

The Business Case for the Learning Sciences

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Abstract: Designing commercial educational technologies requires balancing many different considerations. Specifically, the needs of instructors, students, and institutions need to be addressed in ways that will allow all to meet their educational goals. Designers of educational technologies may sometimes focus intently on meeting those needs without necessarily ensuring that the product also aligns with what researchers have found best supports important learner outcomes, like learning material well and progressing to subsequent courses. The Learning Research and Design team at Pearson helps ensure that our products are likely to deliver those outcomes, by providing expert guidance on how to integrate research-based insights, from the learning sciences, into educational products and services. In this paper, we describe our five-stage model for supporting this effort: 1) reviewing research, 2) iteratively testing new designs, 3) providing implementation support, 4) measuring impact on learner outcomes, 5) using evidence to help grow market share.

Background of our model

In 2013, Pearson announced that we would publicly report on learner outcomes for products, similar to how we report on our financial results. The first set of these audited reports were published in 2018¹. Pearson made a bet that sharing rigorous evidence that our products improve student learning would be good for business. To help achieve the goal of delivering impactful educational technologies, our Learning Research and Design team has devised a five-step approach to help ensure that Pearson products, informed by learning science, are designed and supported to help deliver learner outcomes (see Figure 1). This approach makes explicit why learning science is important to integrate into our design process. While there are many influences on decisions about how a given digital learning experience is designed (including cost, time, learner preference, teacher preference, and many others), our model makes clear how building on a foundation of learning science research is the right thing to do, both to help improve learner outcomes as well as to contribute to growing our business. In this way, we are working towards helping more learners to learn more. In this paper, we will describe each of the five stages, and highlight key challenges we have observed, as well as ways we have begun to overcome them. Note that although this is depicted linearly, this is an ongoing and iterative process, both within individual product development cycles and across the organization, with insights gained from one cycle informing future development.

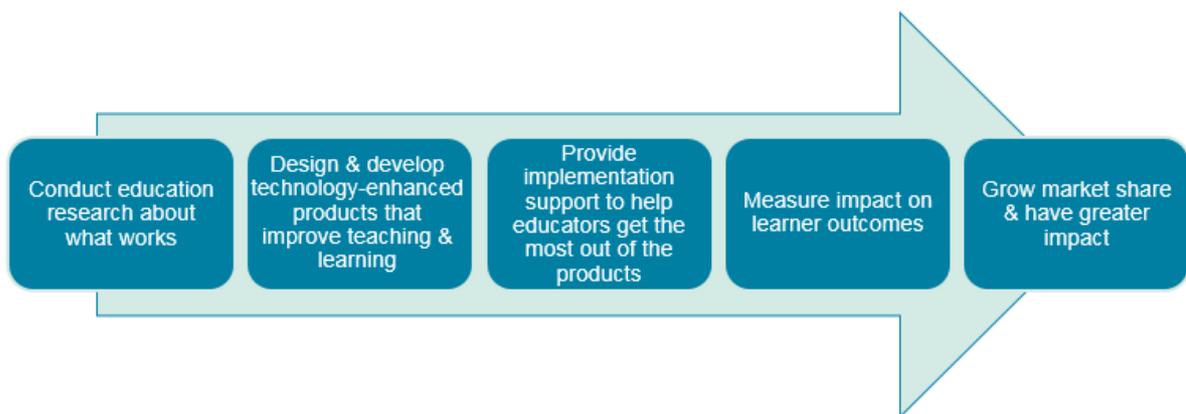


Figure 1. Our model for connecting learning science to impact and growth.

Conducting and synthesizing research

The first stage is focused on “doing research,” which includes synthesis of existing research, as well as new learning experiments and creative design work. That is, to help products achieve particular outcomes, we need to understand the research on a) defining the knowledge and skills underlying those outcomes, b) instructional approaches that may be able to impact those outcomes, and c) how different learners may be best supported in achieving those outcomes.

There are a number of challenges to finding and applying relevant research. A critical one has to do with the “grain-size” of research published in academic journals, which is frequently done on the level of single experiments, whether in laboratory or classroom settings. Given the large variability in learners’ prior knowledge and skills, educational contexts, particular courses and many other factors, it is not clear how replicable and applicable prior research will be. One approach we have focused on is conducting “learning experiments” where we directly test an innovative feature, designed in alignment with prior research, embedded in our products and used by learners in their courses. This allows us to test whether these research-based insights hold, when scaled and implemented directly in digital learning technologies; this “in vivo” approach has been championed by Koedinger, Booth & Klahr (2013) as a fruitful avenue for education researchers to explore.

