

Using Research in Ed Tech



What does research-based product development mean?

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Using Research in Ed Tech:

The what, how, and why of research-based product development

Introduction

Demand for educational technology (ed tech) products is growing, but purchasers often struggle to determine which products are going to help them meet their learning objectives. In a [recent study](#) of ed tech developers, 90 percent reported that their products are “informed by research.” But it’s not always clear to purchasers what the research was and how to evaluate it. For ed tech developers, this lack of clarity can impede the development of powerful solutions that benefit learners, and the ability to take advantage of this fast-growing market opportunity.

What are ed tech purchasers looking for? In the same study, one K-12 technology director said he looks for “standardized, research-proven ways that we can say, ‘This is the positive impact’ or ‘This is how we calculate a return on investment’... [to] explain, justify, rationalize, defend to our community, to our parents, [and] to our board the value of their investment.”

A useful resource for ed tech developers in meeting this need is the 2015 [“Ed Tech Developer’s Guide”](#) from the U.S. Department of Education Office of Education Technology (OET). The guide provides insight and recommendations for research-based product development.

Also valuable are real-world examples of how ed tech developers use research to inform product development and evaluation.

Ultimately, guidelines and examples are needed to help companies develop and evaluate research-based products, and to educate consumers so they make better decisions.

Our Approach

Digital Promise recently ran a [crowdsourcing campaign](#) asking developers to share the science behind their products. We heard from [nearly fifty companies](#) about the what, how, and why of research-based product development. We asked questions like:

- What scientific research on learning informs your product design, and where do you find it?
- How do you conduct research on usability and effectiveness?
- Why is research beneficial to you and/or your stakeholders?

We also talked to researchers and thought leaders in education to get a sense of what they look for in collaborations with ed tech companies. Three main ways in which companies use research throughout product development and evaluation emerged:



Learning Sciences: using scientific research on how people learn to inform product design.



User Research: gathering information about how people are interacting with the product.



Evaluation Research: determining how a product contributes to solving a problem in education.

The following guide provides recommendations and examples from companies on how they use these three types of research in the development of ed tech products.

Learning Sciences



Decades of scholarly work have contributed to the understanding of how people learn. Basing products on learning research can save time and money by helping ensure that your company is developing products that will meet the needs of schools. And, as the [OET's "Ed Tech Developer's Guide"](#) notes, "too often apps are well coded and fully functional but are based on learning theories that researchers debunked years ago" (pg. 21).

Finding the Literature

Before prototyping products, ed tech companies should review research broadly and critically.

[Google Scholar](#) allows you to search across many disciplines of scholarly work, while [ERIC](#) is focused on education research. And, both ERIC's [thesaurus](#) and Digital Promise's [map of education research](#) (currently in development) are useful for figuring out the topics, keywords, and synonyms used by researchers.

Some areas of research to consider include pedagogy/instruction, curriculum studies, psychology, assessment, and cognitive science. **Below are some ways companies have used research to inform their product development.**

Learning Sciences 101

Quick Reads:

- American Psychological Association [article](#) on what increases student gains
- Digital Promise [blog posts](#) on research
- Carnegie Mellon's [Principles of Learning](#)
- Harvard Graduate School of Education's [Usable Knowledge](#), which distills education research

Books and Guides:

- [Knowing What Students Know](#)
- [How People Learn](#)
- [How Learning Works](#)
- [Universal Design for Learning Guidelines from CAST](#)

	Pedagogy/ Instruction	Curriculum Studies	Psychology	Assessment	Cognitive Science
RESEARCH FINDING	Students learn better when they control of the speed of instruction. (Moreno & Mayer 2007)	When learning proportions, one of the common mistakes students make is using an "additive strategy" that leads to incorrect answers. (Misailidou & Williams 2003)	Research suggests effective ways to build children's social skills, such as interacting with parents. (Elliott & Gresham 1993 ; Feldman et al. 2013)	Giving students feedback that they can use to improve their ongoing learning is referred to as "formative assessment." (Black & William 2009)	Actively recalling or retrieving knowledge can promote learning of complex material. (Karpicke & Grimaldi 2012)
HOW IT'S BEING APPLIED	Classroom Inc.'s After the Storm game is student-driven. In addition to controlling where and how they move through the game, students control the pace at which they read and work in all of the game's workplace activities.	For GlassLab Games' Ratio Rancher , the company found research studies that included descriptions of how students understand proportions. They designed the game to specifically look for these types of responses from students.	The Leo's Pad app by Kidaptive includes a single turn-taking game. Its design was informed by psychology research on promoting social skills in young children.	Houghton Mifflin Harcourt's iRead tailors future instruction based on student inputs. It also provides immediate and corrective feedback within students' individualized instructional paths.	The Make-a-Map collaboration between BrainPOP and Ideaphora was shaped by research on how concept maps can encourage students to build their knowledge retrieval skills.

