand, but remain focused on the concepts to be learned, rather than trying too much to entertain.

Learning is more effective if corresponding visual and verbal representations are in working memory at the same time, as when watching a video.



Video can support learning by offering:

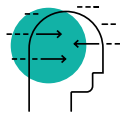
- **representational fidelity:** dynamic visualizations can present content that is difficult to verbalize, making it easier for learners to see step by step details of a procedure, observe others' perspectives, see an event from the start to finish, or view events and scenarios that they could not experience in life
- **ubiquitous and easy access:** almost any device with a screen supports video, so learning is not constrained to one location
- **social connection:** discussing a video in the comments or discussing topics over videoconference can connect learners. Learning communities can form quickly and collaboratively
- **attentional & motivational engagement:** videos can capture attention and focus, increasing interest in the topic, and energizing action

Evidence of effectiveness

- Videos can enhance learners' skills (Kay, 2012). However, it is important to decide whether the learning outcome needs a video component, and to avoid overloading learners with extraneous information (Brame, 2016)
- Making videos allows learners to accommodate their prior understanding and change it to fit new information, solidifying comprehension and surface gaps in knowledge (Nikitina, 2009)
- Videos can work as feedback and discussion tools as long as there is a psychologically safe culture in the group
- Video can help learners transfer existing knowledge into a new context by allowing them to observe demonstrations, receive repeated feedback, and make iterations (Reed, Andrews & Phillips, 2013)

Drawbacks and considerations

- Videos cannot produce visual mental representations — which are optimal for information integration — if the content does not match the learning goals, or if the videos give the learner extraneous information
- Videos are easy to consume passively, so educators need to be trained to use videos not just to substitute other forms of learning, but to enhance it in some way
- Videos can give learners a mistaken belief that they have understood a topic



See these Learning Design Principles:
Developing Understanding
Attention & Cognitive Load

What it means for designing learning experiences

- Use videos that are clearly aligned with the topic at hand, and ideally with learning objectives, not ones that are tangential or "just for fun"
- Use videos to provide examples of learning concepts in real-world contexts
- Embed videos in active learning experiences by using guiding questions, interactive elements, or associated homework assignments
- Keep cognitive load low by:
  - using signaling to highlight information
  - weeding out unnecessary stimulations
  - using conversational language
  - segmenting and packaging videos into short clips

Big Idea 3

Digital reading (ebooks)

Ebooks can support learning by using interactivity and multimedia to encourage active learning.

What it feels like for learners

> *While I read on my digital device, I can interact with content to look up info and take notes.*

Ebooks are digital texts that can include interactive and multimedia features, such as embedded video, interactive tables of contents, and the option to have the reading device read the text aloud.

Ebooks can support learning by offering:

- **ubiquitous and easy access:** ebook platforms can contain thousands of texts and be accessed on most mobile devices, so learning is not constrained to one location
- **cost effective:** ebooks are not very expensive to produce or obtain. They can also update periodically, rather than requiring learners to buy updated textbooks each year
- **interactivity:** interactive ebook features can help make sure learners actively process the information. Interactivity can also create a better experience for learners who need more motivation to engage with reading

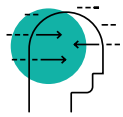
Evidence of effectiveness

- Ebooks that include notetaking and sharing options can promote slower, more intentional reading that results in deeper thinking and better comprehension (Lim, Whitehead, & Choi, 2021)
- Ebooks that allow highlighting, writing keywords, notetaking, writing summaries, and reflection can help to improve comprehension (Dunlosky, Rawson, Marsh, Nathan & Willingham, 2013)
- Ebooks that allow learners to share notes, annotate texts together, and share statistics on reading can create feelings of adaptive social comparison (Coiro, 2021)

Drawbacks and considerations

- Learners who have not used ebooks prefer print texts. Adolescent readers report enjoying the tactile feel of books and the sense of progression as they make their way through a book. 75% of college students would opt for a print textbook over a digital one. However, once learners use well-designed ebooks, they prefer them over print
- When learners are not trained to use ebooks effectively, and the visuals are over-stimulating, or there are time constraints on learning, digital media encourages quick and shallow processing

- When ebooks are designed without their potential added value in mind, they can become digital copies of print texts, and lose the support they could potentially provide
- Learners who use digital texts report spending more time reading but show poorer outcomes on tasks, suggesting that this form of media might undermine efficient, focused processing



See this Learning Design Principle: Active Learning, Memory & Practice



See this Learning Design Principle: Self-Regulated Learning & Metacognition

What it means for designing learning experiences

- Train learners to use digital texts and their features
- Leverage the interactivity of e-books to encourage collaboration
- For accessibility, when designing the text itself, make features operable for both laptop and e-reading formats
- Keep animations and visuals congruent to the content
- In e-books, include highlighting, outlines, and graphic organizers such as maps

Big Idea 4

Games & virtual worlds

Games and virtual worlds can support learners and learning in many ways, especially when combined with traditional instruction.

What it feels like for learners

> *I get to learn via a playful medium of games that have clear goals, feedback, and simulations of problems to solve.*

In games, learners can engage in a playful form of learning that has clear goals and feedback, and simulates a problem to solve.

Learners who used well-designed, serious games have showed higher cognitive gains and reported more positive attitudes towards learning than those who received traditional instruction.

