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SIX KEY PRINCIPLES

For Learning Experience Design

Macmillan Learning series in
Learning Science Foundations

Goal, Overview, and Application

Goal

At Macmillan, our goal is to drive learner outcomes. A fundamental part of our approach is to apply findings from the Learning Sciences to product design, improvement, implementation, and support.

Overview

Here, we have assembled Six Key Principles for Learning Experience Design that educational research and cognitive psychology indicate are instrumental to driving better learner outcomes. These are divided into six “Foundations” and a corresponding set of six “Principles” derived from these foundations. These underly Macmillan’s other Learning Science Foundations.

Application

These Six Key Principles underpin the design of Macmillan’s products. However, these principles may also be applied by institutions, instructors, and instructional technologists to their own learning experiences.

Research Foundation and Process

Foundation

These Six Key Principles are based upon a thorough literature review of educational research and cognitive psychology by learning researchers.

Process

These principles were developed through a rigorous and comprehensive ten-step research and refinement process that included:

- Primary and secondary literature review and synthesis by Macmillan Learning Research team
- Design of principles by Macmillan Learning Research team
- Internal review by 4 Macmillan learning scientists
- External review by 7 students
- External review by 5 experts comprising the Learning Research Advisory Board

All of these researchers, contributors and reviewers are listed to the right.

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Foundations of our Approach to Learning

Everyone has the potential to learn.

Each person has limitless potential to learn and grow -- and that's why it's important to foster self-efficacy, persistence, and to tap into each learner's motivation.

Each learner starts from a different place and learns at their own pace.

No two learners are exactly the same, and that's why providing a learning experience that is personalized and adaptive can help students learn more efficiently and effectively.

Cognition can be enhanced using technology.

Well-designed learning technology can enhance cognition by supporting learning objectives and cognitive learning principles, such as interleaving, spaced practice, and integrated assessment with timely and targeted feedback.

Pedagogy matters.

Each learning experience should be underpinned by a research-based learning model.

Learning is a social activity.

Learning happens when students interact with their instructors and construct knowledge with their peers.

Students should be empowered to manage their learning.

Helping students to think about their learning (metacognition) and make plans for improvement (self-regulation) is the best way to help students succeed over the course of their lives.

The Principles that Form the Foundation and Design of our Products

Our products:

1. Develop learner motivation
2. Provide personalized and adaptive experiences
3. Target cognitive and memory elements
4. Build on well-constructed learning models
5. Create interactive and constructive opportunities
6. Enable metacognition and self-regulation

Principle 1: Develop Learner Motivation

When students are highly motivated, they are able to tackle challenging problems and strive to accomplish goals that will improve their abilities. However, there is no one way to motivate students -- there is no “magic bullet” (Conley, 2012, p. 44). Rather, instructors and instructional technologies can support motivation by providing opportunities for successes, and by framing errors and struggles as important elements in the processes of growing and learning (Bjork, Dunlosky, & Kornell, 2013; Joët, Usher, & Bressoux, 2011; Wolters, 2004). Motivation is an influential mediator of learning as it regulates cognitive processing and affect (Mayer, 2014). Being in a positive affective state and possessing high levels of autonomy can enhance motivation (Pekrun, Elliot, & Maier, 2009; Schumacher & Ifenthaler, 2018). Thus, it’s important to encourage motivation through learner autonomy, goal setting, and positive feedback that focuses on the task, learner process, and/or self-regulation.

Principle 2: Provide Personalized and Adaptive Experiences

Students enter the classroom with a variety of cultures and psychological traits, thus, personalization and adaptation of instruction and assessment can have positive effects for all learners (Alexander, Schallert, & Reynolds, 2009; Sternberg, 2007). Personalized learning environments such as dashboards, which can be adapted by learners, can help students to modify their learning strategies and foster skills in managing, monitoring, reflecting, and motivating their own learning (Knox, 2017; Park & Jo, 2015; Roberts, Howell, & Searman, 2017; Schumacher & Ifenthaler, 2018). Within a course, dynamic testing can improve predictive models of student success and enhance learners' metacognition, learning efficacy, and performance while providing immediate feedback, scaffolding questions, and hints (Feng, Heffernan, & Koedinger, 2009; Tseng, Chu, Hwang, & Tsai, 2008). These systems and tools must be developed through a process considering and involving students' needs at all stages and time-periods of the course (Santos, Boticario, & Pérez-Marín, 2014).