Questions to consider when reviewing research

After tracking down relevant research, it's important to critically review the findings to understand the nuances of each study, including how it applies to the setting in which your product will be used. **Here are some common considerations when evaluating research:**

Is there agreement around this research, or are there competing theories?

- Look for articles in education review journals that provide summaries of the work in a particular area. ERIC maintains a [list of journals](#) with education research, many of which are review journals. Book chapters from edited volumes can also be useful.

Are you using the research responsibly? Avoid selectively “cherry picking” research findings that say what you want to hear.

- Imagine 20 rigorous studies show strategy A works better than strategy B for teaching trigonometry, while two mediocre studies show the opposite. If you prototype an app using strategy B, it may be tempting to “cherry pick” and cite the two studies that support this choice—even though it’s not an accurate reflection of what the literature shows.

In what setting(s) was the research conducted?

- If all the research on a particular learning strategy has been done in a very regimented laboratory environment, it’s hard to know how it will work in

a real-world environment such as a classroom. For example, if you’re developing an app for parents to use at home and the research you review has only been done in large preschools with teachers, then the findings may not be applicable to your product.

Can you be confident in the findings? Look for studies of high quality.

- [Peer-reviewed](#) journals are considered reliable sources of information because several experts in the field have reviewed their articles.
- Here are [ten tips](#) for evaluating research from the Harvard Family Research Project.

Using research in the real world: Kidaptive

Kidaptive looks for research-based practices **“that don’t depend upon a perfectly faithful implementation, because parents don’t have the bandwidth to be that precise in the way they interact with their kids. If you told a parent to do this thing: A) Would they be able to do it in a way that was precise enough to be effective? and B) Would they want to? Would that be a fun way for a parent to spend time with their kid?”**

Partnering with Researchers: Mindprint

Mindprint set a goal of finding a valid, science-based assessment of children’s cognitive skills to build into an online platform. After considering several alternatives, the team at Mindprint found an assessment developed by a team of researchers at the Brain Behavior Laboratory at the University of Pennsylvania’s Perelman School of Medicine.

When asked how the partnership started, Mindprint said, **“We reached out to them, and we were fortunate that the team we found is incredibly open-minded and flexible, and appreciated the opportunity to commercialize their research in a way that would have true practical applications.”**

Mindprint says they continue to talk with the researchers on a weekly basis to discuss new directions and expand the number of skills covered in the assessment. They added, **“We’re doing ongoing research with [the university], where they’re mining [data from] the population of ten thousand children to look for correlations in the data so that we can better understand children with reading disorders.”**

Contributing to New Research: Newsela

In some cases, companies generate data that academics are able to use for scientific research, which can benefit both sides. One example is ed tech company Newsela and its partnership with computational linguists.

Since Newsela is a reading service that provides teachers and students with daily news articles at five levels of complexity, their work involves something that computational linguists are also interested in: text simplification. The academics reached out to Newsela to see if its texts could serve as a possible dataset to analyze, and the company agreed. From the partnership, the researchers published [a paper](#) and the Newsela team gained a deeper understanding of their product.

Newsela told us, **“From their research, we learned more about textual analysis and linguistic modeling, which validated our current approach and will form the basis for continued collaboration... it’s something that speaks to the uniqueness of text simplification and our proprietary process.”**



User Research



Another way companies incorporate research into ed tech products is by working closely with users during product development to understand how people actually engage with the technology. One common approach to user research is iterative design, which is “the process of using short feedback loops to define assumptions, create prototypes, and obtain early user feedback, first to validate the need for your app or tool (or invalidate it, saving time, money, and other resources) and later to improve its usability and impact.” ([OET guide](#), pg. 24)

Ways of getting user feedback

Here are some methods for gathering feedback and user experience data:

- **Create a [Minimum Viable Product \(MVP\)](#)** and show it to users early
- **Conduct focus groups and interviews** with users and/or purchasers (i.e., students, parents, teachers, administrators) about their needs and reactions to the product
- **Utilize A/B testing** to decide between different features
- **Review analytics** from the product to see where people get stuck. One resource is the Office of Education Technology’s issue brief on [educational data mining and learning analytics](#).