Another issue pertaining to grain size is the integration of research findings into larger-scale units of instruction. For example, while individual, short-term experiments may find a benefit for certain instructional approaches, larger efforts to integrate these ideas into semester-long instructional sequences are infrequent, and design characteristics (e.g., sequences, timing, etc.) are not always reported in adequate detail. Even when specific designs are reported, they may be applicable for an individual unit of instruction but may not work as well over long periods, or for all types of content a learner needs to encounter throughout a semester. For instance, worked examples have been found to be quite useful for novices learning new procedures (Atkinson, Derry, Renkl, & Wortham, 2000), but detrimental to students who have achieved some level of mastery already (Kalyuga, Chandler, Touvinen, & Sweller, 2001), and may in some cases reduce students’ deep cognitive engagement (Schworm & Renkl, 2006). To address this issue, we have focused on generalizable principles that underlie diverse findings and research areas. Various reviews and frameworks have been published that prove useful in those efforts, such as Chi’s Interactive-Constructive-Active-Passive (ICAP) framework (2009). We have developed and shared a set of Learning Design Principles, based upon a variety of research areas, which provide a common grounding for conversations around optimizing design for learning. We have made these freely available under a Creative Commons license².

Iterative learning design

Using existing research as a guide, we can put forth general principles that we are confident will help improve learner outcomes. Translating these general ideas into specific designs requires a unique blend of activities and skill sets. Our learning designers work collaboratively with many stakeholders, including user experience designers, content developers, and even authors, helping to ensure that learning science informs those conversations. It can be a challenge to balance the competing visions that these stakeholders have, but one critical contribution of the Learning Research and Design team has been to help provide common frameworks, terminology, and background research with which to begin those conversations. The Learning Design Principles, described above, represent one such touchpoint, but numerous materials (reports, presentations, annotated designs, etc.) have been created by our team to help in that effort.

Another key activity that our team engages in is “design-based research.” Our DBR team works to constantly get input from learners through a variety of methods, including surveys, focus groups, and co-design sessions. Through these interactions, we are able to validate whether new designs align with learners’ needs, if they would use new features as intended or in other ways, and to learn more about what kinds of supports students feel they need to succeed in their courses. We are then able to quickly iterate upon early-stage ideas until they are ready for a more comprehensive design and testing process.

Implementation support

Once a curriculum or tool is released, it is then used in a variety of ways, some of which designers may have intended, and others they did not. Many product designers and developers seek to influence this implementation through user manuals, nudges in products, and professional development, as the ultimate effectiveness of a product is highly dependent on how it is implemented. We have experienced two main challenges in this area: 1) scaling support for implementation and 2) coaching teachers who are experts in teaching.

When releasing a learning product to thousands of classrooms, it is difficult to find ways to support implementation at scale. In the K-12 environment, major education technology adoptions are often accompanied

by one-day, in-service trainings. These often focus primarily on the mechanics of onboarding and navigating the system and only secondarily on the underlying pedagogy and interactions between the teachers, students, and technology. There is a substantial research literature suggesting that one-time professional development opportunities do less to impact student outcomes than more extended programs (Garet, Porter, Desimone, Young, & Yoon, 2001). However, even one day trainings are more than most university instructors receive. Instead, they are often given enormous pdf files containing some combination of technological and pedagogical guidance. From the industry standpoint, when curricula and tools are distributed at scale, the personnel requirements to individually support every institution become large. At the same time, we continue to see that the impact of products is highly dependent on how they are used pedagogically in the classroom. Everything from when students take quizzes to the weight given to online homework assignments in the final grade impacts the relationship between the use of a program and student learning outcomes. There are not easy solutions to this challenge, but we are currently exploring several potential options, including building tooltips and “nudges” for instructors into products. However, this is in primarily at the discussion stage, and has a long way to go before its effectiveness is clear.

Related to the challenge of scaling support is finding the right tone in the guidance offered to instructors. On one hand, many instructors view themselves as the masters of their classroom and believe they do not need to be told how to teach their subject area. So, even offering “nudges” might be interpreted as insulting, unless the tone is correct. On the other hand, many higher education instructors have had little to no training in pedagogy and learning science research. On top of this, in some areas there is concern that education technology will be trying to replace teachers in the classroom, setting up an adversarial relationship from the start of the engagement. To address these issues, we try to use a coaching analogy. Professional athletes are generally better players than their coaches but it does not mean that their coaches cannot offer advice that improves their game. However, as with coaches, that improvement has to become clear to the players for them to continue to accept coaching.