Games can support learning by offering:

- **active learning:** games require the learner to take an active role in the environment, which can foster active learning if well-designed
- **cognitive development support:** using intermittent reinforcement, rewards, characters, and narratives, games allow children to play with new concepts, symbols, and schemas
- **motivation:** games fulfil basic psychological needs such as autonomy and competence, which motivates learning. Their incentive structures help foster high situational interest, which also increases motivation
- **social connection:** gaming environments include chats, message boards, or blogs where players can discuss strategies and share experiences. This type of 'collective cognitive responsibility' is associated with better learning outcomes
- **global connection:** the opportunity to interact with users from around the world can promote cultural sensitivity and awareness of global issues. Translation technology available in some games can overcome language barriers, increasing communication options
- **competition and collaboration:** using leaderboards and peer ratings, games can foster a healthy sense of social comparison, which can spur motivation and performance in some individuals
- **personalization:** games can collect data about the learner as they progress and give them individualized feedback. Adapting and scaffolding to the learner lets them feel in control of their learning, have confidence in mastery over the material, and foster autonomy
- **identity exploration:** learners can choose avatars that are unlike themselves to communicate with other collaborators. These extended options for self-expression can foster creative activities and interaction
- **authentic learning:** games and virtual worlds provide an almost endless variety of virtual contexts that give learners a

sense of "being there," and the ability to apply learning in a plausible, unique context
- **innovative assessment:** games can make sure learners always have the information they need to perform the task at hand, continually updating them so that the various phases of assessing their understanding are independent, not interdependent

Evidence of effectiveness

- Digital games have been found to significantly enhance student learning relative to non-game conditions (g = 0.33)
- Augmented game designs were associated with a 0.34 standard deviation improvement in learning relative to standard games (Clark, Tanner-Smith & Killingsworth, 2016)
- Analyses show that game-based learning can be especially effective in combination with traditional instruction; when learners have some control over how and when to use them; when they include intelligent, explanatory feedback; when learners have training and support to use them; when visual/narrative elements are kept simple and in line with learning goals; and when they include task-oriented active learning components

Drawbacks and considerations

- Game-based learning needs to strike a balance between covering the subject matter and the learner's desire to prioritize game play
- There are not many randomized controlled trials of game-based learning for the K–12 age group



See these Learning Design Principles:
Social & Collaborative Learning
Motivation & Mindset



See this Learning Design Principle:
Personalized Learning & Adaptive Systems

What it means for designing learning experiences

- Game conditions involving multiple gameplay sessions provide significantly better effects
- Single-player games without competition and collaborative team competition games outperform other forms of game
- Games with intelligent agents or that adapt scaffolding to past performance are better than those just indicate success/failure with points
- Simple, schematic, symbolic graphics are more effective
- Simple narratives with shallow content that only involve setting, scenery etc., are better than those with complicated narratives that change over the course of the game
- Rudimentary games that involve adding points and/or badges can be just as effective as those with scaffolding prompts, hotspots, and so on

Big Idea 5

Simulations

Simulations can support learning by providing authentic experiences of tasks and environments that learners could not experience otherwise.

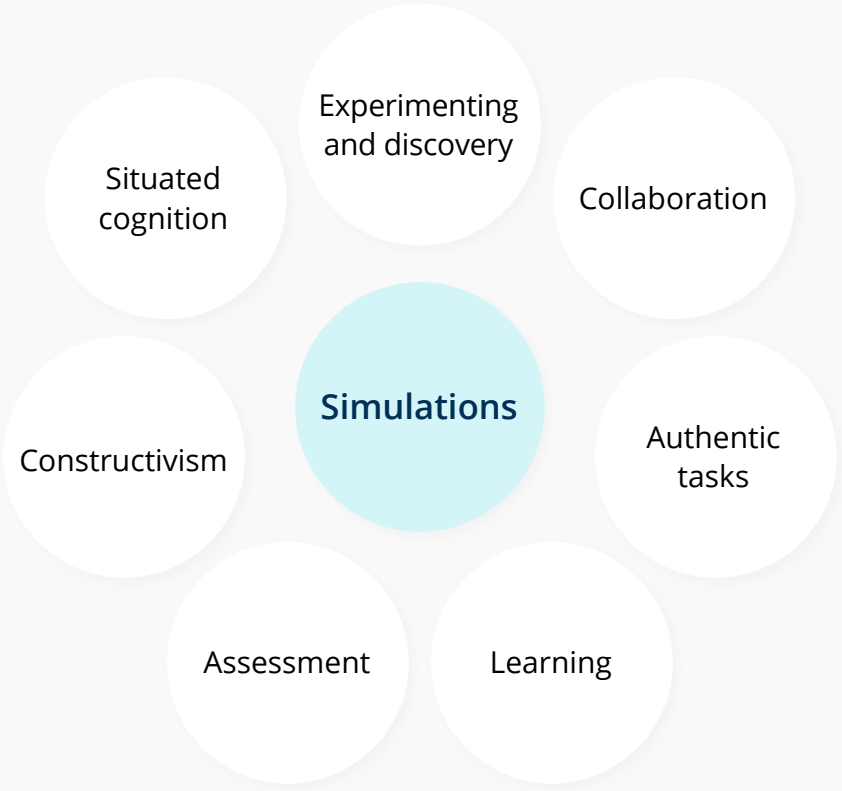
What it feels like for learners

> *I get to engage with an environment rooted in my physical reality, but include parameters of a different world.*

Simulations can allow medical students to practice operative techniques, trainee pilots to learn to fly a plane, and other educational purposes. Simulations are thought to be effective because they allow the learner to learn by doing.