Finding your users

Here are some ways to find people to provide feedback:

- **Engage in social media platforms** such as Twitter. Chats such as the [#edtechbridge](#) chat are a great opportunity for companies to connect with users. There are also region-specific education chats, shown on this [map](#) from the Office of Education Technology.
- **Use help tickets** from the product to pinpoint the most engaged users or those who may have suggestions on how to improve products.
- **Value teacher time** by listening to them, offering free or reduced price versions of the product, and compensating them when possible.

How user feedback can shape products: Ideaphora and Reason Racer

Ideaphora, which makes a concept mapping tool, said, **“We actually had some features that students recommended that we put into the tool. There’s definitely a two-way street. We learn from students and they got to see how important their feedback was to us.”**

The creators of Reason Racer from University of Kansas’ ALTEC wanted to ensure students understood the product’s tasks and questions, which included technical terms related to scientific argumentation such as “warrant.” Here is how their product benefited from user research: **“We’ve had lots of conversations about language. We ask them, ‘what do you think a warrant is?’ One of the kids raised her hand and said, ‘I think a warrant is when the police come to the door and say they got a warrant for my brother’s arrest.’ This word had a different meaning in her world. We ended up changing the name to ‘chain of reasoning’ because that made more sense and that was more clear.”**

Evaluation Research



Evaluation research involves demonstrating that your product works, and determining how it helps solve a problem in education. In addition, it can help you determine the most successful methods of implementing your product to allow teachers and students to get the most out of it. In this section, we share the methods and measures, and implementation strategies most commonly used in ed tech evaluation.

Methods and Measures

It's important to consider methods for evaluation early in the product development process, and to develop data collection strategies that support your selected method.

Companies reported using the following evaluation research methods:

- **Case studies** describe how the product was used in a particular school or classroom.

Schoolzilla Case Studies

Schoolzilla is a K-12 data platform, and the company maintains a blog with several [case studies](#) about school districts using their product. In these case studies, readers learn information about the schools, the implementation process, and how using Schoolzilla is helping to solve an education problem in particular settings.

- **Pilot studies** are run in schools to test and evaluate a product for a set period of time.
- **Short-cycle evaluations** gather data on a quicker timeline than previous research, such as the New York City iZone's [Short-cycle Evaluation Challenge](#).
- **Randomized Control Trials (RCTs)** use random assignment to compare outcomes between a group that received the technology to a control group that did not.

Woot Math RCT Study

Woot Math received a Small Business Innovation Research (SBIR) grant from the National Science Foundation (NSF) to conduct [a study](#) on how a particular feature of their product affects student outcomes. They told us, **"We conducted a multi-site randomized controlled trial that demonstrated that Woot Math's adaptivity (i.e., its ability to adjust to a student's needs) contributed significant effects in learning and retention. Our results establish a causal relationship showing that the addition of these innovative software formative assessment techniques resulted in improved learning outcomes."**

When evaluating products, keep in mind the importance of using existing measures that educators and administrators care about. As the [OET guide](#) puts it, **"At some point developers need to find out whether they are also optimizing against the external measures that are valued in education (such as standardized tests, course completion and mastery of learning)"** (pg. 27). While showing learning gains from internal measures in your product can be a useful start, it's also important to demonstrate that these map onto other commonly used measures in schools.

Implementation

When reporting evaluation research results, provide adequate details about implementation and context about where the study took place so other schools can determine whether the product is a good fit for their teachers and students. This can include information such as demographics, student-teacher ratio, how users were trained to use the product, Internet/wifi access, and product compatibility with existing technology infrastructure and data systems.

Goalbook described what their implementation process looks like: **"When we form a partnership with a district, we work closely with district and school leaders to create a scalable and sustainable plan for supporting teachers with instructional practice. Each implementation plan is tailored to the district's specific needs, desired outcomes, timeline, and budget."**

One example of an [evaluation study](#) that provides detailed information on implementation comes from Houghton Mifflin Harcourt. In this study of their iRead product, information is given on how students accessed the product and how staff members were trained to use it. Additionally, the study includes data from surveys of teachers and administrators that describes their experiences with implementing the product.

Funding and Resources

Though evaluation can be expensive, there are funding and collaboration opportunities to support this work. In reference to the Small Business Innovation Research (SBIR) grant they received, Woot Math said, "I just can't recommend it enough... the proposal really forces you to think through what you're going to do."