Principle 3: Target Cognitive and Memory Elements

Today, there are numerous methods that learning scientists have researched that enhance learner cognition and transfer -- all of which begin with learning objectives, which describe "the intended change in knowledge" (Mayer, 2008, p. 762) and can enable a mastery approach which has positive impacts on conceptual learning, attitudes toward learning, and performance (Pekrun, Elliot, & Maier, 2009). Learning objectives enable instructors and instructional technologies to foster desirable difficulties, interleaving and/or spaced practice which increase storage strength and long-term retention and ultimately aid in performance (Bjork & Bjork, 1992; Bjork, Dunlosky, & Kornell, 2013; Credé, Roch, & Kieszcznkya, 2010; Ehrlinger, Mitchum, & Dweck, 2016). Retrieval-based learning, exercised through certain study methods and during assessments, enhances later performance (Agarwal, Bain, & Chamberlain, 2012; Bjork et al., 2013) and frequent quizzes can support a "testing effect," strengthening students' memories for the retrieved information (Delozier & Rhodes, 2017). Immediate feedback on assessments can lead to high procedural knowledge (Fyfe & Rittle-Johnson, 2016), improve low confidence on correct answers and enhance later performance (Agarwal et al., 2012), and can revise misunderstandings through the use of causal explanations (Hattie & Timperley, 2007; Kendeou, Walsh, Smith, & O'Brien, 2014).

Principle 4: Build on Well-Constructed Learning Models

Being cognitively engaged stimulates learning, specifically, learning that “sticks” (Hirsh-Pasek, Zosh, Golinkoff, Gray, Robb, & Kaufman, 2015, p. 9). Active learning, which can be fostered through models including Project-Based Learning (PjBL) and Problem-Based Learning (PBL), leads to the growth of complex reasoning skills, critical thinking processes, perceived learning (e.g., better conceptual understanding of material, retention of knowledge, transfer of knowledge to new problems), engagement, attitudes towards and perceived usefulness of subjects, self-directed learning, exam performance, motivation, and autonomy (e.g., Crouch & Mazur, 2001; Goedert, Pawloski, Rokooeisadabad, & Subramaniam, 2013; Kay & Kletskin, 2012; Muehlenkamp, Weiss, & Hansen, 2015; Akinoğlu & Tandoğan, 2007; Sawyer, 2014; Tseng, Chang, Lou, & Chen, 2013). PjBL and PBL are considered active learning models because students are required to take responsibility for their own learning processes (English & Kitsantas, 2013).

Principle 5: Create Interactive and Constructive Opportunities

The development of critical-thinking skills and higher-order learning benefit from collaborative learning, which leads to enhancement in academic performance and intellectual development (Bai & Chang, 2016; DeLozier & Rhodes, 2017; Hirsh-Pasek, Zosh, Golinkoff, Gray, Robb, & Kaufman, 2015). When students are able to take an active role in discussions, choose their own topics, and ask questions, they co-construct knowledge and engage in high-level co-regulation through making their thinking explicit and evaluating their peers' and instructors' perspectives (Do & Schallert, 2004; Volet, Summers, & Thurman, 2009). With peers, students can work together to revise misunderstandings (Crouch & Mazur, 2001), and engage in self-explanations which promote "prior knowledge activation, inference generation, and revision of existing knowledge" (Richey & Nokes-Malach, 2015, p. 203). Ultimately, social relationships are important to develop in classrooms as they have strong impacts on student performance, persistence and retention (Bernardo, Esteban, Fernández, Cervero, Tuero, & Solano, 2016). When instructors interact directly with students, it reduces the transactional distance between them, thereby increasing student retention (Simpson, 2013).

Principle 6: Enable Metacognition and Self-Regulation

Accurate metacognition and self-regulation is critical for academic success. Students typically spend time studying items they do not know well, thus, a metacognitive judgment can lead to the decision to terminate learning or to continue. If the judgment is inaccurate, revision time will not be allocated effectively (Dunlosky & Metcalfe; McDaniel & Butler, 2010). Metacognitive illusions, most frequently that learning strategies that feel difficult are not as productive as those that feel easy, can lead to low levels of achievement (Bjork, Dunlosky, & Kornell, 2013). Accurate judgements, however, can lead to the correction of misconceptions and an increase in academic performance (Richey & Nokes-Malach, 2015). Similarly, if students struggle with regulating their learning processes, they will likely become less engaged, make poor study choices, and become less successful in their courses (Ehrlinger, Mitchum, & Dweck, 2016; Kizilcec, Pérez-Sanagustín, & Maldonado, 2017). Learning success is “predominantly attributed to students’ self-regulation capabilities that are relevant for initiating and sustaining learning processes” (Schumacher & Ifenthaler, 2018, p. 397), which are especially relevant for achieving learning goals (Cho, Kim, & Choi, 2017). In hypermedia environments, self regulation skills are imperative in navigating and learning from multiple representations, especially as those who do not regulate their learning tend to become more easily overwhelmed (Green & Azevedo, 2009).