Simulations can support learning by offering:

- **active learning:** simulations require learners to think more creatively, use more collaborative problem-solving skills, and engage in more hands-on work than traditional methods
- **authentic learning:** learners can use simulations to explore phenomena they could not normally observe or manipulate. Since the environment of the simulation is simplified, teachers can focus learners' attention on the objectives
- **personalization:** simulation software can automate individual learner feedback, provide appropriate scaffolding, and generate progress and proficiency reports for teachers and learners. In procedural skills training, receiving immediate individual feedback from multiple sources allows for iterative processing



- **authentic stealth assessment:** simulations serve up challenges based on what the learner is doing, using all actions as assessments rather than ending with a final test
- **attentional and motivational engagement:** simulations allow learners to suspect disbelief and become absorbed in tasks as if they were doing them for real. When students are absorbed in this way, they engage, use higher-order thinking skills, and put more effort into studying

Evidence of effectiveness

- Business school students exposed to business simulator games are more engaged; use more creativity, critical thinking, collaboration, and problem-solving; and perform better on the simulated task outside the simulation (Buil, Catalan & Martinez, 2019; Huang, Silitonga & Wu, 2022)
- Simulations were found to be most effective in conjunction with traditional instruction; when instructional support is provided; and when they challenge preconceptions (Smetana & Bell, 2012)

Drawbacks and considerations

- Simulations can be costly, both financially (for the equipment and infrastructure) and in terms of time to set up the program and integrate it into the lesson plan
- Use of simulations in learning is constrained by space and materials, time, teachers' knowledge, class sizes, learner and teacher mobility, instructional freedom, and internet connectivity
- Simulations need to include as many relevant aspects of the environment as possible to be authentic, but if they contain too many details that are not germane to the problem at hand, cognitive load can introduce construct-irrelevant variance
- If a simulation does not allow learners to interact in significant and meaningful ways, it is difficult to make inferences about what learners know and can do



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

What it means for designing learning experiences

- Match games and simulations to learning goals
- Build in guidance, scaffolding, and structure
- Incorporate instructional examples that state the principles and concepts being illustrated in the simulation, to set the context for the learner and provide a reference for reflection and explanation
- Keep graphics simple
- Allow the user to guide/manage complexity. Moving from simple to complex goals and simulations as learners progress to advanced stages of training can be useful as well

Big Idea 6

Mobile devices

Mobile devices can support learning by empowering learners to learn when and where they want.

What it feels like for learners

> *I can access many types of services on the go from my mobile device.*

With the help of a mobile communication device, learning can take place anywhere. Learning on mobile devices is commonly delivered via mobile apps.

Mobile devices can support learning by offering:

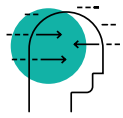
- **seamless and authentic learning:** learners are empowered and supported to learn wherever and whenever they are stimulated to learn, switching between devices, interweaving formal and informal learning, and always remaining connected to peers and teachers
- **ubiquitous and easy access:** learning can occur on almost any mobile and even switch between devices
- **attentional & motivational engagement:** mobile learning often uses game-like elements to make interactions more active and context specific. These elements have been shown to increase engagement, motivation, and creative problem-solving, encouraging imagination and helping learners feel a sense of mastery of the subject
- **multimodal learning:** mobile devices offer a dynamic range of touch, voice, visuals, and audio. Cameras, microphones, accelerometers, and GPS can enable new experiences and interactions as well as lessen the learner's workload
- **informal learning:** most studies show that learners prefer on-demand, informal learning, such as listening to a lecture as they drive, or looking something up at the moment it occurs to them

Evidence of effectiveness

- 69.95% of learners using a mobile device performed significantly better in dependent variables related to cognitive achievement than those not using mobile devices. The effect was larger when the devices were used in informal learning settings (such as museums and zoos) than when in formal settings such as classrooms (Sung, Chang & Lui 2016)
- Students perceive mobile learning material in a very positive light thanks to its game-like elements and flexibility of use (El-Sofany & Haggar, 2020; Evans, 2008)
- Mobile learning has a positive impact on how learners interact with their peers, including increased cooperation, feelings of shared responsibility for learning, and asking for and offering help to others (Lan, Sung, & Chang, 2007)

Drawbacks and considerations

- Compared to reading on a full-size monitor, reading on a mobile device is slower and often decreases comprehension
- Many learners multitask when using their mobile devices for learning. Research shows that multi-tasking overloads the cognitive system and does not allow the learner to fully pay attention to one task, with detrimental effects on learning
- Mobile devices can only keep learners connected with a secure, reliable network connection. Public networks have created new potential targets for third parties to obtain sensitive data
- Different devices have different limitations. For example, older phones have limited storage space; some newer devices have short battery lives; and it can be challenging to input information on small devices that lack a keyboard and mouse



See this Learning Design Principle:
Attention & Cognitive Load

What it means for designing learning experiences

- Start with the learning objectives. Instead of thinking of mobile device use as the outcome, focus on the way devices can enable learning experiences that are not otherwise possible
- Make sure the device being mobile is necessary and meaningful for the learning task
- Leverage the capability of devices to foster social connection, such as through groups or message boards
- Ensure privacy and security for learners by using licensed software, blocking unnecessary pop-ups/ads, and following data use guidelines

Big Idea 7

Immersive learning

Immersive virtual environments can support learning in many of the same ways as games, but with more complete suspension of disbelief.