- Small Business Innovation Research (SBIR) grant opportunities:
 - [Institute of Educational Sciences \(IES\)](#)
 - [National Science Foundation \(NSF\)](#)
- [Institute of Education Sciences \(IES\) grants](#), including [Investing in Innovation \(I3\)](#)
- Foundations doing work in education and related fields. One resource for finding foundations that support research is the [Foundation Center](#)

In some cases, academic researchers conduct evaluations as contractors, such as at Johns Hopkins' [Center for Research and Reform](#) in the School of Education. Third party research organizations also conduct evaluation studies, including American Institutes for Research (AIR), SRI, West Ed, and others.

"You get such a head start if you base your work off prior research because a lot of things have already been figured out and a lot of things that you would find out early on have already been discovered." - GlassLab

Summary

Developing a new education technology product involves risk and uncertainty. However, developers using research to create and evaluate their products can be more confident that their approach will address real-world education problems, and make it easier for purchasers to reach that conclusion.

The ed tech companies we highlighted in this report continue to raise the bar for research-based products by incorporating the latest learning sciences insights, working closely with users, and collecting evidence that their product works. We hope the resources and examples in this guide inspire other developers to follow their lead.



Additional Resources

Helpful Links

Guides

- Office of Education Technology's "[Ed Tech Developers Guide](#)"
- [Universal Design for Learning Guidelines](#) from CAST
- U.S. Department of Education Office of Education Technology on [educational data mining and learning analytics](#)
- U.S. Department of Education's [Privacy Technical Assistance Center](#)
- [Ten tips](#) for evaluating research from the Harvard Family Research Project
- American Psychological Association [article](#) on what increases student gains
- Carnegie Mellon's Theory and Research-Based [Principles of Learning](#)
- Harvard Graduate School of Education's [Usable Knowledge](#), which distills education research
- Digital Promise [blog posts](#) on research

Tools for Finding Partners

- Digital Promise's [map of education research](#)
- EdSurge's [list of ed tech conferences](#)
- Elon University's Center for the Advancement of Teaching and Learning updates a list of [education conferences](#)
- #edtechbridge [chat](#)
- Region-specific education chats, shown on this [map](#)

Getting Familiar with the Learning Sciences

- [Google Scholar](#)
- [ERIC](#), plus its [list of education journals](#) and [thesaurus](#)

- [Ten tips](#) for evaluating research from the Harvard Family Research Project
- American Psychological Association [article](#) on what increases student gains
- Carnegie Mellon's Theory and Research-Based [Principles of Learning](#)
- Harvard Graduate School of Education's [Usable Knowledge](#), which distills education research
- Digital Promise [blog posts](#) on research
- Books:
 - [Knowing What Students Know](#)
 - [How People Learn](#)
 - [How Learning Works](#)

Funding

- [Small Business Innovation Research \(SBIR\) grants](#) from
 - [Institute of Educational Sciences \(IES\)](#)
 - [National Science Foundation \(NSF\)](#)
- [Institute of Education Sciences \(IES\) grants](#)
- [IES' Investing in Innovation \(I3\) grants](#)
- [Foundation Center](#)

Partnering with Academic Researchers

Many ed tech companies benefit from working with researchers. Academics can **serve on your advisory board, collaborate on research projects, conduct product evaluation, provide feedback on an idea, or share more detailed information on research findings.**

How to find academics:

- Review research literature for author information
- Explore Digital Promise's [map of education research](#) (currently in development)
- Participate in conferences and professional associations
 - EdSurge's [list of ed tech conferences](#)
 - Elon University's Center for the Advancement of Teaching and Learning updates a list of [education conferences](#)
- **Timelines**
 - Researchers have varying amounts of time for work on outside projects based on the academic calendar or grant cycles. Approach possible partners early in order to incorporate advice before a product is too far into development.
- **Motivations and Compensation**
 - **Publishing:** Academics are often interested in opportunities to collect data and publish original research from it. You may be able to attract academics by offering them a chance to include their own measures and questions in your product evaluation process. However, be mindful of data privacy concerns. The [Privacy Technical Assistance Center](#) from the U.S. Department of Education provides information on student privacy for those collecting data in educational settings.
 - **Financial Compensation:** Many companies (especially new ones) don't have the capacity to offer researchers data or publishing opportunities. If you are hoping to get advice from researchers on understanding and using learning sciences, budget to compensate them like any other consultant.
- **Trust and Transparency**
 - Trust and transparency are crucial to any successful partnership. Academics are wary of being associated with a product or being quoted out of context for marketing or endorsement purposes.