Measuring impact

A thorough discussion of measuring impact of learning tools and curricula is beyond the scope of this paper. There have been many efforts by numerous organizations, including the What Works Clearinghouse (part of the U.S. government’s Institute of Education Sciences), who have provided guidance on measuring impact. Pearson essentially tries to answer the questions: Does this work? For whom? Under what conditions? We have defined various levels of evidence and the claims we can make based on the kind of evidence available³. One of the challenges for learning science is getting beyond the “does it work?” question when measuring impact.

There are many goals for impact evaluation beyond a simple estimation of whether a learning product “works.” From a learning science perspective, the information from a richer investigation of the impact of different features of the product and their interaction can potentially advance our understanding of learning. From a product perspective, obtaining information about how to improve the product is nearly as important as understanding whether it works as currently created. However, basic impact evaluation studies compare a group using the new product with a group not using it on a measure of achievement; this yields a result that indicates only whether students using the new product scored significantly better than the control group, or not, and averages over many different students, teachers, classrooms, and schools whose characteristics may influence the effectiveness of the product. While statistical techniques can help understand how effects may differ for specific types of learners, instructors, or institutions, many other issues that may influence the impact of a product are not easily quantified in a single variable. In order to address the challenge of learning more from impact evaluations, we have developed a number of activities that work in combination with the traditional impact evaluation procedure. For example, we conduct an implementation study prior to the impact study to understand the variability in implementation that should be captured in the impact study. We have also expanded our use of analytics using large-scale data from learning platforms to understand patterns of usage and their relationships to engagement and persistence.

Adoption

The final step, from an industry perspective, is to translate positive impact evaluation results into market success via increased adoptions. This step is outside the expertise of most research scientists, while most people with marketing and sales expertise have less understanding of learning science and research; as such, this step requires close collaboration between people who speak different languages.

We have started a program to make evidence a core component of conversations between Pearson sales representatives and instructors deciding to use our content and digital services. For example, we have a person whose role is fully dedicated to the effort of translating impact evaluation results into methods for selling with

evidence, and have developed a number of activities that help sales staff talk about evidence. These include scripted statements we have written for sales people in the field to use evidence from our research in response to concerns raised by instructors. This has allowed our sales teams to learn about evidence we have been able to collect, and to feel confident talking about how our product can address particular classroom problems that instructors and administrators may have. In addition, we have written stories of individual instructors' success that are supported by impact evaluation results. Our experience suggests that decisions about which products to use are often influenced by what has been reported successful with their contacts at similar schools. The stories we have (from real instructors) allow us to articulate how the product has been implemented with positive results at different types of schools with different implementation models. These tools have helped us move "the last mile" in the chain to making sales based on evidence.

We have observed the power of this approach, moving rapidly from a successful pilot program with a few members of the sales team responsible for developmental math to using this approach with all our largest sales forces in the US higher education courseware market. Over a five-month period in early 2018, this approach contributed to over \$15m in adoptions, as reported by the sales force themselves. As the program continues to grow, we are building in opportunities to understand how to maximize the potential impact of our "evidence-based selling" approach, both by looking at the data generated in our customer relationship management tools, as well as through regular communication with the sales teams.

Summary

It is clear that moving towards integrating learning science more fully into the design and experience of commercial digital learning technologies is challenging, but with potentially great rewards, in terms of increasing impact on learner outcomes. We feel we have made great progress since the efficacy mission began in 2013, in terms of improving how we use learning science research to inform internal decision making. However, in industry we must show a relationship between learning science and economic impact. We have found that laying out our envisioned path from learning science research to ultimate impact on sales has clarified our assumptions about how the impact occurs, as well as allowed us to test those assumptions. At each stage we can examine our challenges and identify whether we are successful with that stage. Did we successfully get the research into the designed and developed product? Is the product being implemented as intended? Are sales conversations that include evidence of impact more successful? While each step may seem obvious, we have found that their explication has also helped in our internal communication. Having a clear and consistent approach that describes why using learning science research will ultimately be better for students and better for business has helped us be more effective. In particular, our educational technologies are created with input from numerous stakeholders, and our model has helped us align our efforts in ways that make it more likely our recommendations are adopted.

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Endnotes

- (1) See <https://www.pearson.com/corporate/efficacy-and-research.html>
- (2) See <https://www.pearson.com/corporate/efficacy-and-research/our-methods/learning-design-principles.html>.
- (3) See <https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/efficacy-and-research/methods/Efficacy-Framework-Slide.pdf>