What it feels like for learners

> *I get to experience a new environment, be fully present in it, and interact with it in a variety of ways that removes me from physical reality.*

When a learner is fully immersed in a virtual environment, they can suspend disbelief and fully inhabit the new context. This empowers learners with a greater sense of agency, supporting intentional exploration and actions.

Immersive media can be:

- **augmented reality:** imagery overlaid onto the real world (e.g., Snapchat and Instagram filters)
- **mixed reality:** similar to augmented reality, but users can interact with imagery in real time
- **virtual reality:** uses sensory output like sounds and images to create an imaginary world or one that mirrors a real environment, often using a specialized headset
- **cross-reality:** any system that combines the hardware and software of the three above

Immersion can support learning by offering:

- **empathy building:** virtual reality can allow learners to take on another person's role, such as being in a wheelchair or being a different age or race
- **embodied cognition:** feeling fully present in the virtual environment helps learners to effectively interact and construct knowledge
- **personalization:** immersive learning environments allow learners to choose their own path. Personalized goals can improve motivation and engagement with the content
- **identity exploration:** immersive platforms allow learners to create identities separate from their real-world appearance and experiences and to express themselves in the way they want to be perceived
- **active learning:** virtual environments require learners to take an active role in the environment, which can foster active learning if well-designed

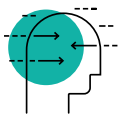
Many of the ways games and virtual worlds support learning also apply to immersive environments.

Evidence of effectiveness

- Immersive experiences are associated with longer memory retention, improved physical task performance, increased collaboration among students, and increased student motivation (Henderson and Feiner, 2009)
- Virtual and augmented reality programs are used for various forms of medical training, and analyses show that they can have positive effects on skill acquisition and performance improvement (Chen et al., 2020; Guedes et al., 2019; Haque & Srinivasan, 2006; Jin et al., 2020; Kyaw et al., 2019; Portelli et al., 2020; Woon et al., 2021; Zhao, Xu, et al., 2020)
- For children with disabilities, especially those with a deficiency in social skills, augmented, virtual and mixed reality interventions were useful in 65% of the results on domains such as emotion recognition, relationship skills, social awareness, cooperation, and executive functioning (Mosher & Carreon, 2021)

Drawbacks and considerations

- Implementing immersive learning technologies at scale is expensive. Advanced virtual spaces using CAVE technology or motion platforms, although useful and effective in promoting learning, are not accessible to the general population
- Most research that shows positive effects of immersive learning has been done with higher end technologies, leaving it unclear whether proposed low-end versions are as effective
- Reviews of immersive media interventions since 2013 found that few studies explicitly used a predetermined learning theory to advise the characteristics or methods



See this Learning Design Principle:
Attention & Cognitive Load



See this Learning Design Principle:
Social & Collaborative Learning



See these Learning Design Principles:
Authentic Learning
Personalized Learning & Adaptive Systems

What it means for designing learning experiences

- Focus on the tools and software already available to many learners: smartphones and tablets
- Consider designing apps for all versions of devices
- Provide meaningful tutorials and online support for navigating the software
- Consider learners' needs and safety
- Consider whether immersive worlds are the correct medium for the learning goals

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Work to balance over and under-stimulation. Match the features of digital tools to the learning goals, while implementing supports whenever possible to reduce extraneous working memory and cognitive load constraints to support relevant learning processes
- Include opportunities for learners to reflect upon information to determine if they understand or need to revisit certain content. Examples include feedback, summarization exercises, etc.

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Consider that learners have varied levels of access to technology. Focus on tools and software that are available to most users, such as smartphones and tablets. A variety of mediums and app/device versions to access digital learning tools should also be provided
- Provide meaningful tutorials and online support to support varied levels of familiarity and background knowledge with certain digital tools and their features

Identity

The combination of dimensions that define who learners are to themselves and others

- Make sure content and customization features (when relevant) are inclusive of all learners (i.e., inclusive pronouns, race and body type customization). Engage with diverse communities and subject-matter experts to review and create content

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Include projects and experiences where possible to provide opportunities for learners to engage in different world experiences, such as participating and connecting with people from different cultures and lived experiences. This can foster inclusion and alternative points of view

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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Tanya Churaman is a researcher and expert programmer that turns data challenges into practical solutions. She earned a bachelor's and master's in Computer Science at Georgia Tech. Her experiences and skillsets span across ML, HCI, XR, Psychology, and Education, which has played a significant role in researching how technology can revolutionize how people learn and work. Tanya has worked as a Quantitative Research Scientist and Psychometric Data Manager to develop evidence-based metrics on learner outcomes and test design at Pearson.