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Foundations of our Approach to Learning

STUDENT ADVISOR COMMENTS

Everyone has the potential to learn.

Each person has limitless potential to learn and grow -- and that's why it's important to foster self-efficacy, persistence, and to tap into each learner's motivation.

Each learner starts from a different place and learns at their own pace.

No two learners are exactly the same, and that's why providing a learning experience that is personalized and adaptive can help students learn more efficiently and effectively.

Cognition can be enhanced using technology.

Well-designed learning technology can enhance cognition by supporting learning objectives and cognitive learning principles, such as interleaving, spaced practice, and integrated assessment with timely and targeted feedback.

Pedagogy matters.

Each learning experience should be underpinned by a research-based learning model.

Learning is a social activity.

Learning happens when students interact with their instructors and construct knowledge with their peers.

Students should be empowered to manage their learning.

Helping students to think about their learning (metacognition) and make plans for improvement (self-regulation) is the best way to help students succeed over the course of their lives.

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"*As a first-generation college student, I think everyone does have potential but if you aren't given certain resources or if you don't have the right social capital in high school, the statement isn't as applicable.*" -Carolina

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"*Macmillan can adopt the latest learning science, merge it with technological innovations, to have a real impact on individual students.*" -Anthony

"*It's one of those things everyone knows but doesn't always say. You go to a lecture hall where it is very standardized and the professor is saying the same thing to 300 students I'm not sure how much it is put into practice in a traditional setting.*" -Yasir

"*In an increasingly tech-based world, Macmillan should work hard to ensure its technology does not isolate people but brings them together.*" -Ben

"*It works better for me if I do it on my own. I don't have the distraction of too many group thoughts. I need to figure it out on my own in a way that works for me.*" -Starshae

Cognition can be enhanced using technology.

ning technology can by supporting learning nitive learning nterleaving, spaced practice, and integra timely and targeted

"*Empowerment and self-efficacy seem to be the first step in learning; Most will not learn if you force them.*" -Yasir

"*I feel this is very important. If you are not taking time for reflection, stepping back to look at the whole, you may not be able to see the grey areas.*" -Asja

Pedagogy matters.

Each le be underpinned by a research-based learning model.

"*A lot of Macmillan tools are available to instructors, however they aren't trained in how to implement those tools and it can result in a strange mix of pedagogy.*" -Anthony

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ning happens when students interact with their instructors and construct knowledge with their peers.

Students should manage their learning.

Helping students to think about their learning (metacognition) and make plans

"*Learning is hard work. Even if you use a lot of these technologies and the instructor does their best to adopt cutting edge pedagogical techniques in the classroom and students are putting in their best effort, you might not be able to learn at the level you set for yourself. There is still a space for failure. Learning isn't always a smooth process and it is easy to become disenchanted and give up on the whole process.*" -Anthony

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LEARNING RESEARCH ADVISOR COMMENTS

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LEARNING RESEARCH ADVISOR COMMENTS

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Each per
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learner's motivation.

"*One needs motivation, but also needs to know how to learn the right way. It's not just motivation and self-efficacy. Students often don't know how to study or spend their time. Motivation and self regulation skills can't be separated.*" -Dr. Mark McDaniel

"*Motivation unlocks each person's potential to learn.*" -Dr. Chris Dede

Each learner starts from a different place and learns at their own pace.

No two le
that's why
experience that is personalized and adaptive can help students learn more efficiently and effectively.

"*If Macmillan can implement this in the technology, this would be great.*" -Dr. Mark McDaniel

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"*For many people, learning is enhanced through interaction and construction but there are people who can argue that they can learn in non-social ways and can engage better through perhaps reading or other media.*" -Dr. Thomas

Pedagogy matters.

Each
be underpinned by a research-based learning model.

"*An abundance of research shows that how to teach affects how students learn. We can no longer just march through chapters of a textbook and hope students will absorb the knowledge.*" -Dr. Erin Dolan

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Develop Learner Motivation

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