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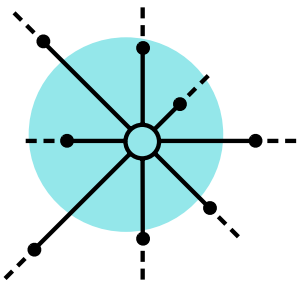
Learning Design Principles

Learn Anywhere

English Performance Standards



Summary

English Performance Standards

How can we make sure language learners focus on the right things to increase their confidence and achieve their learning goals?

We need to be able to describe learner performance based on an internationally recognized standard so we can say where a learner is in their learning journey, set achievable short-term goals, and measure progress against this standard.

Performance Standards are authoritative, internationally recognized documents that guide the language curriculum, syllabus and assessment specifications. They define what skills students need at a given proficiency level.

The core component of a performance standard is the performance-level descriptor — a description of the competencies associated with levels of achievement when performing language activities (e.g., reception, production, interaction).

Some internationally recognized standards:

- China's standards of English language ability (CSE) by the National Education Examinations Authority (NEEA), Ministry of Education, China
- Australian Second Language Proficiency Ratings (ASLPR or ISLPR) by David Ingram
- Common European Framework of Reference for Languages (CEFR) by the Council of Europe



The Global Scale of English (GSE) is a CEFR-derived standard used at Pearson. It is both a proficiency scale and a framework of thousands of objectives describing what learners can do at each proficiency level.

Why it matters

Performance standards guide curriculum development, ensure that what is taught matches what is assessed, inform learners about their learning goals, and inform what assessments should measure, which helps create test specifications.

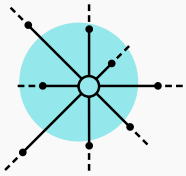
Reference to common standards means useful comparisons can be made between learning goals, performance outcomes, and exams across different contexts. Standards are an important instrument for accountability and recognition of language benchmarks.

Standards have an authoritative power that can lead to unintended consequences. Take, for example, a high-stakes test used for immigration purposes. It is vitally important that the standard accurately measures what it intends to measure and is chosen for the right decision-making process.

Impact

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

- learners persist because they can understand their progress across multiple skills, and what they need to successfully function in English at increasing levels of complexity
- learners can set goals and monitor their understanding, because they can evaluate their progress against meaningful performance descriptors
- learners are confident and motivated because they are optimally challenged by appropriate learning content
- learners master relevant learning objectives because learning content is aligned to objectives



English Performance Standards

The big ideas

1

English performance standards are a **tool for identifying** the language that learners are **expected to demonstrate/achieve** at increasing levels of proficiency.

I know what level I'm at now and what I need to do to make it to the next level.

2

Performance-level descriptors are **high-level categories** that need to be **further specified** into more detailed descriptions of language subskill, such as grammar and vocabulary.

I know what specific language lessons I should be learning to get to the level I want to reach.

3

Reaching a given proficiency level means having a **50% probability** of succeeding at a language task pitched at learners at that level. A **probabilistic definition of language achievement** is needed to define the curriculum and identify cut-scores for assessment.

I should aim to master 50% of the objectives for a given level to be considered to be at that level.

Big Idea 1

Standards as goals and measures

English performance standards are a tool for identifying the language that learners are expected to demonstrate/ achieve at increasing levels of proficiency.

What it feels like for learners

> *I know what level I'm at now and what I need to do to make it to the next level.*

A standard is both something established as a model or example by authority, custom, or general consent, and something set up as a rule for measuring quantity, weight, extent, value, or quality. Therefore a standard is both a **goal** (what should be done) and a **measure** of progress toward that goal (how well it was done).

A language proficiency standard is based on some reference model of competence that describes the activities, strategies, and competences needed to perform increasingly complex tasks. It defines increasing levels of achievement using a given scale.

- The Common European Framework of Reference for Languages (CEFR) is a ten-level framework that describes proficiency in a language and context.
- Pearson's Global Scale of English (GSE) defines proficiency on a more detailed and precise scale.

What it means for designing learning experiences

Align intended outcomes to the performance-level descriptors (e.g., the GSE learning objectives) and associated resources.

- **Analyse needs** by consulting all relevant stakeholders, including teachers and learners. Identify the target level of performance in relation to learner type, focus skill, learner needs, language context of use, target proficiency, etc.
- **Select descriptors** according to the target learner, communicative goals, and proficiency level. Select all relevant scales and subscales (listening and reading comprehension, spoken and written interaction, spoken and written production, mediation)
- **Refine descriptors** to make the list relevant to the particular goal and context of the course — descriptors can be adopted, shortened, simplified, merged, and supplemented



See this Learning Design Principle: Objective Design

Big Idea 2

Standards as a starting point

Performance-level descriptors (e.g. the GSE objectives) are descriptions of functional language performance that need to be further specified into more detailed language subskills, such as grammar and vocabulary.

What it feels like for learners

> *I know what specific language points I should be learning to get to the level I want to reach.*

Performance level descriptors like the GSE objectives are useful for **describing intended outcomes**. But outcomes are just the starting point for learning experience design.

A standard typically describes what learners can do (activities and strategies) and how well (competences). However, it typically doesn't provide the specifics around operational language and tasks.

This means a standard and a set of objectives, however robust they are, are not enough by themselves. The GSE framework specifies the skills (such as grammar, vocabulary, and pronunciation) that learners need to meet each objective, and the targets learners should meet as they develop those skills.

> *"A key ongoing challenge facing teachers [...] is the relating of lesson tasks and corresponding materials to a core list of can-do statements as learning outcomes, which by necessity describe communicative competences in a broad way, rather than as sequential teaching items"*
>
> **Goodier, 2018**

What it means for designing learning experiences

Turn performance-level descriptors (e.g., the GSE objectives) into achievable and identifiable targets. This involves identifying the specific language that needs to be learned as well as the materials and tasks appropriate at a given proficiency level.

- **Identify language targets:** starting from your scope and sequence or test construct, identify targets for each performance descriptor (e.g., being able to correctly use "Why don't you...?" as a target for the objective "Can give advice...")
  - Be sure to at least identify target grammar and vocabulary
- **Identify tasks:** what tasks will prompt the performance being targeted? How should tasks be sequenced in a course? What should be included in the test specifications?
- **Use standards as intended:** as non-

prescriptive tools to help develop curricula, courses, and exams, and to outline goals, inform learners of their achievements, and align assessment and instruction

- Do not use a standard as a syllabus or to test things it is not designed to test

The GSE vocabulary and grammar databases and associated resources offer a basis for level-appropriate content and test specifications. See the GSE Teacher Toolkit for guidance.



See this Learning Design Principle:
Objective Design

Big Idea 3

Standards are probabilistic

Achieving a given level means having a 50% probability of succeeding at a language task set at an appropriate difficulty for a learner at that level. A probabilistic definition of language achievement is needed to define the curriculum and identify cut-scores for assessment.

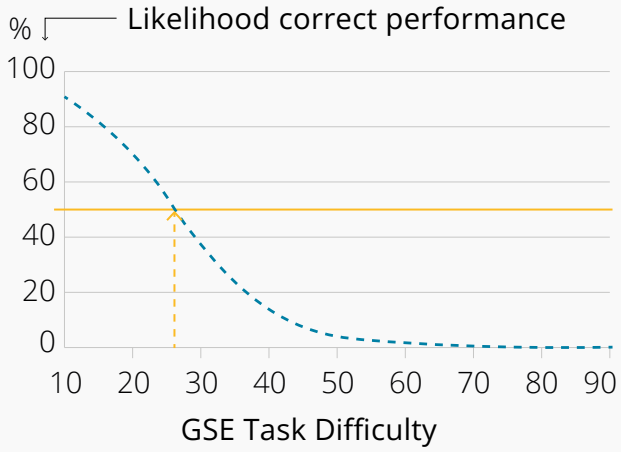
What it feels like for learners

> *I know that I should aim to be able to master 50% of the objectives for a given level to be considered being at that level.*

50% is the threshold used by many assessment providers to confidently assign students to a given level of achievement.

This probabilistic model shows that a learner at level 25 on the GSE has an above-50% likelihood of success at tasks below that level, and a below-50% chance in more complex tasks.

When defining a curriculum aligned to the GSE, the activities used to assess learners' proficiency are assigned an indicative estimate corresponding to the GSE value of the related objectives.



The chosen objectives can cover a range of points on the GSE scale, typically aiming to provide most of the content at the targeted level of the course and complementing this with below-level and above-level content as needed.

Successfully completing activities assigned to a given level is a good indicator that a learner may be proficient at that level, but not a guarantee, because standards are probabilistic. Their proficiency needs to be confirmed by a calibrated assessment.

What it means for designing learning experiences

- Align level-appropriate content to GSE learning objectives within the intended ability range — and to objectives from adjacent ranges below and above the level
- When choosing GSE learning objectives to represent the intended content, make sure they are authentic to the relevant ability level and aligned to real-life tasks

- Allow for probabilistic variations in performance by creating multiple assessment items for each learning objective
- If comparing across assessments, ensure thresholds are the same. A discrepancy in 'being at a level' can lead to misclassifications across different testing contexts (Harsch, 2019)



See this Learning Design Principle: Assessment & Evidence-Centered Design

Making it inclusive

We aim to design a great learning experience *for everyone*. These considerations will help you get closer to designing a truly inclusive experience.

Accessibility

Accommodations provided to allow learners with specific needs to participate in a learning experience

- Expand what the demonstration of a skill (e.g., reading, writing, listening, speaking) looks like. By expanding how we define the manifestation of language skills, we provide more ways for learners to demonstrate progress in an equitable, inclusive, and accessible manner.

Availability and access

Barriers — often external and systemic — that affect whether the tools and resources needed for learning are available to learners

- Consider that learners have varied levels of access to test sites, technology, and bandwidth. Provide a variety of opportunities to take part in assessment.

Identity

The combination of dimensions that define who learners are to themselves and others

- English language learning is historically and currently connected to marginalization and even erasure of historically marginalized identities. Honor and uplift learners' unique identities via authentic representation in order to invite them to learn English without the threat of losing their unique identity.

Culture

Shared patterns of behaviors and interactions, cognitive constructs, and affective understanding that learners acquire through socialization

- Stress the importance of varying the outcomes and objectives based on what would be most culturally relevant to the learners the experience is being marketed to when setting learner outcomes and learning objectives for an English language learning experience.
- Assess learner performance in multiple ways to allow learners with different experiences and backgrounds to show progress and proficiency. For example, allow learners to show understanding not only by taking a summative-style multiple-choice test, but also by submitting a written or spoken essay.

In partnership with CAST

CAST is a nonprofit education research and development organization that created the Universal Design for Learning framework and UDL Guidelines, now used the world over to make learning more inclusive.

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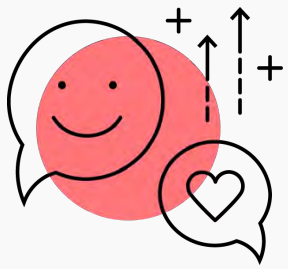
The Big Ideas Index

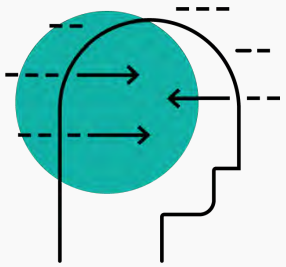


Motivation & Mindset

1. Interest sparked by elements of the learning experience can engage learners, but deeper **individual interests** motivate them to **apply effort and persevere**.
2. Learners are motivated when they believe that their learning is **valuable and relevant** to them personally.
3. When learners **believe** they are competent and can achieve their goals, they usually do. Experiences of succeeding and achieving goals help **build confidence**.
4. Helping learners **focus on growth** and reaching their own goals **encourages persistence** and aids success.
5. Learners are more **motivated** when they **feel connected** to others and to the learning environment.
6. Learners are more **motivated** when they have a sense of **autonomy**, but for learning to be effective, they need support with their choices.

Social & Collaborative Learning

1. Because humans are social animals, we naturally **pick up on social cues** and learn from others in social settings.
2. People can learn to do something by **watching others** and trying it out on their own.
3. When learners **feel they belong** in the learning environment, they are more motivated to learn.
4. There are lots of different ways to learn together. The **more collaborative** learning is, and the more learners can construct new knowledge together, **the better**.
5. Explicitly agreeing **ways of working** together up-front leads to better collaborative learning.
6. Many of the benefits of social learning can still take place when the **other participants are virtual**, rather than human.



Attention & Cognitive Load

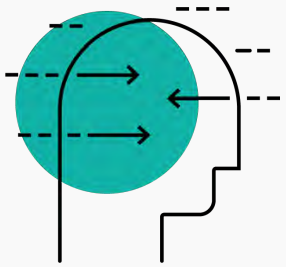
1. Attention can be **guided towards the important information** using design layout and formatting.
2. **Distractions can pull attention away** from learning. Distractions in the learning content, the environment and in our own thinking influence what we attend to and take up processing power.
3. A learner can only pay attention to a **limited amount of information** at a time, and only for so long.
4. The **way information is presented** can capture a learner's attention but can also create distractions.

Developing Understanding

1. New information is best learned, remembered, and integrated in a learner's mind when it is **connected to information they already know**.
2. Skills and knowledge must be practiced to **build 'muscle memory'** and take on more complex tasks.
3. Knowledge can be flexibly applied if a learner's knowledge is **deeply organized and connected**, and the learner understands the underlying concepts and can recognize when to apply what they've learned.
4. Learners develop their understanding through **checking** their performance and **reflecting** on how they might improve. Feedback and reflection help learning stick.

Desirable Difficulty & Scaffolding

1. Learning should be **appropriately challenging** and take appropriate **effort**.
2. **At first**, learners benefit from a scaffolded learning environment with high levels of **structure and support**.
3. As learners progress, **fading out the supports** is beneficial for learning.
4. Sometimes **exploratory problem-solving** before instruction can be an effective way to induce desirable difficulty.

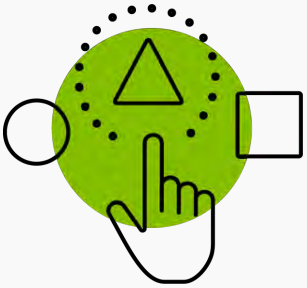


Active Learning, Memory & Practice

1. To learn more deeply, learners need opportunities to **generate and construct** their own understanding.
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.
4. Making learning more active can help make **deeper connections** and build **richer understanding**.

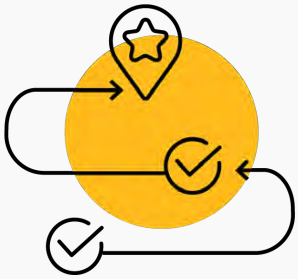
Feedback for Learning

1. When providing feedback, it's important to determine **when the learner will best be able to utilize it** to improve their learning. This may mean feedback is best provided sooner or later in the learning process.
2. Feedback should be provided in a way that learners see **non-judgmental**. It is important for feedback to be perceived as helpful and supportive.
3. Feedback should help learners reflect on **where they are currently** and **where they want to be** in their learning goals, with **specific steps to get there**. There is such a thing as too much or too little feedback.
4. There are many ways to **deliver feedback**, through **instructors, peers, learning systems or agents**. They all have their place, so it is important to consider what makes each one effective.
5. Feedback is information learners use to **regulate their own learning**. Self-regulated learning interventions that incorporate feedback can improve learning, self-regulated learning, and motivation.



Self-Regulated Learning & Metacognition

1. Self-regulated learning involves maintaining a cycle of **monitoring and control**.
2. **Before studying**, learners should identify the gaps in their knowledge; decide the right learning level; analyze tasks; set appropriate goals; create effective plans; and prepare resources.
3. **While studying**, learners should continually **monitor** their progress and **control or adjust** their learning strategies as needed.
4. **After studying**, learners should **reflect** on the content they covered, the study strategies they used, and the feedback and outcomes they achieved to decide whether to stop studying, keep studying, or change study strategies.

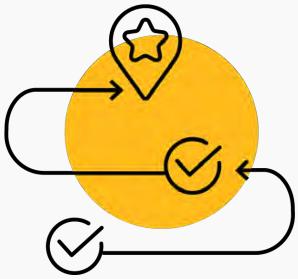


Objective Design

1. When we **create the objectives first**, they form a foundation for designing the learning experience. Instruction and assessment aligned to the objectives support learners to achieve their learning goals.
2. Well-designed objectives are **clear and measurable**, and taken together they reflect what learners should know or be able to do by the end of the learning experience. Aligning objectives to an external framework can increase reliability, validity, and applicability of the learning experience.
3. Two-level objective hierarchies are essential to learning experiences that equip learners to achieve **complex learning goals**.
4. Because they are learning goals, objectives **drive assessment and instruction design**. This helps learners progress towards the objectives and allows us to make inferences about the performance of learners and learning experiences.
5. Objectives can help a learner decide if a learning experience is relevant and valuable for them, increasing transparency and motivation and learning. They can improve trust by **informing learners up front** what will be required and what support will be available.

Assessment & Evidence-Centered Design

1. Assessments can diagnose, support, and evaluate learning. It's essential to design assessment **with the purpose in mind** to make sure assessment provides valid evidence.
2. The starting point for ECD is the domain model — a clear **lay of the land** of the learning domain that helps plan effective instruction and gives an accurate idea of a learner's knowledge level.
3. Showing and tracking the development of understanding in a domain, or **learner proficiency**, over time is needed to target instruction design and personalized learning. This is the learner model.
4. Learning tasks or activities reveal evidence about what a learner knows and can do. Tasks should be **designed to capture evidence** of success, or learner behavior that reflects the desired objective or outcome. This is the task model.
5. All the ways a learner could respond to a task count as evidence and provide **insights into their proficiency** and understanding. This is the evidence model.
6. Assessments should consistently and accurately **measure what they claim to**. A reliable, valid, and fair assessment means we can make sound claims about learning.

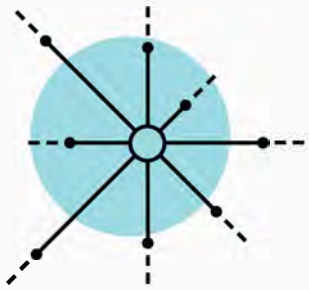


Personalized Learning & Adaptive Systems

1. There are degrees of personalization, and **some methods are more effective** than others. Compared to experiences that aren't personalized at all, personalized learning environments can improve learning.
2. Learning experiences that are **personalized to learners' knowledge and skills** are more efficient and effective than learning that is not.
3. Learning experiences that are **personalized to learners' interests** can support greater motivation and learning.
4. Personalizing content to match learning styles **does not** support learning or motivation.
5. Personalizing content according to **non-cognitive factors**, such as affective states and identity, can sometimes improve learning.
6. Providing learners with **guided choice** in their learning experience can enhance motivation, autonomy, and self-directed learning.

Authentic Learning

1. When learning experiences are explicitly linked to achieving a **real-world goal**, learners find them more meaningful and so are more engaged and motivated.
2. When learners understand the **underlying concepts** and rationales, they can make better use of practice in an authentic environment.
3. **Models and demonstrations** help learners learn what good performance looks like (and what it doesn't).
4. Practicing in **authentic scenarios** with real-world problems prepares learners better for real-world tasks.
5. Learning authentic tasks happens best when learners tackle **ill-defined problems**, **craft their own path** to a solution, and **reflect** to become good self-directed learners.
6. Genuinely taking part in a **community of practitioners** hones the knowledge and **habits of mind** needed to join that community for real.



English Performance Standards

1. English performance standards are a **tool for identifying** the language that learners are **expected to demonstrate/achieve** at increasing levels of proficiency.
2. Performance-level descriptors are **high-level categories** that need to be **further specified** into more detailed descriptions of language subskill, such as grammar and vocabulary.
3. Reaching a given proficiency level means having a **50% probability** of succeeding at a language task pitched at learners at that level. A **probabilistic definition of language achievement** is needed to define the curriculum and identify cut-scores for assessment.

Digital & Virtual Learning

1. Delivering information as **audio** can support learning by freeing up learners' working memory.
2. **Videos** can support learning as long as they are closely aligned with objectives.
3. **eBooks** can support learning by using interactivity and multimedia to encourage active learning.
4. **Games and virtual worlds** can support learners and learning in many ways, especially when combined with traditional instruction.
5. **Simulations** can support learning by providing authentic experiences of tasks and environments that learners could not experience otherwise.
6. **Mobile devices** can support learning by empowering learners to learn when and where they want.
7. **Immersive virtual environments** can support learning in many of the same ways as games, but with more complete suspension of disbelief.



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